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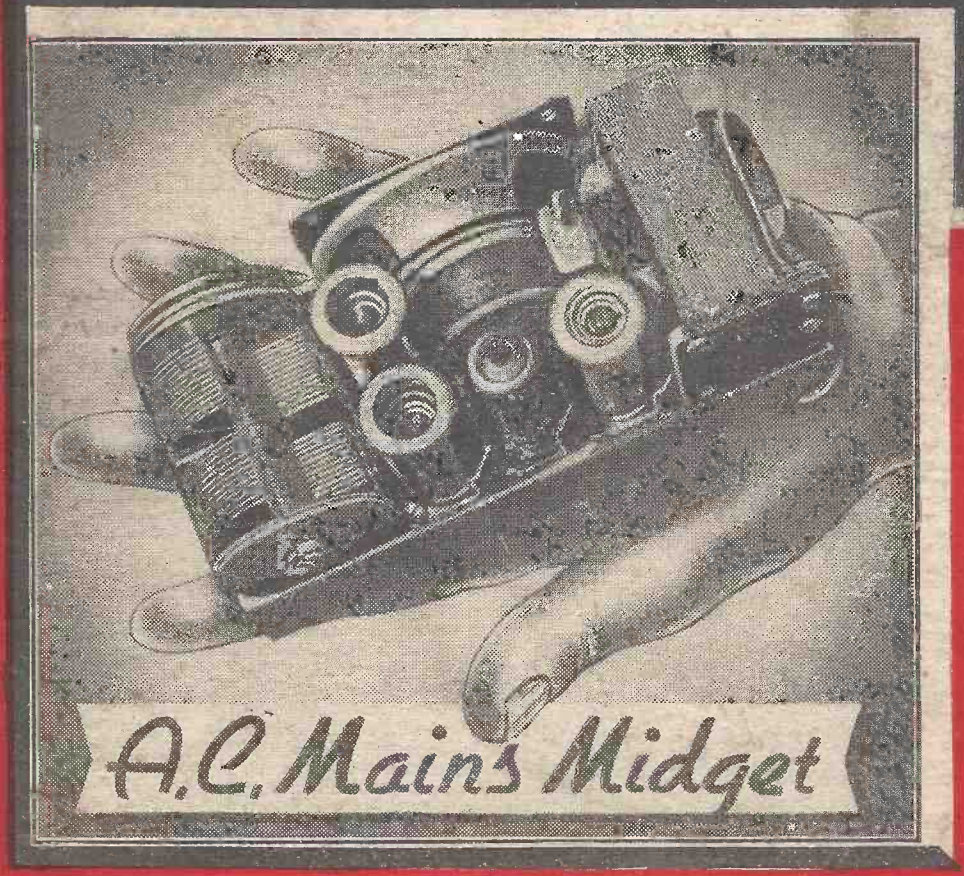
Vol. 27 No. 540
OCTOBER, 1951

PRACTICAL WIRELESS

EDITOR:
F.J.CAMM



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Practical Wireless

19th YEAR OF ISSUE

EVERY MONTH
VOL. XXVII. No. 540 OCTOBER, 1951

Editor E. J. CAMM

COMMENTS OF THE MONTH

By THE EDITOR

A Jubilee of Radio

IT is 50 years ago this year that the Atlantic was first spanned with wireless by Marconi and his associates. He did this in spite of the prediction by mathematicians and scientists that communication by means of electro-magnetic waves would be limited to a distance of about 155 miles. Construction of the Poldhu transmitting station in Cornwall was started in October, 1900, and it was completed and ready for experiments in January, 1901. Judged by to-day's aerial arrays, photographs of the Poldhu aerial system seem quaint, but it undoubtedly demonstrated that the scientists were wrong and pointed the way to radio as we know it to-day.

The aerial system consisted of a ring of 20 wooden masts 200ft. high, and arranged in a circle 200ft. in diameter supporting 400 aerial wires forming an inverted cone. A gale wrecked this aerial on September 17th, 1901, and it was replaced by a fan-shaped aerial of 54 wires suspended by a triatic at 1 metre intervals; it was 150ft. high.

The transmitting apparatus was of the simplest character. It consisted of a 32 horse-power oil engine driving a 50-cycle alternator with an output of 25kW. at 2,000 volts. The 50 cycle A.C. was raised in voltage by two ten-to-one ratio transformers connected in parallel, and the output was connected through H.F. chokes to a closed oscillatory circuit in which a condenser discharged across a spark-gap through the primary of a H.F. transformer. The secondary of the transformer was connected to a second spark gap and condenser and the primary of a second H.F. transformer, the secondary winding of which was in series with the aerial. Keying of the transmitter was effected by the short-circuiting of chokes connected in the output from the alternator. The condensers were constructed from 20 glass plates 16in. square coated on each side with a square foot of tinfoil, the whole being placed in stoneware boxes filled with linseed oil.

A surprising fact is that the wavelength of the transmission was not recorded! At that time there was no apparatus in existence for measuring high frequency, but from the available data and the results achieved it is estimated that the fundamental wavelength emitted was between 1,000 and 2,000 metres.

A corresponding station had been commenced at South Wellfleet, Cape Cod, Massachusetts, but the circle of masts there suffered the same fate as those at Poldhu and it was then decided to make the attempt to receive the Poldhu transmission in Newfoundland. Marconi left England on November 27th, 1901, and arrived at Newfoundland on December 5th.

The pre-arranged signal was the letter S in Morse (three dots) and it was sent continuously from 3 p.m. to 6 p.m. Greenwich time each day, commencing on December 11th, 1901.

In Marconi's pocket diary there is a brief entry for December 12th "Sigs. at 12.30, 1.10 and 2.20," and on the following Friday "Sigs. at 1.38." That is the first known radio signal to be transmitted and received.

THE NATIONAL RADIO SHOW

The first Radio Show commenced in 1922, when the "First All British Wireless Exhibition and Convention" was organised by Bertram Day and Co., Ltd., for the benefit of the wireless manufacturers and traders existent at that time. They were a very small band indeed, and the exhibition was held in the comparatively small premises of the Horticultural Hall. There were only about 50 stands.

Glancing through the pages of the first Wireless Exhibition Catalogue one finds the names of several firms which are still actually serving the radio public, among them Cossor, Dubilier, Igranic and Peto Scott. One also finds the names of others who were at the time well known, but who have since fallen by the wayside or transferred their activities to other branches of the trade. After the 1922 exhibition the name changed year by year to "N.A.R.M. A.T. (National Association of Radio Manufacturers and Traders) Exhibition," "National Radio Exhibition," and, finally, "Radiolympia." The exhibition has been held at the Royal Albert Hall, the New Hall, Olympia, and in the Grand Hall, Olympia. The previous exhibition was held in Birmingham, but this year it is held at Earls Court, and the name now is National Radio Exhibition.

ROUND the WORLD of WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate numbers of licences issued during the year ended June 30th, 1951:

Region	*Number*
London Postal	2,370,000
Home Counties	1,657,000
Midland	1,767,000
North Eastern	1,915,000
North Western	1,621,000
South Western	1,072,000
Welsh and Border Counties ..	732,000
Total, England and Wales ..	11,134,000
Scotland	1,117,000
Northern Ireland	208,000
Grand Total	12,459,000

The above total includes 897,000 television licences.

Junction Transitor

THIS is a new name given in America by the Bell Laboratories to a germanium crystal in which a thin electrically positive layer is sandwiched between the two electrically negative ends. It derives its name from the two "junctions" between the negative ends and the positive layer. It differs markedly from the earlier types in which the point contacts were essential.

Suppressed Aerials

A FEATURE of the S.B.A.C. display was the showing by the Marconi company of suppressed aerials for use in aircraft. Their exhibit showed how the external aerial has been eliminated in the "Comet" and how present-day communication and navigational aid aerials are built as integral parts of the aircraft fuselage.

Radiotelephone Service Between the United Kingdom and Iraq

THE Postmaster-General announces that a direct radiotelephone service between the United Kingdom and Iraq was opened at 3.0 p.m. on Wednesday, August 1st, when greetings were exchanged between the Assistant Postmaster-General, Mr. Charles R. Hobson, and Dr. Diajaffer, the Minister of Communications and Works, Baghdad. Mr. A. M. Khederi, the Iraqui Minister in London, was present with the Assistant Postmaster-General at the opening ceremony and exchanged greetings with Mr. H. Beeley, Counsellor at the British Embassy in Baghdad.

The telephone service with Iraq will be available to the public daily except Sundays from 3.0 p.m. to 4.0 p.m. at a charge of £3 for a call of three minutes plus £1 for each additional minute. The report charge (where applicable) will be 4s. Calls may be made to most of the principal places in Iraq with the exception of Basra.

G.P.O. Criticised

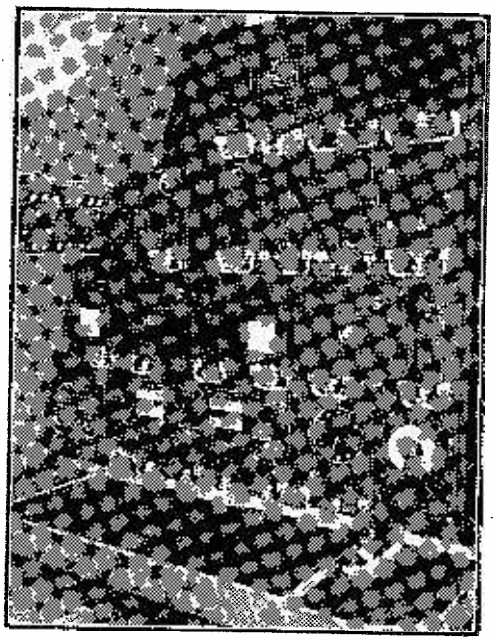
AT the annual meeting of the Pye Company the chairman, Mr. C. O. Stanley, said, *inter alia*, "In the field of radio, unless something is done quickly to change the outlook of the G.P.O. we shall find ourselves a long way behind other countries."

South Bank Reproducers

THE sound reproducers in the Sports Arena at the South Bank Exhibition were supplied, we understand, by Grampian Reproducers Ltd.

Dr. V. K. Zworykin

FOR "his outstanding contributions to the concept and development of electronic apparatus basic to modern television . . ." Dr. Zworykin, well-known radio expert and vice-



Wireless communication and navigational aid installation in the de Havilland "Comet," showing the intercommunication units, power units for the Marconi AD.107 high power transmitters, and intercommunication station box.

president and technical consultant of the R.C.A., has been awarded the Medal of Honour by the American Institute of Radio Engineers.

Philips at the "Pigalle"

THE well-known London night-spot has been equipped with Philips Sound Reproducing Equipment in which a hanging microphone is fitted over what is claimed to be the largest stage ever erected in a London restaurant, and of the other stand microphones one has a detachable head so that it can be carried by an artiste if required.

Assistant Superintendent Engineer Recording

THE B.B.C. announces that Mr. R. C. Patrick, Associate I.E.E., has been appointed assistant superintendent engineer recording.

Mr. Patrick joined the research department of the B.B.C. in 1925 and has since had experience in a number of other departments of the engineering division. During the war he was assistant engineer-in-charge at the B.B.C.'s emergency headquarters and later became senior assistant to the superintendent engineer recording.

Sir John H. Woods, G.C.B., M.V.O.

THE English Electric Co. Ltd. announce that Sir John Woods, Permanent Secretary of the Board of Trade since 1945, is shortly taking up an appointment within the group. From 1943 to 1945 he was Permanent Secretary to the Ministry of Production.

Schools Electrical Installation

FOR the County Borough of East Ham Education Authority's three secondary schools on the one site, at Langdon Crescent, Barking Road, all the electrical installation work is being carried out by Rashleigh Phipps & Co., Ltd. The project comprises a boys' grammar, girls' modern and a boys' modern school, accommodating a total of about 1,700 pupils, administration block, dining rooms and kitchens.

Electricity supply will be obtained from a substation with two 500 kVA transformers. Crompton Parkinson, Ltd., are supplying 5,000 yards of Crompton paper-insulated lead-covered cable, 70 miles of V.I.R. cable, lamps, tubes and fluorescent lighting fittings.

Company Reorganisation

IN view of the increasing load of defence contracts being undertaken by companies within the Automatic Telephone and Electric Group, it has been decided to undertake some reorganisation in order to increase the Group's potential and to facilitate the allocation of work in the most appropriate factories within the Group.

As part of this reorganisation, British Insulated Callender's Cables, Ltd., and the Automatic Telephone and Electric Company have agreed to transfer the Radio Gramophone Development Company —a wholly owned subsidiary of British Insulated Callender's Cables, Ltd.—to the Automatic Telephone and Electric Company.

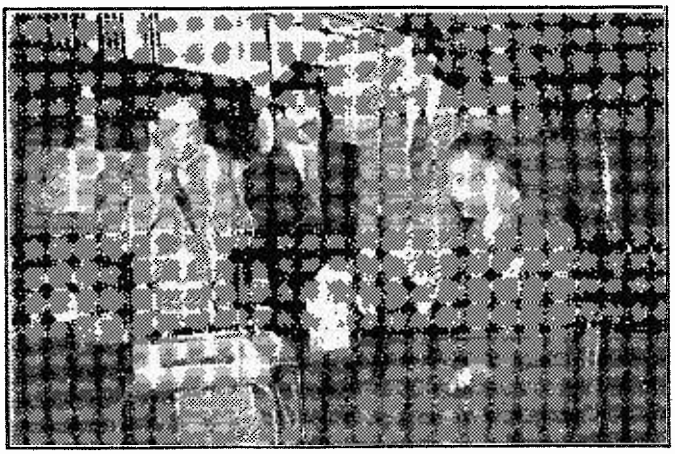
The Radio Gramophone Development Company will thus become a wholly owned subsidiary of the Automatic Telephone and Electric Company and, in future, will be employed as a unit in the Automatic Telephone and Electric Company Group, principally concerned with meeting defence requirements in respect of radio and associated equipment, including sound-amplifying equipment.

Production of domestic television receivers will continue in accordance with the existing planned programme up to the end of 1951, but the volume thereafter will depend upon the availability of materials and components and the number of high priority defence orders coming into production at that time.

Assistant Superintendent Engineer Lines

THE B.B.C. announces that Mr. G. Stannard, A.M.I.E.E., has been appointed assistant superintendent engineer lines in succession to Mr. W. G. Edwards, who has retired.

Mr. Stannard joined the Operations and Maintenance Department of the B.B.C. in 1932, and was transferred in 1935 to the Lines Department. In 1947 he joined the newly formed Designs Department, where he has since been engaged on the design of equipment associated with the G.P.O. line networks that link the B.B.C.'s studio centres and transmitting stations.



Members of the Chilean Press Delegation, who visited E.M.I. recently, inspect the Emidicta Recording Machine.

Patent Office Library

READERS are reminded that the Patent Office Library, at 25, Southampton Buildings, Chancery Lane, London, W.C.2, is now open to the public from 10 a.m. until 9 p.m., Mondays to Fridays, inclusive, instead of closing at 6 p.m. as previously. Saturday opening, however, continues to be from 10 a.m. to 5 p.m.

Amateur Radio Exhibition

THE Fifth Annual R.S.G.B. Amateur Radio Exhibition will be held at the Royal Hotel, Woburn Place, London, W.C.1, from November 28 to December 1, 1951.

Principal Exhibits Reviewed

Ace Radio, Ltd.

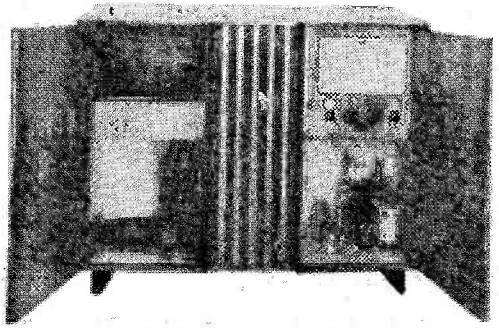
AMONG the receivers displayed by this firm was an entirely new chassis incorporated in the "Cadet" and the "Mercury." In this chassis the customary 532 pF gang condenser has been dispensed with and a smaller condenser (187 pF) used in its place. It is claimed that the improved L/C ratio renders tuning easier and selectivity and gain are increased. Other models included a table radiogram and a combined radiogram and cocktail cabinet. [Stand No. 41]

Aerialite, Ltd.

THIS exhibit consisted, as usual, of a wide range of aerial equipment, ranging from simple but effective indoor aerials to elaborate multi-arrays intended for long-distance television reception. Practically every part of the aerial assembly is supplied by this firm. [Stand No. 47]

Ambassador Radio

RADIO, radiograms and television receivers, ranging from table models to elaborate de-luxe-styled television receivers were featured on this stand, and the radiograms in some cases featured the three-speed unit suitable for any type of record. [Stand No. 4]



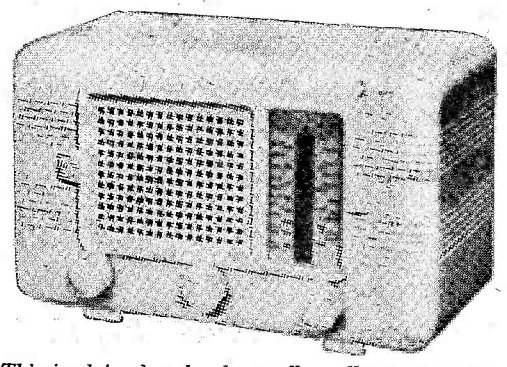
The Berkeley Radiogram produced by Ace Radio.

Antiference, Ltd.

IN addition to the well-known television aerial equipment, featured on this stand were the anti-static aerial equipment in a redesigned form: the "Arnine" aerial, specially designed for short-wave reception and transmission, and car radio aerials for scuttle mounting. The "Arnine" is of most interest to the short-wave enthusiast and consists of two flexible spans calibrated in metres and megacycles, together with a down lead. The whole forms a folded dipole with all connections sealed and is available in two models, one for 7 Mc/s upwards and one for 14 Mc/s upwards. [Stand No. 94]

Automatic Coil Winder Co., Ltd.

IN addition to coil-winding equipment the range of Avo portable instruments attracted most attention here. Most interesting of the models was



This is claimed to be the smallest all-wave superhet. It is an Alba product.

the new Model 8 Universal AvoMeter with a range of 20,000 ohms per volt and incorporating all the well-known AvoMeter features plus new design innovations. [Stand No. 9]

Balcombe, Ltd., A. J.

WHAT was claimed to be the smallest all-wave superhet was shown here. With three wavebands from 16 up to 2,000 metres, this now incorporates a five-valve circuit instead of the original four. Other models ranged up to large radiograms with autochangers, costing over £100. [Stand No. 89]

Bell and Croydon (Savory and Moore, Ltd.)

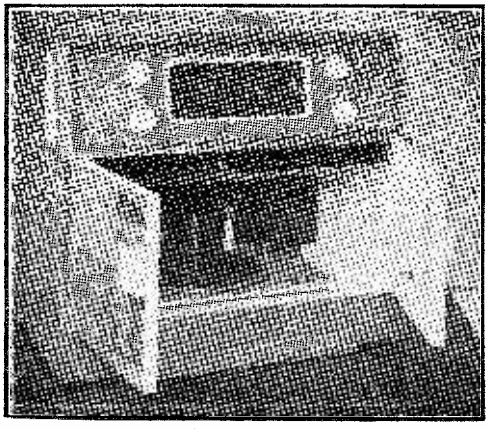
THE specially developed miniaturised components seen on this stand attracted considerable interest, as well as the completed deaf-aids in which these components were incorporated. Sub-miniature packaged amplifiers with the Mullard special valves were also shown, as well as a portable miniature oscilloscope measuring only 9¼in. by 3½in. by 5in. The tube in this instrument measures only 1¾in. in diameter. [Stand No. 22]

Belling and Lee, Ltd.

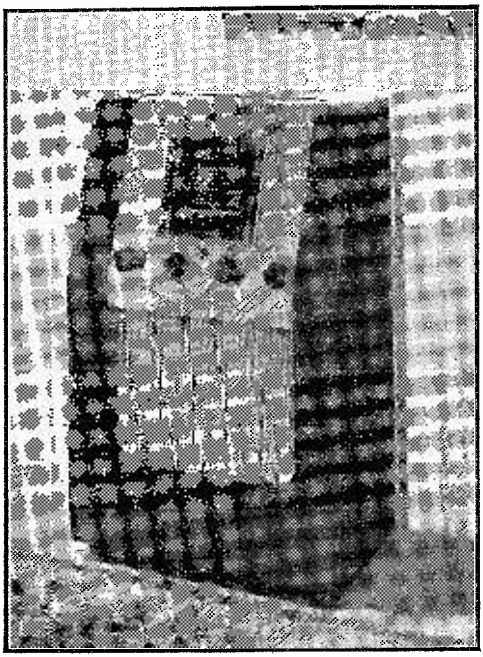
NO introduction to this stand was needed and the extremely wide range of small accessories, as well as the larger television and anti-interference aerials attracted considerable attention. Suppressors, plugs and sockets, fuses, terminals, valve-holders all upheld the famous Belling and Lee tradition. [Stand No. 64]

Bush Radio, Ltd.

THIS exhibit consisted of battery portables, mains portables, table models (with and without push-button tuning) and radiograms, the latter being for A.C. only. All other mains models are either universal or have an alternative type for use on D.C. Amongst the most recently re eased models is a console with push-pull output, 10in. loudspeaker and flywheel tuning. priced at 43 gns. including tax. [Stand No. 62]



This table radiogram also comes from Ace Radio and is the "Cadet" model T.R.G.645.



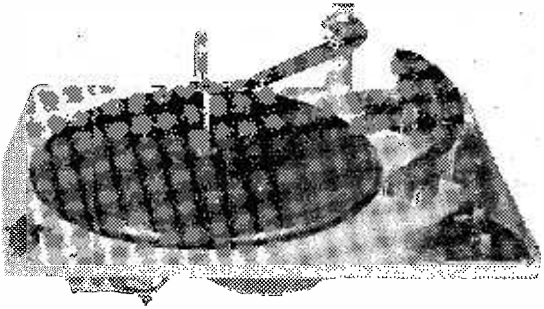
This Bush radio console has a push-pull output stage delivering 6 watts. It is Model SUG.26.

Cole, Ltd., E. K.

THE very wide range of Ekco equipment shown here ranged from portable A.C., D.C. and battery personal models to those designed for commercial use in aircraft. Car radios, school receiving equipment and similar specialised items were shown, together with attenuators, extension speakers and other accessories. The Festival receiver is a model designed for high-class reproduction and instantaneous tuning of four selected stations. [Stand No. 57]

Collaro, Ltd.

APART from the simpler types of motor-driven turntable, Messrs. Collaro were also showing the newer types of three-speed unit designed for use with the latest long-playing records, automatic changers and plug-in pick-up heads. The latest pick-up to be shown is known as the "Ortho-

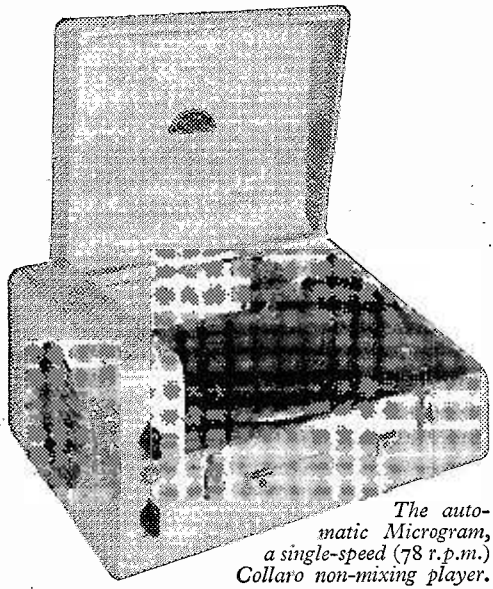


A 3-speed record changer from the Collaro range. It is non-mixing.

dynamic" unit and incorporates a special twin-point alloy needle. At the moment this is available only for export. [Stand No. 81]

Cossor, Ltd.

APART from the wide range of valves and cathode-ray tubes, the various Cossor receivers were displayed round the well-known "Melody Maker," one of the original 1927 home-constructed models, as most of our older readers will remember.

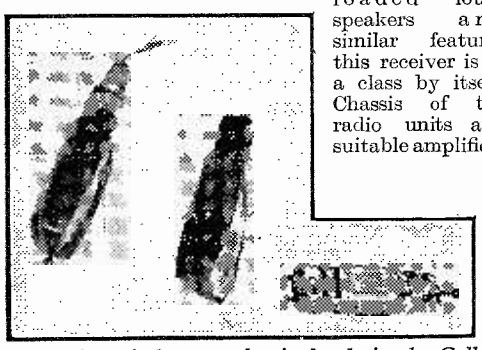


The automatic Microgram, a single-speed (78 r.p.m.) Collaro non-mixing player.

The particular receivers range from a low-consumption streamlined portable to an auto-radiogram, and outside the receivers were the specialised items such as electronic test instruments and "export only" models. [Stands No. 86 and 202]

Dynatron Radio, Ltd.

APART from the Nucleonic and Electronic apparatus, chief point of interest here was the Ether Conqueror Radiogram in its various forms. With special tuners, elaborate tone controls, air-loaded loudspeakers and similar features this receiver is in a class by itself. Chassis of the radio units and suitable amplifiers



A selection of the new plug-in heads in the Collaro range are seen here. The inset cartridge crystal unit is for 78 r.p.m. only.

were also exhibited and revealed some interesting features. [Stand No. 71]

Edison Swan Electric Co., Ltd.

THE famous Mazda range of valves and cathode-ray tubes were shown by Ediswan as well as radio products, including those by Plessey, for which Ediswan are the sole distributors. A single record-player with press-button feature and improved pick-up head; loudspeaker phone intercom. units; and electronic and electrical medical equipment are some of the other items which were displayed. [Stand No. 63]

Etronic (Hale Electric Co.)

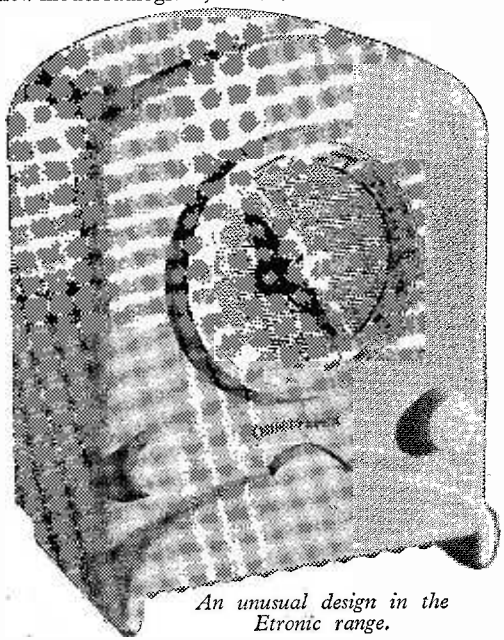
RADIOGRAMS and radio receivers in various ranges from a midget 4-valve A.C./D.C. receiver in moulded cabinet to a "Cheltenham" radiogram incorporating a five-valve all-wave superhet were to be seen here. The "Windsor" employs a similar chassis but has an auto-changer and is available with a three-speed version for long-playing records. [Stand No. 92]

Ever Ready (G.B.), Ltd.

THE answer to the question "What is all-dry radio?" was demonstrated on this stand. Three-dimensional cartoons extolled the virtues of the Ever Ready all-dry radio, including "No aerial," "No earth," "No accumulator," etc. The range of receivers shown included a brief-case four-valve all-dry superhet portable, a simple two-valve home receiver and miniatures in plastic and coloured all-weather cabinets. The "Saucepan Special" (dealt with in our issue dated August 1950), a novel export receiver, was also shown. [Stand No. 49]

Ferguson Radio Corporation, Ltd.

THE complete range of radio receivers, radiogram and television receivers seen here included a new model radiogram, Model 332RG. This is claimed



An unusual design in the Etronic range.

to provide an astonishing advance in fidelity of sound reproduction. Distinctive cabinet designs and an all-purpose receiver with fabric-covered cabinet operating on batteries or A.C. or D.C. mains was also another highlight on this stand.

[Stand No. 77]

Ferranti, Ltd.

THE radio receivers seen on this stand included two A.C. mains table models each incorporating fly-wheel tuning and a built-in aerial which can be switch-disconnected to give maximum efficiency on either frame or external aerials. An "island" receiver was another interesting exhibit having no conventional back and front, tuning dials and speaker apertures being mounted on both sides of the cabinet. Auto-radiograms with three-speed mechanisms were also shown and it is interesting to note that the only moulded cabinet included in this year's Ferranti range was a battery-operated table receiver. [Stand No. 74]

Gamma Electronics, Ltd.

A COMPLETELY new range of radiogramophones was seen here, including a de-luxe model incorporating a cocktail cabinet. Table models for battery, A.C. and A.C./D.C. operation were also displayed, and special models with alternative wavebands were seen for the overseas markets.

[Stand No. 15]

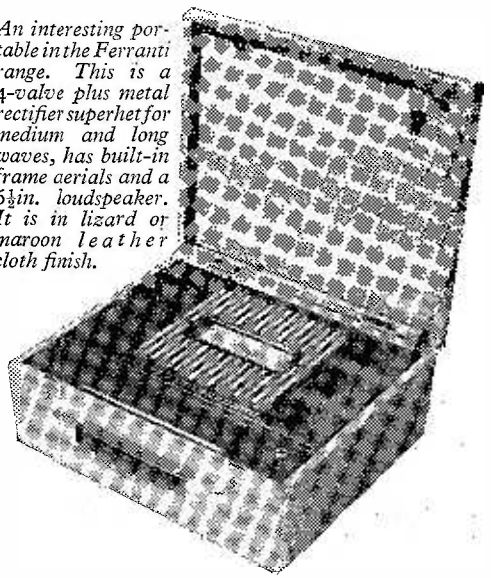
Garrard Engineering & Mfg. Co., Ltd.

SOME very novel pick-up arms were shown here with the usual popular range of gramophone motors and motor units. Three-speed units are now almost universal, and one of the most interesting of the pick-up heads for the long-playing discs is known as the "Turnover dual stylus head." It has two styli, one of .0025in. radius sapphire for 78 r.p.m. discs, and one of .001in. radius sapphire for 33⅓ or 45 r.p.m. discs—a turn of the knob presenting the correct needle. [Stand No. 68]

General Electric Co., Ltd.

THE large range of "Osram" valves and cathode-ray tubes formed a large part of the G.E.C. exhibit, which also included radios and electronic equipment of all kinds. Four new models were seen in the domestic radio side. Miniature and sub-miniature valves attracted considerable interest and the larger valves used commercially formed a vivid contrast. The Germanium crystal range brought to the fore the question of the "crystal receiver" and it appears that there is still a wide interest in the use of this component apart from its use in multi-valve equipment.

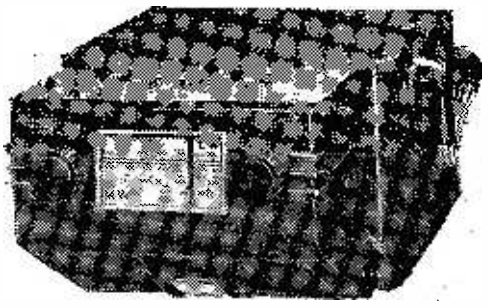
[Stand Nos. 51, 28 and 211]



An interesting portable in the Ferranti range. This is a 4-valve plus metal rectifier superhet for medium and long waves, has built-in frame aerials and a 6½in. loudspeaker. It is in lizard or maroon leather cloth finish.

Goodmans Industries, Ltd.

IN addition to the usual range of speakers four new models were shown here. Two elliptical speakers (10in. by 6in. and 7in. by 4in.) interested those who are concerned with better quality

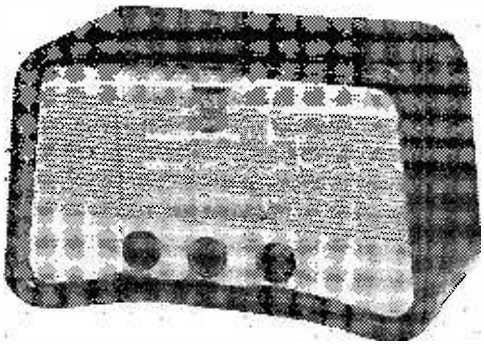


This is the Masteradio Car Radio for medium and long waves.

This portable in the Invicta range has unusual control knobs. It is Model 25.

reproduction in small cabinets as they provide better bass response with directional effects in the upper register. A "Concentric Diffuser" has been introduced to meet the demand for an omni-directional reproduction for out-door use and the Axiom 150 is the latest of the Axiom range of high-fidelity units with a 12in. cone.

[Stand No. 96]



As with most of the Murphy receivers the novel design is an attractive feature of this set. It is Model 152 and is for export only.

Gramophone Co., Ltd.

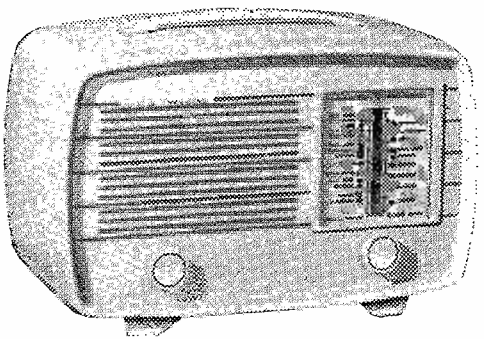
SPECIALISED equipment was shown by E.M.I. on these stands, together with a range of normal domestic receivers and radiograms. Model 1615 attracted considerable interest as it incorporated in a cabinet little larger than the normal table radio an auto-changer with five-watt output and 10½in. elliptical speaker. At the other end of the scale is model ARG28 AE which is a six-valve, five-waveband auto-radiogram with a special R.F. stage for improved S.W. reception and bandspread tuning. It has record-storage space.

[Stands Nos. 84 and 85]

Grampian Reproducers, Ltd.

THE main item here appeared to be the eight-watt receiver amplifier in a neat cabinet designed particularly for schools, hotels, clubs, etc. It incorporates a superhet circuit and two pentodes in parallel in the output stage, capable of feeding three or four loudspeakers at high quality.

[Stand No. 110]



The latest version of the Little Maestro, a Pilot receiver which has already made a big name for itself.

Invicta Radio, Ltd.

A COMPLETELY self-contained battery superhet, a mains/battery portable and the "Station-master" were the prominent exhibits on this stand and most interest centred round a six-valve 11-waveband superhet, designed for operation from mains or six-volt vibrator unit. Autochangers for long-playing as well as standard records were also to be seen and the inclusion of the "trawler" waveband is a feature of some of the models.

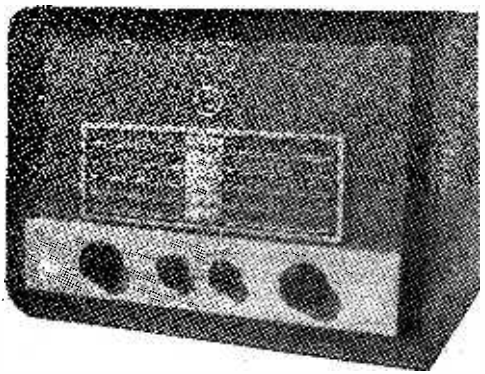
[Stand No. 78]

Kolster-Brandes, Ltd.

BATTERY and battery/mains portables in cellulose acetate cabinets were among the models shown by K.B. Table models, record players and radiograms were also featured, centre of interest probably being Model FG.50, which is an eight-waveband superhet, with spin-wheel tuning, 10in. speaker and three stages of push-pull output with two lightweight pick-ups with sapphire needles. The cabinet is of walnut with sycamore interior with pneumatic lid closure and storage space for 200 records. It costs 120 gns. [Stand No. 52]

Margolin, J. & A., Ltd.

THE Plus-a-gram, sapphire needles and a portable in figured walnut case with three-speed motor and dual pick-up head were shown on this stand.



Another unusual design in the Murphy range. Note the 10 push-buttons in the centre of the tuning scale. This also is an export-only model.

All the equipment related to gramophone record reproduction. [Stand No. 25]

Masteradio, Ltd.

THE "Ludlow" made its first appearance at the Show, and it consists of a three-waveband five-valve auto-changer radiogram with record storage space and costs £55 13s. 6d., plus P.T. Other models included the Sandown Star, a five-valve miniature all-mains receiver with built-in frame aerial and a standard five-valve A.C. model. In addition there were three car-radio receivers one of which included a remote control head.

[Stand No. 80]

McMichael Radio, Ltd.

FOUR new models were seen on this stand and a number of early features were retained in these. The twin-speaker A.C./D.C. transportable

which was so popular last year has led to the production of a new Model 851, consisting of a five-valve superhet, completely self-contained even to the frame aerial. Quality of reproduction is the keynote of all the McMichael models.

[Stand No. 59]

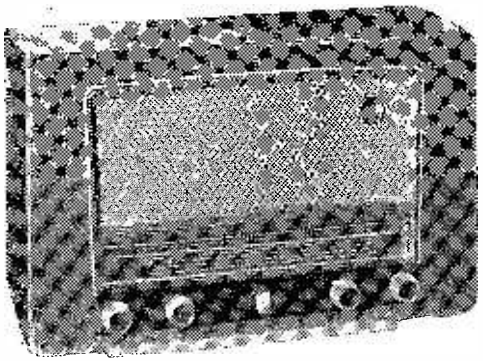
Mullard, Ltd.

VALVES, C.R. tubes and individual components were shown by Mullard, in addition to radio receivers and specialised electronic equipment. The new World Series of miniature valves showed what could be done in reducing overall size and at the same time increasing efficiency, whilst the special equipment which has been developed has now been introduced into most modern radio equipment. The magnetic material, for instance, is widely used in loudspeaker manufacture. The valve-tester, which operates on the punched-card principle, enables even a non-technical person to make a thorough test of any valve, rapidly and without error.

[Stand No. 75]

Murphy Radio, Ltd.

A SELF-CONTAINED mains portable, a baffle table receiver, a radiogram with dual-speed player and some special export models were shown by Murphy and the original cabinet work was probably the most outstanding visual attraction.



A 5-valve all-wave A.C. receiver in which the cabinet is finished with a graining effect achieved by a new veneer process. This is Philips Model 413a.

Great attention has been paid to the reproduction side of the receivers and accounts for the general cabinet design. The new radiogram with dual speed player costs £127. The export-only models showed some interesting points, especially the high-gain bandspread short-wave model with push-pull power output stage. [Stands Nos. 61 & 219]

Newman, J. & S., Ltd.

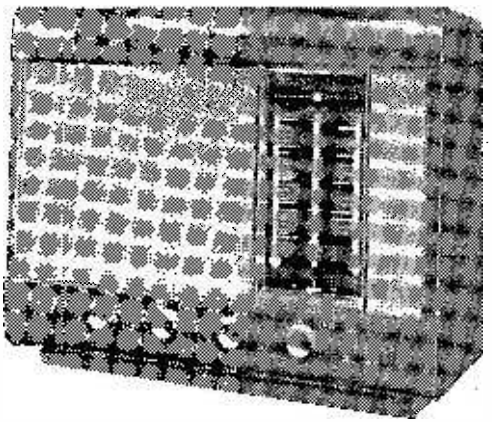
THE novel tool kit which was illustrated in our last issue was perhaps the outstanding exhibit on this stand. It will be found of the utmost use by all experimenters and service men and serves to keep together those small items which are so easily mislaid. [Stand No. 29]

New London Electron Works, Ltd.

THE original Electron Wire of which it is claimed that over 1,000,000 cartons were sold in 1922 and no less than seven million before 1925. The price now is 2s. 9d. for 100 ft., and in addition to this aerial a comprehensive range of telephone wires, cables, etc., were shown. [Stand No. 44A]

Ossicaide, Ltd.

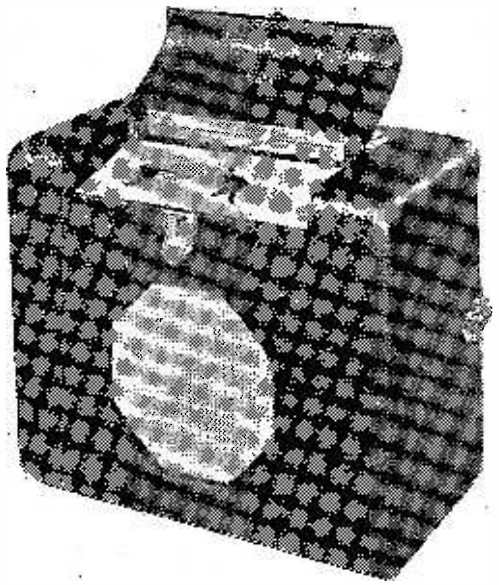
A COMPLETE range of hearing aids were shown here, including the unique Model R.P.15 which incorporates both the inductive system



This Pye receiver has the speaker fret broken by the tuning dial, covering three wavebands. It is Model P33TQ.

for use with the telephone and radio and a system of A.V.C. which is essential in some cases of deafness. A miniature three-valve aid much smaller than a playing-card was also an interesting exhibit.

[Stand No. 32]



One of the well-known portables in the Roberts Radio range. Note the cover to protect the dial and controls when the receiver is not in use.

Peto Scott Electrical Instruments, Ltd.

A FIVE-VALVE three-speed auto radiogram with 10in. loudspeaker was the main radio exhibit and was executed in a most pleasing modern design in walnut. [Stand No. 73]

Philips Electrical, Ltd.

THE "Little set with the Big Performance" is still the slogan of the small radio Model 200 U. This is executed in a moulded case and incorporates a five-valve all-wave superhet for A.C. or D.C. mains. Other models included a radiogram "Masterpiece" introducing a new form of tuning which the makers have termed "Featherweight." It incorporates a three-speed autochanger and a new type of sapphire needle, together with a five-valve all-wave superhet. Push-button tuning was also seen in the Model 574V which provides for four pre-selected stations and is available for 12-volt operation and may easily be converted for six-volt working. [Stands Nos. 83 and 90]

Pilot Radio, Ltd.

THE latest release seen for the first time here was Model R.G.A.61, a radiogram with auto-changer and flywheel tuning. In addition the Blue Peter, the Mariner, the Dandy and the popular Little Maestro were among other radio models shown. The latter has been redesigned and is available in a special export model. [Stand No. 66]

Portogram Radio Elec. Industries, Ltd.

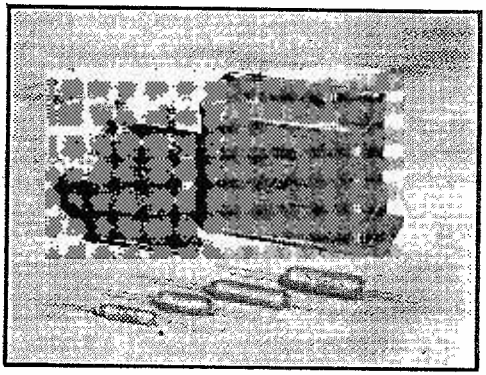
IN addition to record players and radiograms, here was seen the amplified auto-change record reproducer, a table unit which consists of a record player without radio and which has a push-pull output stage with high-fidelity loudspeaker. The new Portogram long-playing needles in a visual pack were also shown. [Stand No. 115]

Pye, Ltd.

THE radio models seen here ranged from a record player of the "table gramophone" portable type with record storage space in the lid to an eight-waveband bandspread auto-radiogram at 88 gns. This incorporates a five-valve circuit for A.C. operation, three-speed motor for long-playing and standard records and a lightweight pick-up, with a 10in. loudspeaker. [Stands Nos. 17, 65, 224]

Regentone Products, Ltd.

ONCE again Regentone made a big feature of the famous Auto "99." This is a five-valve A.C. automatic table radiogram which costs 45 gns., but is also available with a three-speed version at 50 gns. A.C. and A.C./D.C. table receivers in various styles were shown and a striking feature of a new model (ARG.85) is the storage space for 250 records. This also is available as a single-speed or a three-speed model. Model ARG.75 is an automatic console radiogram with a piano-style lid, but has easy access to the controls. [Stand No. 88]



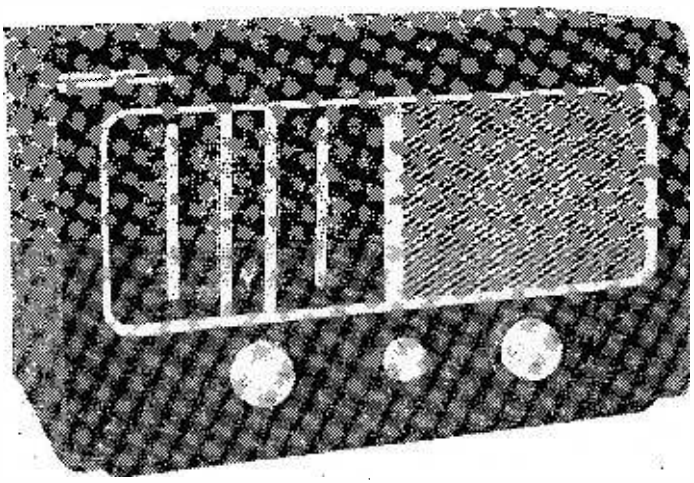
A group of the T.C.C. new type condensers—Plastapack is the term which is given to them.

Radio Gramophone Dev. Co., Ltd.

THE well-known R.G.D. trade-mark identified the high-class receivers shown here. For the export market was a five-waveband, model 1048G3, incorporating four bandspread ranges and excluding, of course, the long waves. In addition a portable magnetic recorder was shown in which two tape speeds are provided, and three motors have been fitted to keep wow and flutter at low levels. Other recorders were also shown, including professional studio models. [Stand No. 76]

Roberts' Radio Co., Ltd.

NEW models shown here included the R.P.4, a battery receiver, and R.M.B., an A.C./battery model. These are both superhets of the portable type using all-dry batteries, and leaflets were available giving circuit diagrams and technical data. The "Junior" model is being continued and was also on show. [Stand No. 44]



A Vidor home-market receiver. This is a 4-band table model, No. CN.417.

Rola Celestion, Ltd.

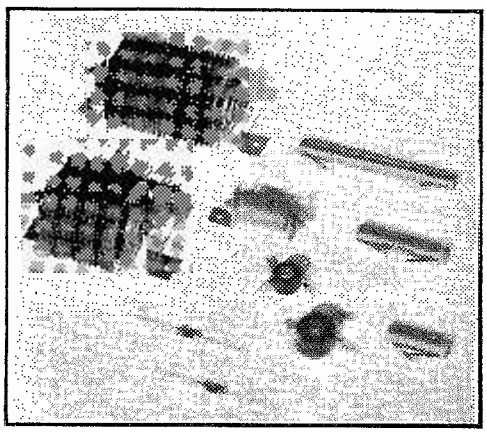
THE well-known loudspeakers carrying these names were shown in a wide range, from the miniature 3in. models up to 18in. high-fidelity designs. In addition output transformers for all conditions and circuits were on view. [Stand No. 39]

Scophony-Baird, Ltd.

THE "Home Recorder," which is already widely known, was prominently displayed here and it has a number of novel features. Visitors were able to record their voices and hear the results played back. [Stand No. 50]

Simon Sound Service, Ltd.

SOUND recording and reproduction equipment were the main exhibits on this stand, and included a new tape recorder and some existing professional models. Of these the Model 49A is



A selection of Westinghouse "Westalite" rectifier units, including meter, R.F. and L.T. components.

probably best known, having twin channels and being designed for disc recording. The Simon Monitor equipment, produced for the Ministry of Civil Aviation, attracted keen interest. The new Model 1A recorder provides two tape speeds ($3\frac{3}{4}$ and $7\frac{1}{2}$in./sec.), has twin tracks, a response from 50 to 9,000 c.p.s. at the higher speed, independent bass and treble tone controls and an output power of eight watts. It costs £76. [Stand No. 13]

Sobell Industries, Ltd.

AN all-wave luxury receiver, a superhet table model and table auto-radiograms were the principal features of this exhibit. A patented push-pull circuit is featured in the luxury receiver, whilst the table radiograms include both single- and three-speed changers. [Stand No. 56]

Stella Radio & Television Co., Ltd.

NEWCOMERS to the radio industry, Stella, were showing a five-valve all-wave superhet for A.C. or D.C. mains, with a single turn frame aerial incorporated for the medium and long waves and a plate aerial for short waves. Another model incorporated a built-in plate aerial with provision for fitting an external aerial and a tone switch giving three differing tone values for radio and two for gramophone reproduction. [Stand No. 111]

Stratton & Co., Ltd.

THE well-known "Eddystone" trade-mark identified this stand, and, in addition to the communications type of receiver for the amateur, there were some special models for marine use. The popular "74" and "750" models were seen again, whilst a wide range of accessories suitable for both the experimenter and the amateur transmitter were well displayed. [Stand No. 7]

Sugden & Co., Ltd.

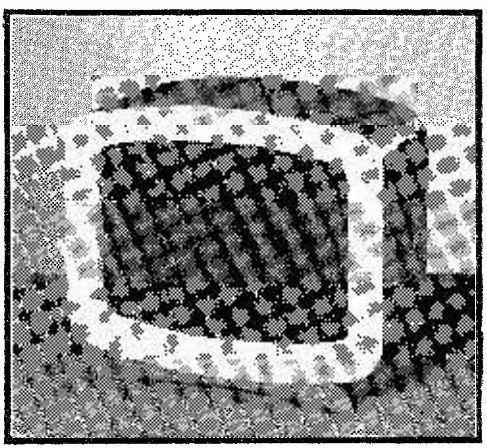
THE "Connoisseur" range of accessories were to be seen here, including a "varigroove" recording unit for discs. This incorporates a "hot" needle if required and is suitable for long-playing as well as standard records. The cutter head is of the moving-coil type, and other motor units, recording heads, reproducing heads, turntables, etc., were featured. Among the needles were to be seen the lightweight steel, sapphire and cutting styli. [Stand No. 12]

Taylor Electrical Instruments, Ltd.

PRACTICALLY every instrument of use to the service engineer or the advanced experimenter was to be seen here. Laboratory equipment included oscillographs and a comprehensive valve tester enabling mutual conductance tests to be made on over 3,000 valves. The new Model 77A testmeter is an open scale multirange A.C./D.C. meter with rotary selector switch and socket connections. Another new model is a 90-range portable meter with a resistance of 20,000 ohms per volt D.C. and 2,000 ohms per volt on the A.C. ranges. [Stand No. 38]

Telegraph Condenser Co., Ltd.

IN addition to all the well-known ranges of paper, mica, ceramic and electrolytic condensers some new lines made their appearance on this stand.



The famous W.B. speakers now include this cabinet extension speaker which is included in the Festival of Britain Stock List. It is fitted for use with the "Long Arm" remote control.

These included the "Plimoseal" protected ceramic and mica condenser and the "Plastapack" plastic film dielectric condensers. In addition the cathodray condensers have been improved and are now available for working voltages up to 75 kV. Visitors were extremely interested in the T.C.C. Robot Tester, which is one of the machines built and developed at the T.C.C. works. It tests and grades silvered tubular ceramic condensers at the rate of 2,000 an hour, separating them into five different groups of capacity tolerance from ± one per cent. upwards. [Stand No. 97]

Trix Electrical Co., Ltd.

SOUND equipment is the business of the Trix people and some interesting P.A. equipment was shown. In addition to smaller units large rack-type installations were shown and some of the special amplifiers were designed for high-fidelity with special twin-channel compensation circuit. Some of the amplifiers have been designed for schools use, whilst the range of equipment included loudspeakers suitable for continued outdoor use. [Stand No. 23]

Ultra Electric, Ltd.

REPRESENTATIVE of the modern trend in portables the "Carnival Twin," in a plum-coloured plastic cabinet, is designed for both mains and battery use and is converted from one to the other in less than half a minute. Other receivers shown included the "Ultragram," a three-speed autochanger with three wavebands and automatic tone compensation. This feature is also included in the "Leader 51," a table five-valve three-waveband superhet. [Stand No. 53]

Valradio, Ltd.

AS specialists in power supply equipment Valradio showed a wide range of vibrators, D.C./A.C. vibrator converters and heavy duty power-units incorporating vibrators, some of these being suitable for use with mobile transmitters. It is claimed that the efficiency of these units is over 70 per cent. A popular unit is that delivering 500 volts at 250 mA and 6.3 volts at 6 amps from a standard 12-volt car battery. [Stand No. 21]

Vidor, Ltd.

BESIDES the well-known dry batteries bearing the Vidor trade-mark, portable radio receivers and models specially for the export market were prominently shown. There are now three models in the portable range, in the attaché case pattern, together with small power units intended for operating these from mains supplies. A new A.C. mains table receiver with five valves and covering four wavebands is designed for high-quality reproduction. [Stand No. 55]

Westinghouse Brake & Signals Co.

SPECIALISED rectifier applications were illustrated in the various units shown on this stand. Standard H.T. and L.T. units used in modern receivers and equipment contrasted with the larger commercial units designed for heavy duty work. Small units for use in electrical instruments, and a hermetically-sealed rectifier, "biscuit" shaped and primarily intended for motor-cycle battery charging, were shown. [Stand No. 43]

Whiteley Electrical Radio Co., Ltd.

PROMINENTLY featured on this stand was the new Stentorian cabinet extension speaker, known as the "Mayfair." The design of this was chosen for inclusion in the Festival of Britain Stock List, and in addition to it the well-known range of Stentorian baffle and cabinet speakers were displayed. New magnets and new cones were introduced and in most models a push-button for use with the "Long Arm" remote control was fitted. Special purpose loudspeakers were also shown and a radio relay cabinet loudspeaker in over 30 different patterns and a "relay gram" recently developed by the Whiteley people were also shown. The Radio Sonde transmitter, which is used by the British and many overseas meteorological officers, created great interest. [Stand No. 60]

Wright & Weaire, Ltd.

THE central part of this stand consisted of a sound-proof room wherein demonstrations of magnetic recording took place. Radio and electronic components formed one half of this exhibit, the other half being devoted to magnetic tape recorders. Typical Ferrograph recorders, tape-decks and rack-mounted assemblies were shown together with many of the Wearite coils, I.F. transformers, coil packs, etc. [Stand No. 112]

Notes on the "Summer All-dry Portable"

IT is apparent that some readers have not obtained the excellent results this receiver can provide, and an examination of likely causes has revealed one or two points which the constructor should not overlook.

Due to the circuit employed, the positive tag of the 50 μF bias condenser is wired to the metal chassis. The condenser is secured to the chassis by a clip (Fig. 1). If the condenser is of the metal-cased type, and the negative tag is common to the case (as it so often is), the condenser will be short-circuited, so that the output valve is operating without bias. This will reduce volume, increase anode current severely, and cause distortion. The cardboard type shown in the illustrations should be used, or brown paper or other insulating material wrapped round the condenser.

If any departure is made from the frame aerial details given in Fig. 5, it is essential to make certain that the aerial will tune over both wavebands satisfactorily. A fault in the aerial should be suspected if the aerial tuner does not peak sharply on each station on both wavebands.

Some ex-service coupling transformers which are available are not in any way suitable for ordinary inter-valve couplings, and their use will reduce volume most noticeably.

Finally, the coil specified has a large primary (as shown in Fig. 1), because maximum volume is required, and selectivity is not important. Coils with small primaries, though providing ample volume and extra selectivity in receivers with ordinary aerials, are best avoided here. If such a coil is already in use, an improvement may be effected in volume if tuned-anode coupling is adopted. To do this, connect "Earth" tag of coil to H.T. positive. Also take lower switch tag in Fig. 6 to H.T. positive. Take 1T4 anode to fixed-plates tag of detector tuner. F.G.R.

TONE CONTROLS

AN EXPLANATION OF SOME UNUSUAL ARRANGEMENTS AND THEIR USE IN STANDARD CIRCUITS

By W. J. DELANEY (G2FMY)

TONE controls appear to have a mixed reception by the amateurs interested in home construction, but an analysis of queries indicates that this section of a receiver or amplifier offers the greatest headache—apparently on account of the varied assortment of circuits which are available. To the purist, of course, tone controls are out of the question, and amplifiers must be designed to have a straight-line response. But

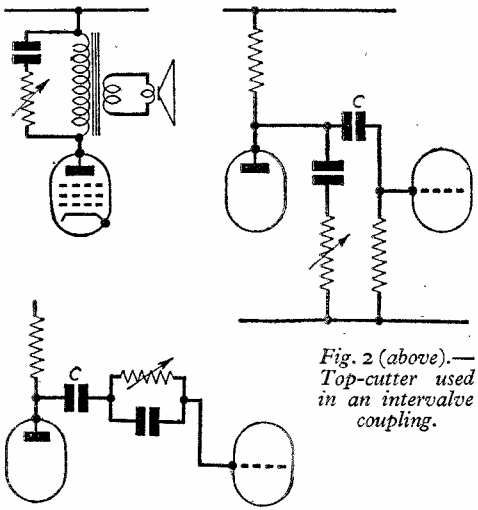


Fig. 2 (above).—Top-cutter used in an intervalve coupling.

Fig. 1 (top).—Standard top-note cutter. Fig. 3 (bottom).—This is the arrangement upon which "bass cutting" is developed.

the ear varies with the individual, and as one advances in years perception of the high notes decreases and thus it may give music a wrong tonal effect although nothing can apparently be done to increase the perception of the high notes. The presence of harmonics or overtones, however, will give to lower notes a quality which is different when those overtones are missing and this may be useful to some listeners. Similarly, rooms differ in the type of furnishing and it may be desirable to make reproduction more brilliant or less brilliant as the case may be, and thus there is a legitimate excuse for tone controls in one form or another.

Alternatives

Equipment is available in which four controls may be used, one for bass lift, one for bass cut and one each for "top" cut or lift. In other circuits a single control may suffice to give both cut and lift, and it is in this selection that the average constructor finds difficulty.

First, it must be pointed out that in the majority of cases the control actually does just the opposite to what its name indicates. Thus, a "bass lift" control will be found actually to be a "top cut" device—the reduction of the upper frequencies giving the effect of a raising of the lower frequencies but accompanied, of course, by a reduction of overall volume. Thus it is found that where effective tone control devices are fitted extra amplification must be carried out, either by replacing simple triode valves by pentodes or by adding one or more stages of amplification. A further point for consideration for those who are interested in adding tone control is the form which the control shall take, that is, whether it is to be a gradual increase or reduction in the particular range desired, or whether it is to be in steps. For the former, of course, a normal type of potentiometer would be used, whilst for the latter a rotary selector switch with a number of contacts would be employed. One further point to be decided upon is whether each control should give a falling characteristic at one end and a rise at the other, passing through a "normal" position, or whether each control shall start from normal and pass to a maximum of either rise or fall. It will thus be seen that there is some ground for doubt as to what to adopt in each circumstance and the following notes will cover the more usual arrangements and some special circuits which may be added to most normal amplifiers.

Top-cut Control

A condenser in series with a variable resistor is well known as a top-cut device and is found in most radio receivers in which a pentode output stage is employed (Fig. 1). This same circuit arrangement may be included in an intervalve coupling to serve exactly the same purpose (Fig. 2). In the Fig. 1 arrangement, of course, the resistor

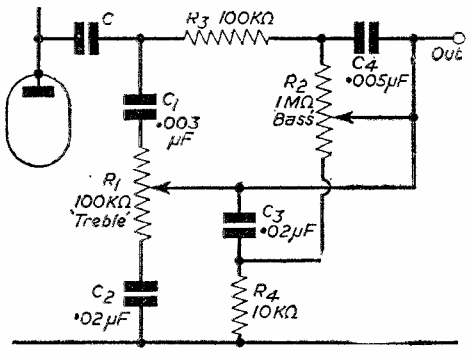


Fig. 4.—Simple combined bass and "top" controls without switching.

would be of a lower value, say up to 50,000 ohms with a condenser of .01 to .05μF. In the interval stage the condenser may be of the same range but the resistor could be up to 1 or 2 MΩ in value. The standard bass cutting or lower frequency shunt is seen in Fig. 3. Here the reactance of the condenser is varied by the shunt resistor. If desired, of course, the two circuits of Figs. 2 and 3 may be combined into the one interstage coupling, and with slight variations this is the arrangement used in Fig. 4, which is a reproduction of the scheme adopted in the Unit described in our July issue.

Push-pull Stage

For use in a push-pull stage an interesting circuit is advocated by the makers of the Brimar valves and is shown in Fig. 5. This could easily be incorporated in a standard push-pull amplifier by substituting the input valve by one of the double-diode types such as the 6SN7. In association with these two controls the use of a normal top-cut control of the Fig. 1 type is recommended, this being added across the anodes of the input stage.

The devices so far illustrated utilise variable resistors or potentiometers, but for those who are interested in the "stepped" form of control we reproduce a scheme recommended by the G.E.C. (Fig. 6). The losses incurred are made up in this arrangement by using a high-gain triode (or pentode strapped as a triode) in the input stage. Values are given but need not necessarily be adhered to as there is a wide range of tolerance depending upon the speaker in use and the range of control which is required.

In many cases it will be a simple matter to add these control circuits to an existing layout, but in view of the increased bass response which is given it will be found that difficulty will, in most cases, arise from hum. This is because the slight residual hum which is present in most circuits will receive emphasis, or the increased H.T. drain incurred by an additional stage will result in the need for better decoupling. It is therefore recommended where such troubles do arise, that the tone control network, or complete stages if valves are added, be included in a metal box, screened thoroughly and earthed. If valves are included they also should be enclosed, but in this case one side of the container may be made from perforated zinc or fine copper gauze so that adequate ventilation may be afforded to the valves and other components which are not intended to run at high temperatures. If a long grid lead has to be employed to couple either a radio unit or a gramophone pre-amplifier to the main unit, this should be of standard television coaxial rather than the thin, braided flex usually employed.

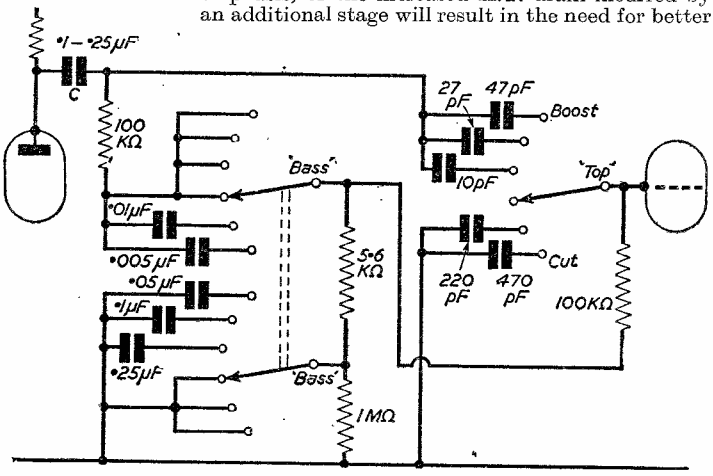


Fig. 6.—A switched bass and treble tone control circuit. The two condensers on the upper sections of the bass control "cut" bass, whilst the lower three "boost" bass.

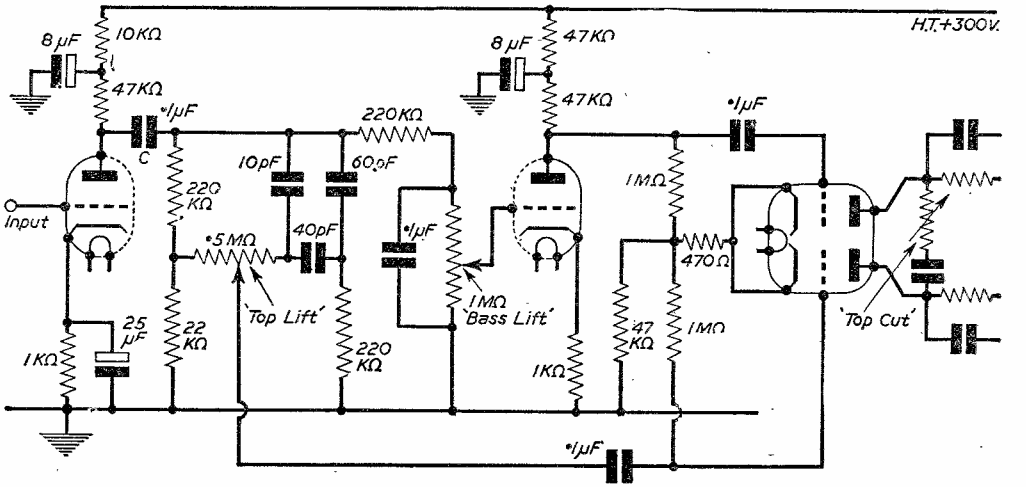


Fig. 5.—A comprehensive circuit giving complete control in a push-pull amplifier.

On your Wavelength

by THERMION

P.D. or E.M.F. ?

PERIODICALLY I receive a query from students who are puzzled by the use, sometimes synonymously, and at others distinctively, of the terms *Potential Difference*, and *Electro-motive Force*.

I am asked to explain the difference, if any, and I do so straightaway by saying that there is no real difference. It is indeed a distinction without a difference. Purists will argue that in some instances it would be proper to refer to P.D. and let in others to E.M.F. The fact is that the two terms mean exactly the same thing.

It is like the double sharp and the double flat in music; if the signs were not used you would still play the same note, but, of course, it is theoretically correct scoring. As a matter of fact there is no need for sharps as well as flats. Everything could be scored quite correctly by making use of one or the other only, as you will see from the following mnemonic:

Flats	6	5	4	3		2	1
Key	G	o	o	D	A	l E and	B e e F
Sharps	1	2	3	4		5	6

I have no doubt that I shall receive a crop of letters from teachers and others carefully explaining the old argument why P.D. is not equal to E.M.F. Perhaps, therefore, they will explain why authorities like Professor Adams use the terms synonymously.

In the Electrical Engineering Section of his engineering handbook he writes: "If the electro-motive force (E.M.F.) or potential difference (P.D.) equals one volt . . . etc." As a matter of fact I do not like either of the terms. Force is force, no matter what is used to create it. There is no difference between an electrical horse-power (746 watts) steam horse-power, a diesel horse-power, or a petrol horse-power. Let us use the good old term *force* and forget *electrical pressure*, potential difference and electro-motive force.

The National Radio Show

IT is part of my duty to visit manufacturers before the Show and to garner advance information concerning their new season's programmes. I am always surprised at the state of unpreparedness in which I find them year after year. Most of them seem to make up their minds in the spirit of "Oh well! I suppose we have got to do *something* for the Show," about a fortnight before the Show opens. A journalist's work is not made any easier because of this late disclosure which brings with it the inevitable corrections almost on the eve of the Show when the report has already gone to press. These corrections indicate that programmes have been left to the last minute, and that important items have been overlooked in the haste.

Some manufacturers play the cat and mouse game, waiting for rival manufacturers to disclose details of their programmes, so that they might go one better, perhaps by knocking a shilling or two off the price.

The radio industry is not the only one which adopts these methods. The motor trade and the cycle trade are also offenders. Can I, therefore, enter a plea for an earlier preparation of the new season's programmes?

Commentator

THIS is a horrible word, and suggests an inferior quality of "spud"! Why not commentor? Even the Oxford Dictionary doesn't like it. It says: the word commentate was rare in 1794. Under "commentator" it says: "the writer of a commentary." It prefers the word "commentor." It may be a matter of interest to readers to know that the word was first coined in 1641. A man who dissents is a dissenter, not a dissentator. The B.B.C. has been very anxious during recent years to correct our English for us, employing anyone but Englishmen for the purpose! Perhaps they will employ a Select Committee to "sit on" this monstrosity.

Where the Sets Go

BRITISH radio exports in the first six months of 1951, were valued at £10,195,333, which is 39.4 per cent. more than the figure for the same period last year, an all-time record and five times the value of a whole year's exports before the war. Of course, we must remember that prices have jumped about five times as well and this could account for the increased value. The point I wish to make is that price statistics as a measure of export efficiency or otherwise are utterly misleading. The only fair basis of judging what we are exporting now in relation to what we exported before the war is by means of the number of units exported. If before the war we exported 100,000 wireless sets valued at £1,000,000 that surely is far better than exporting 50,000 wireless sets at £2,000,000. In the latter case the higher price is merely an indication of lower productivity and hence the lower purchasing power of the £1.

The biggest increase in the case I have quoted above, was in the export of radio receivers which rose by 74 per cent.; receiver manufacturers were able to expand their markets in almost all countries, and were particularly successful in South Africa, South America, Egypt and Malaya. Surprisingly enough some manufacturers are even exporting to America!

The British Commonwealth, however, took about 40 per cent. of the total exports.

Components

IT will not be long, I hope, before constructors will open an issue of this journal and find the blueprint in it as was the case before the war. I mention this because many readers ask why we do not now issue blueprints. The fact is that in the early days of the war it was illegal to do so owing to paper shortage. I am hopeful that the situation may change soon.

For the Transmitter

SUPER-MODULATION

PRINCIPLES OF A FORM OF TRANSMISSION WHICH IS FINDING INCREASING POPULARITY AMONG AMATEURS

By WM. A. HOPE

SUPER-MODULATION came into being commercially during the 1939-45 World War, when R. E. Taylor tested its advantages from the commercial viewpoint. This type of modulation is sometimes referred to as "Taylor's Modulation."

The majority of amateurs to-day are using amplitude modulation (A.M.); but, on the other hand, super-modulation (S.M.) seems to be very much to the fore with the minority. When S.M. is used, the carrier level is greatly reduced and the sidebands are greatly emphasised. When this is the case, about four times the sideband power is obtained in spite of the fact that about one-half of the normal A.M. bandwidth is being utilised. Because of this, BCI and TVI is reduced to a great extent —a deciding factor when a transmitter is operating during television programmes, thus doing away with harmonic traps in the transmitter proper. Another advantage of S.M. is that about 5 watts of audio only are required to modulate a 150 watt carrier; thus large modulators are not needed and restricted space is conserved.

Theoretical Aspect

Theoretically, a modulation frequency of 2.5 kc/s. produces sidebands of 2.5 kc/s. on either side of the carrier frequency, compared with the sidebands of about 8 kc/s. on either side of the carrier as produced by distortion, etc., in practice. Fig. 1 shows the waveform of a typical amplitude-modulated (A.M.) carrier, while Fig. 2 shows the waveform obtained using super-modulation (S.M.) Fig. 3 shows a basic S.M. circuit as applied to amateur radio-telecommunication. In the circuit the 807 valve acts as a typical power amplifier (P.A.), while another 807 acts as the positive modulator (P.M.) valve. R.F. drive is supplied from a V.F.O. (variable frequency oscillator) via a tuned or untuned buffer amplifier (B.A.) to the condenser network C_A and C_B which divides the R.F. drive between the 807 P.A. and the 807 P.M. valves. The R.F. drive applied to the P.M. valve is approximately twice that applied to the P.A. valve. The audio volts (audio power here is

(*Continued on page* 453)

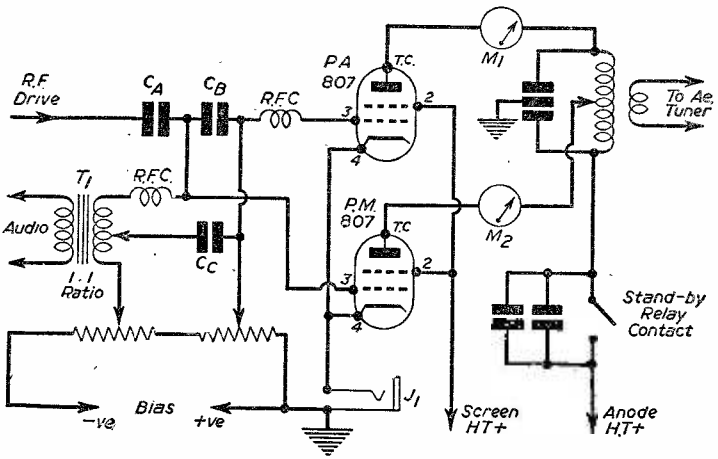
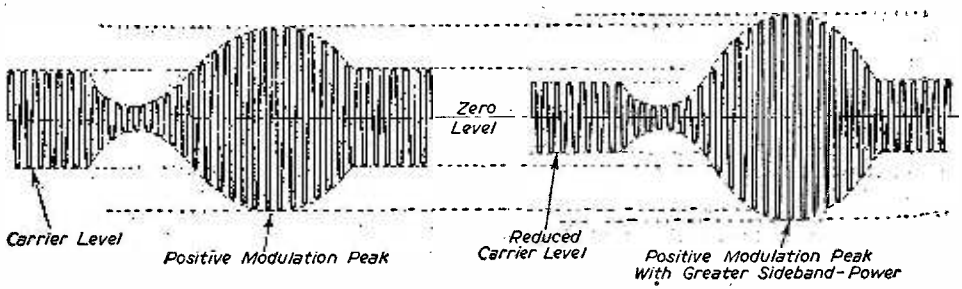


Fig. 3.—*Skeleton Super-modulation Transmitter circuit.*



Figs. 1 *and* 2.—*On the left an Amplitude-modulated carrier, and on the right a Super-modulated carrier.*

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(*Continued from page 450*)

referred to in terms of voltage) is also applied to these two valves, the P.M. having twice the audio applied to the control grid of the P.A. valve. It will be seen from Fig. 3 that the audio voltage is applied to the P.A. valve via condenser Cc which also isolates the P.A. grid from the bias voltage applied to the P.M. valve.

H.T. is applied to the anodes and screen grids of the 807s and readings will be obtained on the milliammeters M_1 and M_2. The P.M. valve is biased well beyond the "cut off" point—that is when the P.M. valve takes no current as indicated by M_2—R.F. drive is applied and the bias on the P.M. valve is adjusted till the P.M. valve just begins to draw current and no more. This allows the P.A. to be tuned without producing any snags. When audio is applied to T_1 (ratio 1 : 1), the bias on the P.M. valve will be reduced and the 807 will draw current and begin to amplify. Because of this, a large positive peak waveform will appear at the centre of the "final" coil. Under Class C conditions, when positive modulation is applied to the P.A. grid, no reduction in the P.A. anode current will be noticed; but when negative modulation is applied to the P.A. grid, there will be a decrease in anode current due to an increased negative bias voltage on the P.A. grid. This, in turn, produces a decrease in R.F. output to the aerial tuner. The P.A. valve is thus producing negative modulation peaks while the P.M. valve is producing positive modulation peaks which are superimposed on the transmitted carrier. With reference to Fig. 2 again, the reader will note the difference between the output waveforms using either A.M. or S.M. The author wishes to emphasise that the circuit shown in Fig. 3 is a "skeleton," and does not claim that it cannot be improved upon. The jack is provided for C.W. where a key can be plugged in with ease. It is, of course, self-shorting. By utilising the 807 valve, which is now selling at 5s. to 7s. 6d. in many shops, the amateur can build a small S.M. transmitter very cheaply. The 807 is extremely robust and can be (and often is) overrun considerably.

Power Supplies

The question of power supplies now crops up, and the author gives the following data in relation to the 807 valve.

C.W. Operation

Anode H.T.—750 v.
Screen grid—250 v.
Control grid (signal)—20 v.
Input—75 w.

Phone Operation

Anode H.T.—600 v.
Screen grid—275 v.
Control grid—60 v.
Input—60 w.

Ionospheric Recording and Communications

THE D.S.I.R. Stand at Earls Court, showed the use of ionospheric recording in short-wave communications. From information obtained by recording stations all over the world the best frequencies for transmitters to use are forecast six months before. Radios tuned in to the same broadcast on different frequencies proved how accurate these forecasts are.

Ultra-violet Radiations

Short-wave radio reception depends on the state of the ionosphere, the layers above the earth from which radio waves reflect like light from a mirror. The state of the ionosphere is affected by the ultra-violet radiation from the sun. Variations in this radiation according to the season, the sunspot cycle and other causes have to be taken into account when deciding what frequency should be used for transmission if reception is to be as clear as possible.

Collation at Slough

All over the world there are stations continuously recording the height and density of the ionisation of the layers above the surface of the earth. The Radio Research Station has its own apparatus for doing this at Slough, and there are other stations either operated by it or associated with it at Fraserburgh in Scotland, the Falkland Islands, Singapore, Ibadan in Nigeria and Khartoum. The records from these and other stations, which number about 60, are collated at the Radio Research Station. A series of monthly bulletins is published which enable forecasts to be made six months ahead of the best frequencies to be used for communication between any two points in the world.

Accuracy

The accuracy of the current forecasts was demonstrated on the Stand by using three radio receivers, all tuned in to Station WWV in the U.S.A., on three different frequencies. This station broadcasts standard frequency and time signals 24 hours a day. The public were able to see how correct the forecasts are by noting the difference in the reception of the same broadcast on the three frequencies, one of which was recommended in March this year.

The forecasts are used by the B.B.C., ships at sea, the Armed Forces, Cable and Wireless, the Post Office and other organisations.

CROSS-CHANNEL WALKIE-TALKIE

One of the features of the recent successful *Daily Mail* Cross-Channel Swim was that, for the first time, all the swimmers were kept in touch with the control ship by Pye Walkie-Talkie sets supplied by Alfred Imhoff, Ltd., in conjunction with Pye Telecommunications, Ltd. A fixed V.H.F. station was also set up on the jetty at Dover and, in addition, Pye set up their own monitoring station on the Dover cliffs capable of overhearing the walkie-talkies on the swimmers' pilot boats and on the control vessel.

Pye marine radio expert, R. I. T. Falkner, has already reported that the monitoring station was able to hear the walkie-talkies in action right across the English Channel.

D.C. Supplies–1

A COMPREHENSIVE SUPPLY PANEL FOR THE WORKSHOP

By W. NIMMONS

AS we are providing a fixed power panel, and not merely an eliminator, the size of the panel is immaterial but will in any case be larger than an eliminator proper, so it would be as well to provide facilities for charging an accumulator or accumulators. The panel itself can be 14in. by 8in., the baseboard being the same width but deeper—say 14in. by 12in. The panel should be of ebonite or fibre (bakelite, etc.), while the baseboard can be wood ½in. thick; plywood will resist warping.

The panel will carry the necessary terminals, which should be insulated; a means of selecting the required currents (of which more anon); an ammeter to measure the current going into the accumulator; and a rheostat for varying this current. There will be a length of flex leading from the back of the apparatus, terminating in a plug top which can be plugged into the mains point. The whole should be provided with a cover, or enclosed in a box which can be painted grey; this will give it a workmanlike appearance.

The Circuit

Dealing with the D.C. version first, Fig. 1 shows the circuit from which it will be seen that it differs from a conventional eliminator in that a means is provided for varying the current.

The reason for this is as follows. A conventional eliminator has to supply fixed voltages and currents only, whereas we may have to deal with a wide variety of currents. To take an example. Suppose an eliminator was supplying a four-valve set at 120 volts 20 mA. This would mean, for 220-volt mains, that the resistance inside the eliminator would be 5,000 ohms. Suppose now we replace the four-valve set with a one-valve or converter taking, say, 2 milliamps only. In the former case the voltage drop was 100 volts; in the latter it is 10 volts only, so that 210 volts would be supplied to the valve's anode, neglecting for the moment any resistors in the set. This is far too high for a battery valve, and its life would be a short one. This illustrates the importance of the resistance of the eliminator. It must be designed for the voltages and currents of the apparatus to which it is connected.

Ohm's Law will give the required resistance for various currents and voltage drops, but in practice five or six steps are all that is needed to supply the majority of sets, from one-valvers to multi-valvers. The following table gives a representative selection:

Type of Set	Current mA	Resistor (ohms)	Required voltage	Voltage drop
One-valve (Detector) ..	1	140,000	80	140
Short-wave Converter..	2	40,000	140	80
Two-valve	5	20,000	120	100
Three-valve	10	7,000	150	70
Four-valve or Superhet	20	3,500	150	70
Five-valve or Amplifier	30	2,300	150	70

It will be seen that for small currents the value of the resistor is increased, and, conversely, the greater the current, the less resistance is required. The table is for 220-volt D.C. mains.

The method of selecting which of the above resistances will be used can be by means of studs, but as these are rather difficult to set up correctly it can be carried out by means of a Yaxley switch or by sockets and a flying lead. The latter method is adopted, as one can tell at a glance which range is in circuit, and it also presents rather less difficulty for the beginner. The sockets should be well insulated and the metal recessed.

It is presumed that any set connected to this apparatus will have its own voltage-dropping

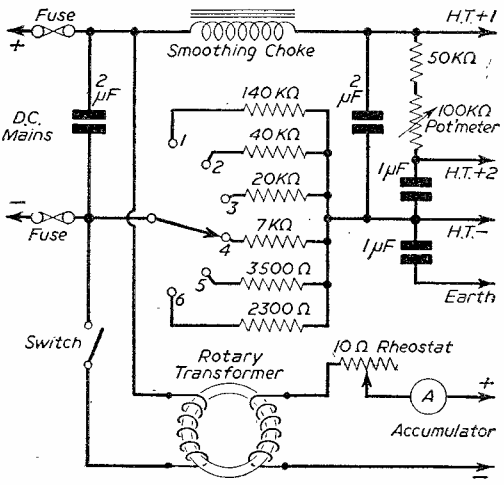


Fig. 1.—Circuit of a D.C. eliminator.

resistors incorporated. An extra lead is provided, however, so that a set which requires a screen tapping is provided for. This takes the form of a fixed 50,000-ohm resistor in series with a 100,000-ohm variable resistance, so that the resistance can be varied from 50,000 to 150,000 ohms. The fixed resistor will prevent damage to the valve should the variable resistance be inadvertently turned "full on." This lead is decoupled by a 1 μF condenser.

Referring again to the table, the first three ranges can be fed by 1-watt resistors, the next two by 2-watt, while the last should be a 3-watt resistor if trouble-free operation is desired. A 1-watt resistor may hold out for a time on any of the ranges, but it may get unduly hot and is liable to failure.

Fig. 2 shows the set-up

of the D.C. version, together with all wiring. The rotary transformer is for the purpose of charging an accumulator at currents up to 5 amps., which it can do while taking a very small current from the mains. Its associated switch and ammeter are on the panel. It will charge a two-, four-, or six-volt accumulator at currents up to that mentioned.

The rheostat used for regulating the current from the rotary transformer should be capable of handling the current, otherwise it will get very hot and may burn through the insulation of its former. It should be wound with not less than No. 22 gauge resistance wire, preferably on a fireproof former.

It is not intended that the rotary should be running while the rest of the apparatus is in operation, though this could be done by connecting the leads from the L.T. terminals of the accumulator at the same time as the leads from the receiver. In this case care should be taken that the accumulator does not become fully charged while running the set, as the excess voltage may damage the valves.

A 0/6 Amp. meter is included so that the actual charging rate may be seen. These ammeters may be had quite cheaply from our advertisers, or one may be made by conversion from a milliammeter by connecting the appropriate shunt. No details of this can be given, since it depends on the actual meter what resistance will be required.

As mentioned previously, the rheostat should be capable of handling the current. At one or two amps an unsuitable component may just get a trifle hot, but at four or five amps it may get *red hot*, and will certainly burn through the insulation. If no suitable rheostat can be obtained it would be worth while to wind one's own by stripping the wire from an old rheostat and rewinding with a larger gauge of wire taken from an electric fire element. Failing that, two terminals can be provided on the panel in place of the rheostat and a motor-car headlamp or sidelamp bulb connected to these until the necessary current is obtained; this will naturally mean that the current is not continuously variable, but against this is the fact that the light gives the apparatus a businesslike appearance and shows that charging is taking place.

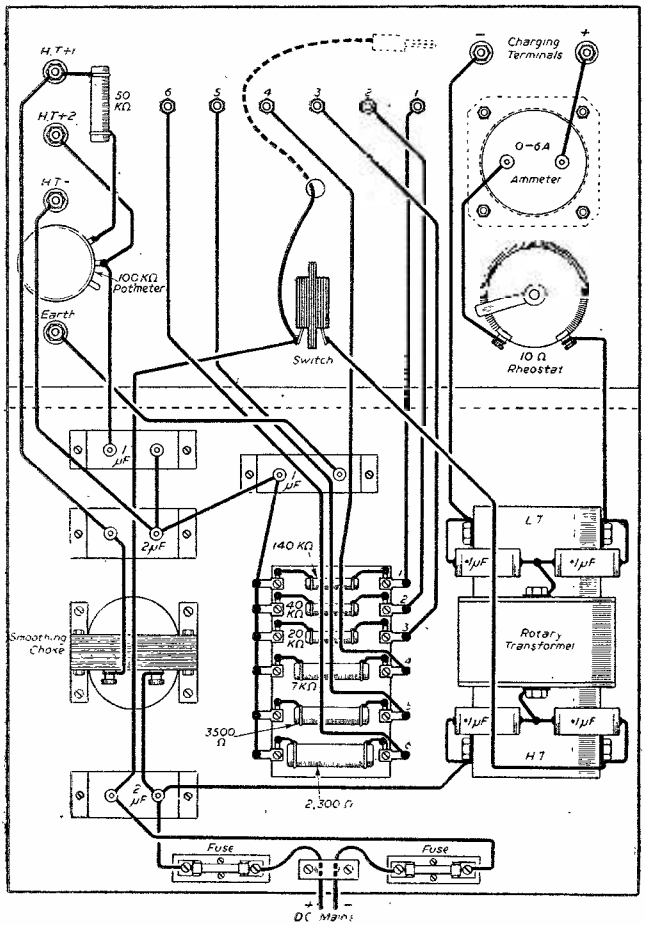


Fig. 2.—Wiring diagram of the circuit shown in Fig. 1.

Wiring

In Fig. 2, which shows the wiring diagram of the D.C. version, the rotary transformer is shown unmounted. Actually it should be mounted because (a) it lessens the noise, and (b) takes up the recoil when the rotary is switched on, which causes the instrument to lunge in a direction opposite to the direction of rotation.

It may be mounted on sponge rubber by screwing a wooden block at either end to hold it in position and placing the sponge rubber beneath it; or it may be suspended on a piece of car inner tubing from the same blocks. Whichever method is adopted the aim should be to prevent the rotary from touching the wooden baseboard which acts as a soundboard and amplifies the noise.

Fig. 2 illustrates the method of selecting the H.T. range. There are six sockets on the panel, with a flying lead passing through a hole from the back of the panel to the front. Beginning at the left-hand side, looking from the front of the panel, the first socket gives the least current and thence through sockets 2, 3, 4, 5, each socket giving a progressively higher current to socket 6, which gives the greatest current. If desired, these sockets might be coloured brown, red, orange, yellow, green and blue to represent the steps from the highest to the lowest.

A neat way of disposing of the resistors required in the voltage-dropping arrangements is to group them together on a small board or strip. This can be seen in Fig. 2 and, except for the 50,000-ohm resistor associated with the screen voltage-dropping, provides a satisfactory arrangement.

(To be continued)

A.C. Mai

A T.R.F. RECEIVER UTILISING MIDGE

By K.

THE receiver described in this article s designed for minimum size whilst preserving some of the advantages of normal A.C. designs, i.e., current for valve heaters from a heater transformer and a separate winding for the rectifier heater to avoid heater-cathode insulation stress. To allow the use of a small transformer the following valve sequence is adopted—9003 R.F. 9001 Detector, EL91 Output, EL91 Rectifier. The EL91 is strapped for use as a rectifier and has performed this function for many months without failure or change in characteristics. An EY91 may be used but takes over twice the heater current.

The circuit is a conventional T.R.F. with a pentode detector, using a miniature ganged condenser for tuning. In the prototype this was of .00037 μF maximum capacity with self-contained trimmers. The anode of the output valve is connected via the speaker transformer primary to the rectifier cathode. In spite of this the hum level is quite low and the smoothing to the earlier stages and screen of the output valve is much better as a result. No reaction is used with the detector though a certain amount may occur in the R.F. stage when the volume control is at its maximum. It will be noticed that no mains switch is included in the circuit ; this was due to the lack of a suitable combined volume control and switch.

Transformer Data

Whilst the set does not present many constructional difficulties—the prototype being assembled and wired in two evenings—the difficult items to make are the heater and output transformers, which demand some patience and a little previous experience. However, if the details are followed carefully the outcome should prove successful. It is best to construct these items first as the set is built around them, and therefore the first step is to obtain suitable laminations. Those for the heater transformer were obtained from a small output transformer and have the dimensions in Fig. 2. Laminations for the output transformer were obtained from a small potted transformer used in many American aircraft receivers, such as the A.R.R.2 and BC453, one of the series of Command Receivers. They are used for coupling a 12A6 output stage to 'phones and are filled with a compound that makes dismantling rather messy.

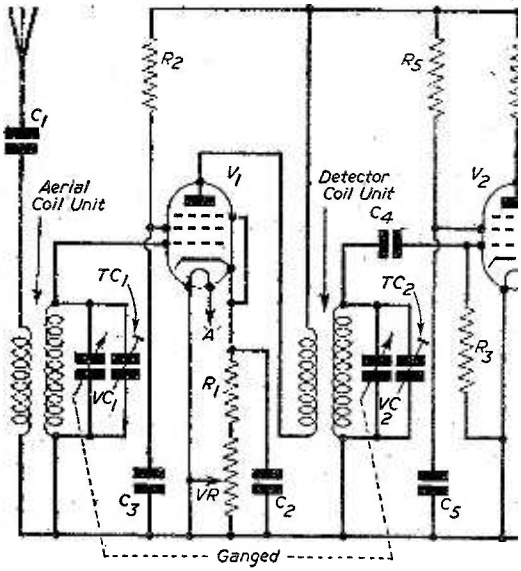
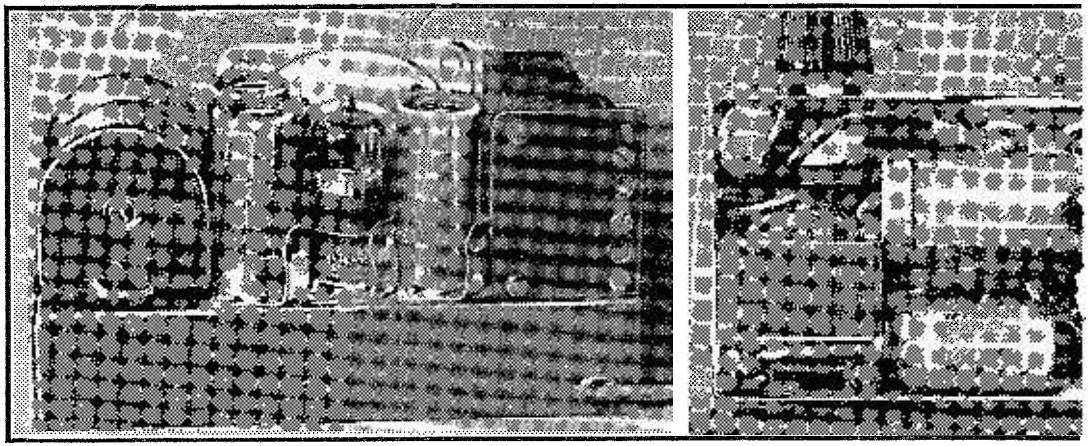


Fig. 1.—Theoretical circuit of the Midget. Above- an



Three views of the completed receiver. Th

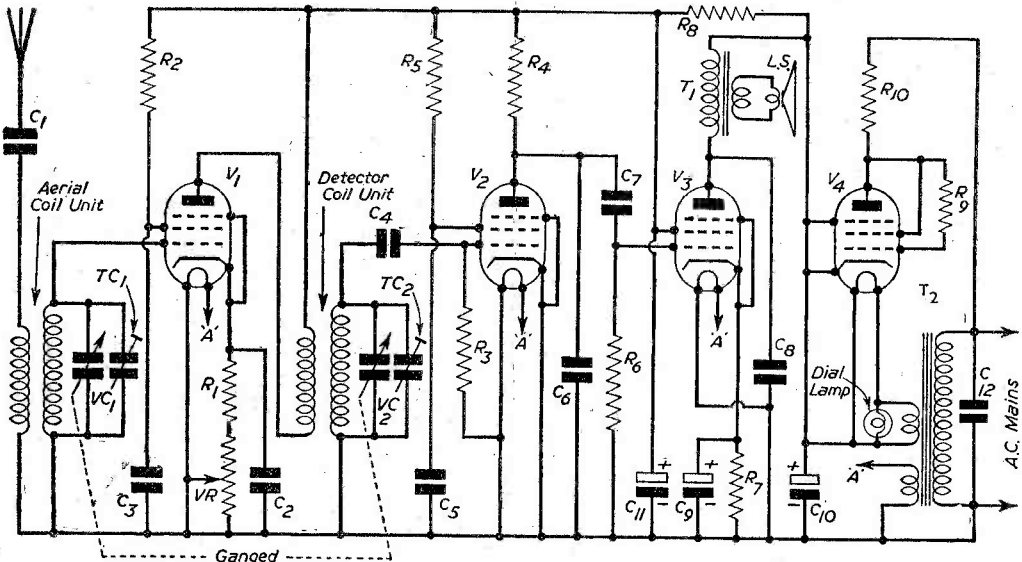


Fig. 1.—Theoretical circuit of the Midget. Above- and below-chassis wiring details will be given next month.

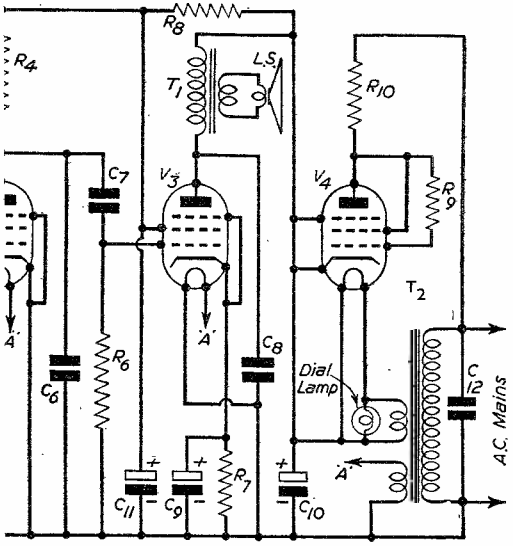
ns Midget

T. VALVES AND A 2½IN. SPEAKER

ASKED

Petrol or carbon tetrachloride will clean the laminations. Dimensions are given in Fig. 3.

It is essential that laminations closely approximating to these be obtained as otherwise there will have to be a change in chassis dimensions. There must not be any reduction in winding space, or core area, especially in the case of the heater transformer. Although of such small overall size, the heater transformer operates with quite a low temperature rise even after several hours and does not become more than just perceptibly warm. The output transformer, if connected to a large speaker, will be found to have a reasonably good bass response but it will not be very evident with a 2½in. speaker.



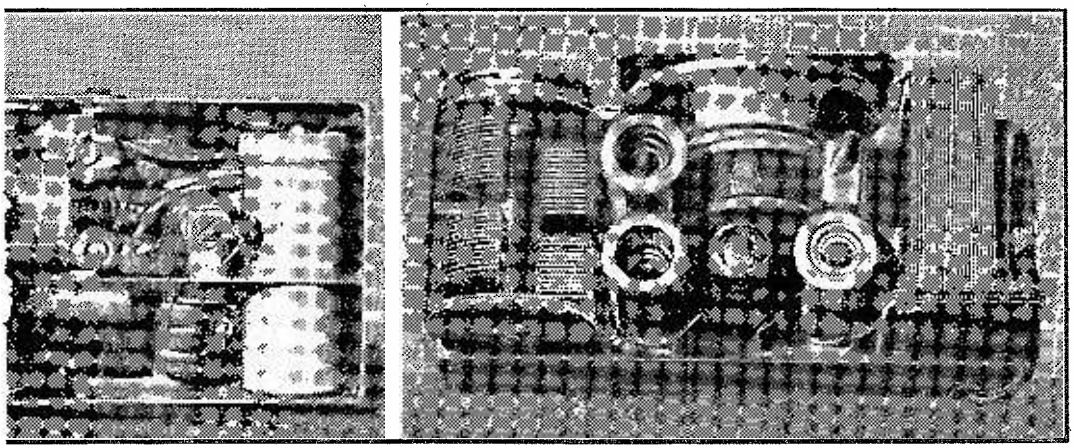
d below-chassis wiring details will be given next month.

Heater Transformer

Having obtained the laminations a former will have to be made, for even if the original former is available it will probably be made of material too thick for the new transformer. As much winding space as possible must be provided. From a piece of wood or other suitable material, shape a core of the same cross section as the transformer core and about 1½in. long. Using very thin card (postcards will do) cut a strip ½in. wider than the window space and of length sufficient to go round the wooden core and overlap to form a ¼in. joint which *must* be placed as shown in Fig. 4. Remove the card and cut down the four creases on each side for ¼in. and bend outwards for use as tabs—Fig. 4.

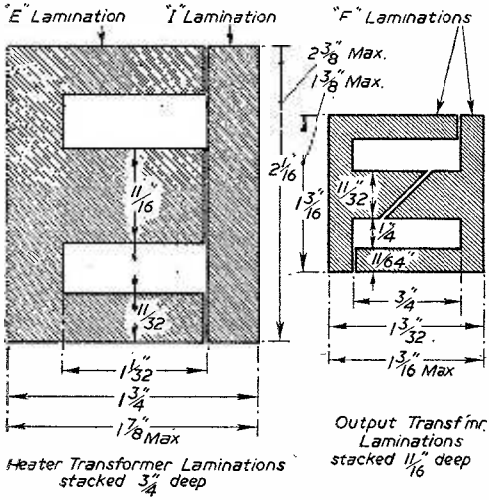
Replace tube on core and cement joint with balsa cement or Durofix, taking care not to fix the former to the core. It might be advisable to wax the core so that it will slide in and out without damage. Cut cheeks as in Fig. 7 with a central opening to slide on the tube. This will be slightly larger than ¾in. x 11/16in. owing to the thickness of the card used for the tube. Cement the tabs outside the cheeks as in Fig. 5, positioning the cheeks as shown. After setting, the former may be slid off carefully. Check that the laminations will fit into the bobbin without fouling the outer edges of the cheeks. If correct, give it several coats of shellac varnish, allowing time to dry between coats. This will result in a strong, rigid former.

Drill the wooden core lengthwise through its centre and pass a bolt through so that the core



e chassis actually measures 5¾in. by 2⅜in.

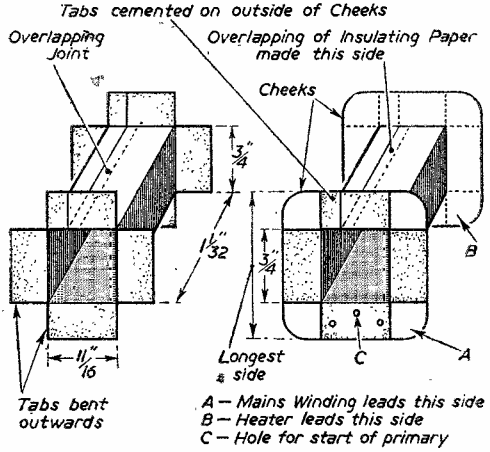
may be secured in a hand drill. Slip the former on the core. Winding may now commence. Pierce a small hole through the cheek as in Fig. 5 and, using 38 s.w.g. enamel-insulated wire, feed a few inches through and secure out of the way. Wind as evenly as possible 3,300 turns on to the former, tapping at 2,850 for 200 volts operation if desired.



Figs. 2 and 3.—Details of the laminations for the heater and output transformers.

The winding must be level when finished. From a condenser of the block type procure some of the thin insulating paper. Cut strips from it very slightly wider than the former and put on two turns of insulating paper.

Place the overlap in the correct position. There will not be much stress on the insulation as the outer of the first winding and the inner of the next both go to chassis. The next winding is the heater winding for V1, V2, V3. Wind on 100 turns of 26 s.w.g. enamel in two layers as tightly as possible, taking care that the wire does not slip through at the edges to the first winding. Secure the outer lead with a small loop of tape before passing through cheek. Insulate the winding and



Figs. 4 and 5.—Transformer bobbins are made up as shown in these illustrations.

wind on 100 turns of 28 s.w.g. enamel for rectifier heating winding. It must be stressed that if the windings are to be placed in the space allotted great care will have to be taken.

Check that the laminations will pass into the former without touching the windings. If all is correct give a coating of shellac and cover the outside winding with Empire cloth or strong paper. Then assemble the transformer laminations, reversing alternately through the stack. Take the

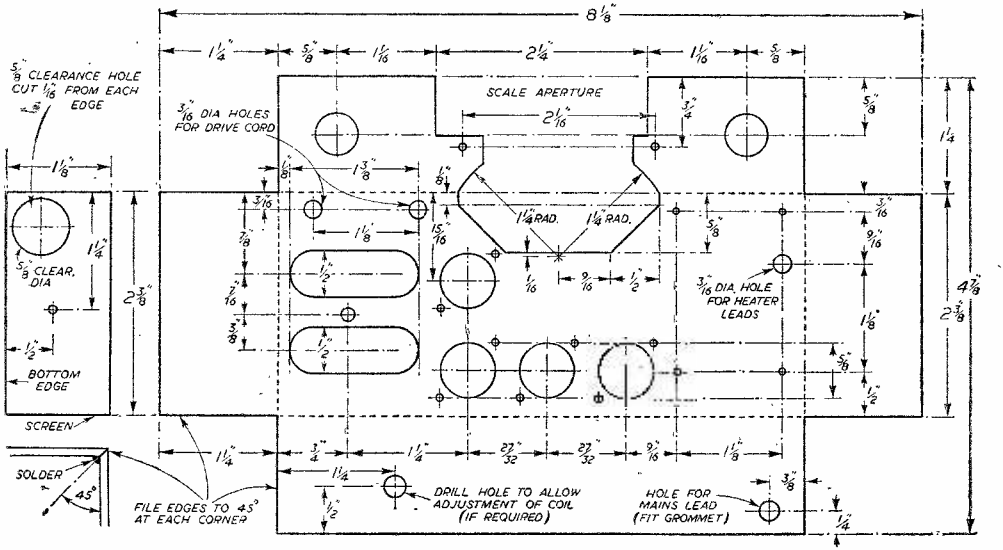
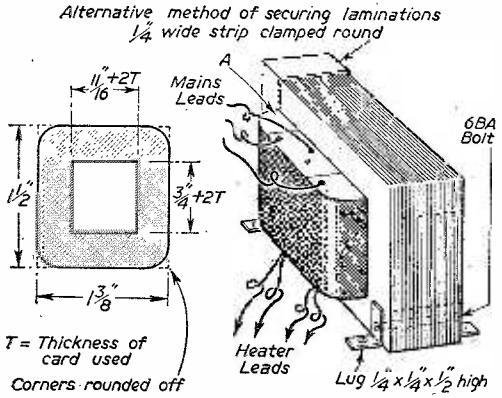


Fig. 6.—Details of the chassis with drilling and bending measurements. The right-hand speaker fixing hole is 1 9/16th in from the right-hand chassis edge.

utmost care not to cut through the former as the laminations are very sharp. If the corners cut through the former all the previous work will be entirely wasted. After assembly the stack should be tightly held in the former. Test the transformer, using appropriate loads after checking insulation of windings to each other and the core. The voltages should be within reasonable limits



Figs. 7 and 8.—Details of the end-cheeks and an alternative method of securing the laminations.

whilst on load but will be about 7 volts on open circuit. Shellac varnish may now be run into the laminations so that they do not vibrate. Fig. 8 shows the completed transformer and methods of securing to chassis.

The Output Transformer

As before, construct a bobbin of thin card to carry the windings, modifying the dimensions to suit the smaller laminations. Wind 3,500 turns of 40 s.w.g. enamelled wire for the primary and insulate. The secondary consists of 50 turns of 24 s.w.g. enamelled wire in two layers. A piece of tape or Empire cloth will protect the outer winding, followed by a coat of shellac varnish. Assemble core in the butt-jointed manner, as a gapped joint is required. It is sufficient to butt the laminations closely together. The finished transformer and mounting clip is shown in Fig. 9.

Chassis

Using brass or tinned steel of 22 s.w.g. form the chassis, using Fig. 6 as a guide. The dimensions given may have to be varied slightly according to the components used—this is left to the constructor's discretion. It would be wise to ensure the exact location of all the large components so that no difficulties occur later. Cut out the loudspeaker aperture first before bending the sides but the rest of the drilling and cutting is best done later or it is very difficult to form the sides without

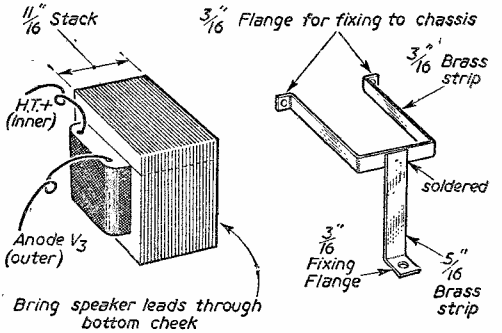


Fig. 9.—The output transformer and its fixing clip.

distorting the chassis. The corners are soldered to strengthen the chassis. The slots at the end of the chassis allow the trimmers and connecting tags of the tuning condenser to pass through. To make a neat joint at the corners of the chassis cut lengths of resin-cored solder 1½in. long and, holding the joint in a horizontal position, place a piece of solder along the joint and hold the soldering iron on the underside of the joint until the solder runs. Naturally, the corner must be cleaned, where the solder forms the joint, as an initial operation. The screen is of brass or copper.

Assembly

Fix the heater transformer to the chassis using one of the methods shown. The lug nearest to V4 may need a little filing to fit correctly. A clip sweated to the chassis holds the output transformer in place and it may be necessary to put the volume control in position first. Before fixing the tuning condenser in position, remove the perspex dust cover, cut off the right-hand fixing lug and shorten the shaft to project ¼in. only. Take care that filings, etc., do not penetrate into the condenser.

(To be continued)

LIST OF COMPONENTS

Voltages are Working Voltages.

R1—150Ω 1/10 W.
R2—47 KΩ 1/10 W.
R3—2.2 MΩ 1/10 W.
R4—470 KΩ 1/10 W.
R5—2.2 MΩ 1/10 W.
R6—470 KΩ 1/10 W.
R7—680Ω ½ W.
R8—5 KΩ ½ W.
R9—2.2 KΩ ½ W.
R10—100Ω ½ W.

VR—50 KΩ variable.
VC1, TC1 Twin gang condenser
VC2, TC2 .00037 μF. maximum.
C1—.005 μF. 500 v. Metalmite T.C.C.
C2—.04μF, 150 v. Hunts W99.
C3—.04 μF. 150 v. Hunts W99.
C4—100 pF. Ceramic.
C5—.04 μF. 150 v. Hunts W99.
C6—100 pF. mica.
C7—.01μF. 500 v. Metalmite T.C.C.
C8—.005 μF. 500 v. Metalmite T.C.C.
C9—10 μF. electrolytic Micropack 25 v.
C10—8 μF. electrolytic B.E.C. } 450 v. wkg.
C11—8 μF. electrolytic B.E.C. } 1⅝in. long, ⅝in. diameter.
C12—.01μF. 500 v. Metalmite T.C.C.
T1, T2—See text.
L.S.—Speaker 2½in.
V1—9003.
Coils—See text.
V2—9001.
V3, V4—EL91 (V4 may be EY91).

Voltage Stabilised Power Units

FEATURES OF THE DESIGN OF THIS FORM OF POWER SUPPLY

By J. S. KENDALL*

ONE of the most useful types of power units for laboratory, shack, or workshop use is the voltage stabilised unit. This type of unit can be divided into two main types, series and parallel.

The simplest type of fixed parallel is the gas discharge tube such as the Brimar VR150/30, VR75/30 and the VR105/30; these tubes are for shunt operation only and maintain a fairly constant voltage with a variation of from 5 to 30 mA. through them, i.e., a load current variation of 25 mA. Fig. 1 shows a typical circuit.

This article deals with the valve as a voltage stabiliser, and gives typical circuits, along with a large amount of carefully worked out data in the form of Table 1. Complete circuits for units are given along with the application in circuitry.

The impedance (not to be confused with resistance) of the above-mentioned tubes is about 80 ohms, so that the variation between minimum and maximum current is $80 \times 25 \times 0.001$ equals 2 volts. This is good enough for most purposes. It should be pointed out that these tubes must not be connected in parallel, as owing to the different striking voltages the current will not divide equally (that is if it divides at all). Conversely, they can be used in series very effectively.

The series operation causes a rise in the impedance of the unit and consequently poorer stabilisation, as the impedances of the units are added, so that if two VR75/30 were used in series the overall impedance and regulation would be 160 ohms and 4 volts or just double that of one VR150/30, but such a system has the advantage that two different voltages can be obtained off the same unit. If two tubes are connected in series separate D.C. paths must be provided across each unit as shown in Fig. 2. A suitable value for these resistors is about 1 megohm. and its purpose is to ensure that the tubes all strike without an undue rise in voltage. A condenser should be connected across each tube as they generate an amount of noise by means of the Schotte effect. This effect is noise generated by the electrons in the tube and can be a decided nuisance when very low levels are being amplified, and also when large bandwidths are used. This noise, named after the German physicist Schotte, is due to the very slight change in potential as each electron arrives at the anode of the tube in a rather haphazard manner and spreads noise through the entire spectrum used in radio work. An idea of how small it actually is can be gained from the fact that 1 ampere consists of a flow of 6.290,000,000,000,000,000, electrons per second! It is usually quite sufficient to shunt the tube with a 0.1μF condenser to get rid of it.

In cases where the output of a gas tube is not of suitable voltage or current it can be used to control a triode, tetrode or pentode valve in either a series or parallel circuit.

Typical Circuit

Fig. 3 shows a typical circuit for series control. The valve is, in effect, connected as a cathode follower so that any change in cathode voltage causes a change in anode current, i.e., the grid voltage remains constant whilst the cathode voltage moves in respect to it, causing a change in anode current in just the same way as if the grid potential changed and the cathode potential remained constant. With such a circuit if the load current changes by 10 mA. then, if the slope of the valve is 10 mA. per volt the cathode potential will have to change one volt to compensate. Impedance is the change of volts divided by the change in current, so that in this case the impedance of the unit will be

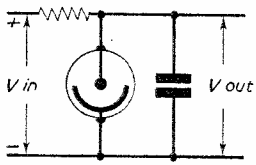


Fig. 1 (left).—Shunt stabilising circuit using a single gas tube.

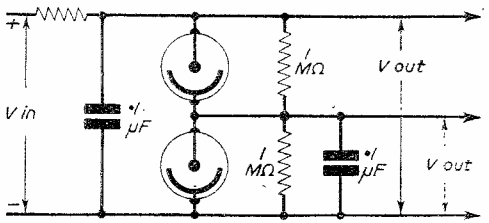


Fig. 2.—Shunt stabilising circuit using two tubes giving two outputs.

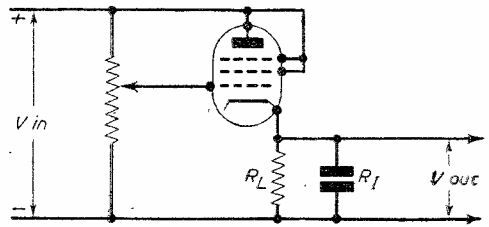


Fig. 3.—Variable output series circuit.

$\frac{1}{.01}$ (voltage in volts and current in amperes) equals 100 ohms. From this it will readily be seen that the output impedance is approximately the reciprocal of the slope in amperes of the valve being used. This circuit can be used with similar valves in parallel. In this case the impedance is that of one valve divided by the number of valves used. In Fig. 3 it will be seen that there is a resistance in the cathode circuit of the valve. This must be of such value that it takes about 1/10th of the total cathode current and keeps the valve operating on the straight portion of its curve. One very important point to be remembered is that the total anode dissipation of the valve must not be exceeded or the valve will be destroyed by overheating and excessive emission.

Take, for example, the 6L6. This valve is rated as G2 2.5 W. max. Anode 19 W. max., so that with anodes and screen tied, the maximum dissipation can be taken as 20 watts (the anode and screen must be joined by a resistance in order that the screen dissipation is not excessive). If the input voltage is to be, say, 450 volts and the output 200 volts the maximum current will be 20/250 amperes equals 80 mA.), but of this 1/10th has to be passed through the cathode resistance. The slope of the valve at this point is 6 mA./v.; so that the impedance is 170 ohms at the output voltage of 50 volts; the overall drop will be 400 volts, so that the maximum current will be 50 mA. But as the slope is higher the result is that the output impedance is lower, and, consequently, the regulation is better.

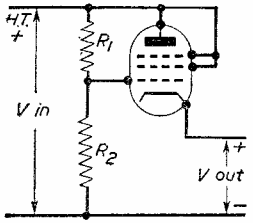


Fig. 5.—A fixed output series stabilised circuit.

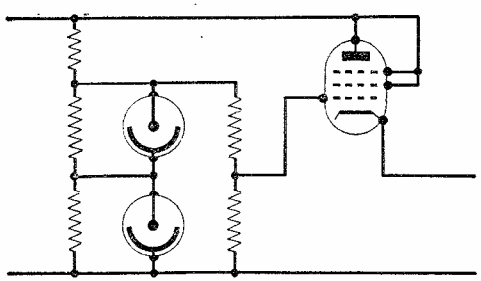


Fig. 6.—Series stabilising circuit using fixed and stabilised grid voltage to make output independent of supply variations.

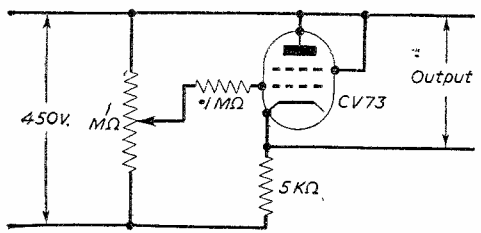


Fig. 7.—Shunt stabilising circuit.

Fig. 4 shows a full circuit with an output of 80 mA. over a range of 50 to 250 volts, stabilised and regulated to an impedance of about 75 ohms.

The mains transformer is of the 350-0-350 volt 120 mA. type, with a 6.3 and a 5 volt winding. The 6.3 volt heater windings can be joined by a high resistance, but if it is used for the supply of heaters in other circuits the maximum cathode to heater voltage should not be in excess of 180 volts or the insulation will break down and the valves be spoiled.

Data

Table I gives the operating conditions, as voltage stabilisers, of a number of common valves. The H.T. voltage is assumed to be, after smoothing, direct from the cathode of the rectifier with an input of 350 volts which gives approximately 450 volts. It will be remembered that the full rectified voltage is just under the peak value of the input voltage, i.e., 1.4 times the R.M.S. value.

TABLE I

The characteristics of various valves when used for stabilising. Note I is in mA. and the impedance in ohms. Input volts taken as 450 max.

Type	Rk.	I max.	Z
EF37	100 KΩ	5	400
EC31	50 KΩ	20	300
EL32	50 KΩ	25	400
EL33	50 KΩ	30	90
EL37	25 KΩ	50	200
PenA4	50 KΩ	30	100
QVO5-24	25 KΩ	70	100
QQVO4-20	25 KΩ	60	100
6f1	50 KΩ	10	110
6P25	25 KΩ	40	100
HL41	1 MΩ	2	300
P61	100 KΩ	10	120
Pen44	20 KΩ	60	80
Pen46	25 KΩ	50	110
SP41 } SP61 }	25 KΩ	10	110
6J7	50 KΩ	6	700
6SH7	50 KΩ	10	200
6AG7	50 KΩ	25	90
L63	100 KΩ	4	400
KT8	25 KΩ	50	200
KT36	50 KΩ	25	95
KT71	50 KΩ	25	100
KT63, 6F6	50 KΩ	30	400
KT81	30 KΩ	35	80
MH4	100 KΩ	4	300
MKT4	50 KΩ	30	350
ML4	100 KΩ	12	200
N78	50 KΩ	35	80
PX4	50 KΩ	45	180
PX25	25 KΩ	75	120
Z90, EF50	100 KΩ	100	100
Z66	100 KΩ	7	100

In many cases it is far better to go to the expense of a stabilised output for dropping voltage from one part of a circuit to another where good regulation is required, or where lack of feed-back due to common impedance coupling is essential, as in the case of the very high gain amplifier. A typical controlled ratio circuit is shown in Fig. 5. Here the ratio of voltage in the output circuit is directly proportional to the ratio of R_1 and R_2, but any variation in the supply volts is reflected in the output volts. To overcome this R_1 and R_2 can be placed across one or more gas tubes, as shown in Fig. 6. This has the effect of rendering the output very nearly independent of the supply volts. In the case of the voltage divider circuits the standing anode current must be large enough to keep on the straight part of the valve curve, i.e., the load resistance must not be less than the value of Rk given in the table. The particulars of various gas tubes are given in Table II.

The other, and in my opinion less useful, type of voltage stabiliser circuit as regards hard valves is the parallel circuit. In this circuit (Fig. 7) under the no-load condition, the valve draws the full current, but as the load current rises the valve gradually draws less and less until it actually stops conducting and the circuit tends to choke itself. The circuit shown in Fig. 7 employs the well-known ex-W.D. valve, the CV73, or to give it its civilian number, the Mazda 11E3. The transformer used in the actual unit was a 350-0-350 120 m.A., out of an old receiver, and the established output

TABLE II

Gas stabiliser tubes

Type	Regulation	Striking V.	Operating V.	I max.	I min.
ST11	5	140	100	8	1
NE5			110	30	
4687 } 4687A }	250 ohms	130	90–110	40	10
7475	300 ohms	140	90–110	8	1
85A1	290 ohms	125	83–86	8	1

is 50 m.A. It will be seen that a change of 2 mA. in the cathode current causes a change of one volt, so that if one tries to draw too much current the drop across the bias resistor at a current of 90 mA. represents a full short-circuit! The impedance of the unit up to 50 mA. is 100 ohms.

It will be seen that with a little ingenuity stabilised units can be designed that will be of great value in improving circuit efficiency and stability.

Radio Control at the Model Engineer Exhibition

SUBMARINE sound transmissions controlled the movements of the fine model of the s.s. *Port Brisbane*, which was shown coming into dock, securing alongside and unloading her cargo in the water tank, which was one of the chief attractions at "The Model Engineer" Exhibition.

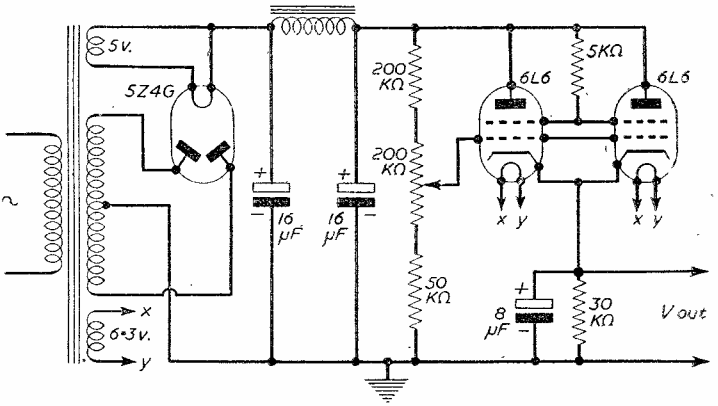


Fig. 4.—Circuit of a 50 to 250 volt series-stabilised circuit giving up to 80 mA. output.

This model was built exactly to scale, the hull being constructed of plates similar in type to those used in full-sized construction. All the internal fittings and machinery on each deck are to scale and it is believed that this is the first time that a model constructed in such detail throughout floated on her designed waterline and operated exactly like a real ship.

Also perfect in every detail was a model cruiser which was radio-controlled. Powered by scale steam turbines, this cruiser is very manœuvrable and its guns fire actual shells. Signals can be made from the masthead and smoke can be made.

Giant Airship

A giant radio-controlled model airship was one of the chief spectacles of the exhibition. Twelve feet six inches long, the airship has a capacity of 70 cubic feet. It is constructed on the rigid principle and power is supplied by a miniature internal-combustion engine. This model was specially built for the exhibition.

FREQUENCY MODULATION

A NEW SERIES

1.—AN INTRODUCTION TO THIS INCREASINGLY POPULAR METHOD OF TRANSMISSION

By J. F. GOLDING

THE advantages and limitations of frequency modulation, as compared with amplitude modulation, are many and varied, but, probably, its most striking feature is the fact that poor reception is virtually non-existent. By the very nature of the system, an F.M. signal is either received at full volume with a good signal-to-noise ratio or it cannot be received at all. For example, during some recent tests carried out by the author, it was found that the experimental F.M. broadcast from Wrotham were received at full loudspeaker strength, using a dipole aerial mounted on the roof, but when the aerial was brought indoors it was impossible to receive any signal whatsoever. The same procedure, when receiving the A.M. V.H.F. broadcast from the same station, produced a difference in audio output of only about 3 db. However, when the F.M. signal was received, it was noticeably free from interference even though the receiving apparatus was somewhat crude and did not do justice to the improved quality.

In order to understand the reasons for this behaviour and to master the technique of using F.M. it is necessary to form a clear picture of what actually takes place electrically and to compare the properties of an F.M. with the corresponding A.M. signal.

Three Systems

A carrier may be modulated in three ways. The orthodox method of modulating the amplitude is so well known that little need be said about it except perhaps to mention that the whole of the intelligence is carried in two sidebands spaced above and below the carrier by an interval equal to the modulating frequency. The two other types of modulation—phase and frequency modulation—have a great deal in common and some considerable confusion exists in the minds of many engineers as to the exact difference.

In a frequency modulated system, the carrier *frequency* is varied at a rate corresponding to the modulation frequency and by an *amount* proportional to the modulating voltage, whereas in phase modulation, although the frequency necessarily varies, it is the phase of the carrier which is shifted at a rate equal to the modulating frequency and by an amount equal to the modulating voltage. In both these types the carrier amplitude remains constant and, if a sinewave modulating signal is used, a phase-modulated and a frequency-modulated transmitter would produce an almost identical output signal.

For this reason the three types of modulation are illustrated in Fig. 1, the modulating waveform being of the form shown in Fig. 1 (a) instead of the more usual sinewave.

Figure 1(b) shows the familiar amplitude-modulation envelope; the modulation depth is 60 per cent. The frequency modulated signal is shown in Fig. 1(c). It will be noticed that during the rising edge of the modulating signal the frequency of the carrier decreases and stabilises at a lower frequency during the peak portion of the waveform. Then during the falling edge the carrier frequency increases, to stabilise at a higher frequency during the trough portion of the wave. The phase-modulated signal, shown in Fig. 1(d), however, maintains the same mean frequency at the peak and trough portions, but the frequency increases during the rising edge and decreases during the falling edge in order to advance and retard the phase respectively.

The most noticeable similarity shown in the diagrams is the fact that, in both frequency and phase modulation, the amplitude remains constant. In fact, a number of precautions are taken both at the transmitter and the receiver to make sure that it does remain constant in order to eliminate certain types of interference.

A second important difference between amplitude and frequency modulation is the number of sidebands produced. It was mentioned earlier that an A.M. signal consists of a carrier and two sidebands. A frequency-modulated signal, on the other hand, has a theoretically infinite number of pairs of sidebands spaced at intervals equal to each multiple of the modulation frequency above and below the carrier.

This may be demonstrated very simply by means of a frequency-modulated oscillator and an ordinary narrow bandwidth A.M. communication receiver fitted with a local beat-frequency oscillator for the reception of C.W. signals. Let us assume that the F.M. oscillator is modulated by a 10 kc/s note to such a degree that the carrier frequency varies by an amount of, say, 75 kc/s from its mean value in either direction. This latter figure is known as the deviation. Now, if the receiver is tuned to the mean carrier frequency the local b.f.o. may be adjusted to give a convenient audio note from the loudspeaker. Then by swinging the tuning control of the receiver in either direction from the mean

carrier frequency, a series of whistles will be heard at intervals of 10 kc/s on the tuning dial as the receiver is tuned to each sideband in turn. If the modulation frequency is reduced, the beat notes will, naturally, be much closer together.

A demonstration of this nature illustrates very clearly that the theoretically infinite number of sidebands is, in practice, limited, and that those sidebands separated from the carrier frequency by an amount greater than the deviation are so small as to be negligible and that the higher modulation frequencies produce a few powerful sidebands while the lower modulation frequencies produce a large number of smaller sidebands. This means that, for all practical purposes, a bandwidth of rather more than twice the maximum deviation frequency is required.

The maximum deviation adopted for broadcast purposes is generally accepted as 75 kc/s so that a bandwidth of at least 150 kc/s. is necessary. It is plain that the medium and short wavebands cannot accommodate a bandwidth of this order. In addition to this, as it is a fact that any selective fading or phase displacement would cause considerable distortion in the final audio signal, F.M. transmission must be confined to line of sight propagation. That is to say that over a flat terrain with a transmitter aerial height of some 700ft., a service area of about 35 miles radius can be expected from a powerful transmitter.

It is clear, therefore, that F.M. broadcast transmission must utilise the V.H.F. portion of the spectrum, a frequency between 90 and 150 mc/s being found the most suitable. The present B.B.C. station at Wrotham operates on a mean carrier frequency of 91.4 mc/s with a maximum deviation of 75 kc/s.

Advantages of F.M.

We have just considered the most important limitation to the frequency-modulation system and are now in a position to look into its particular advantages over amplitude modulation.

The four most important of these are as follows:

(1) Greater signal-to-noise ratio.

(2) Lower power consumption at the transmitter for a given effective signal at the receiver.

(3) Less amplitude compression of the audio signal.

(4) Less interference between stations having adjacent carrier frequencies.

Let us consider each of these advantages individually, taking the improvement in signal-to-noise ratio first.

Noise is produced by electrical disturbances inside and outside the receiver, the latter being mainly of the impulse type and, whether man-made or atmospheric, it is usually caused by an electric discharge of some form. The internal noise in a well-designed receiver with no bad contacts is due to random motion of electrons in valves and conductors, mainly in the input circuit or first R.F. stage. These are known as shot noise and thermal agitation respectively.

All these types of noise are effectively R.F. voltages covering a wide frequency band and, in an A.M. receiver, these voltages beat amongst themselves when no signal is being received and are made audible by the detector, giving the characteristic hiss of a sensitive receiver. When the A.M. receiver is tuned to a signal, the noise voltages act as sidebands to the carrier and audible beats are produced between the carrier and the noise so that only those noise components within audio range of the carrier are heard.

The effect of these noise voltages on an F.M. receiver is very different for two reasons. In the first place, there is no detector in the form of a non-linear device in which A.F. beats may be formed and, secondly, a device known as a limiter is incorporated to suppress any amplitude changes in carrier voltage. It is plain, therefore, that noise cannot have the same effect as in an A.M. receiver.

However, in addition to the amplitude change, noise causes a phase change in the carrier and this, in turn, gives rise to a frequency deviation. This deviation is directly proportional to the effective noise frequency, so that noise sidebands near to the carrier give much less audio output than those more distant from the carrier. The noise produces an audio output of frequency equal to its spacing from the carrier so that the response characteristics of the A.F. amplifier and the ear become, to a certain extent, limiting factors.

Pre-emphasis

For broadcast systems the signal-to-noise ratio is improved still further and is kept reasonably level over the whole audio band by pre-emphasis or pre-accentuation of the high audio frequencies, and the reverse process, de-emphasis or de-accentuation, at the receiver.

(*Continued on page* 469)

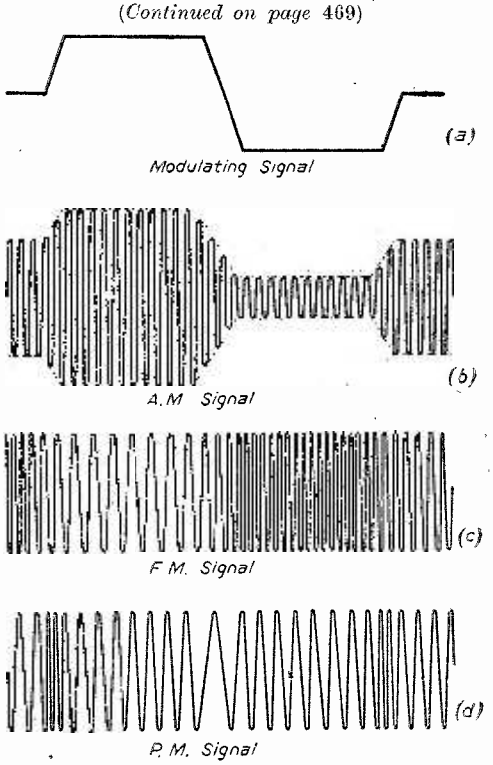


Fig. 1.—Modulation curve and its form under different conditions.

"OCCASIONAL 4" CABINET.—Attractive bakelite cabinet, size 12in. x 5in. x 6in., suitable for making a T.R.F. or superhet receiver. Price, with back, **17/6.** In Walnut, Green or Ivory. Post and Insurance, **2/6.**

Punched Metal Chassis.—T.R.F. for three valves and rectifier, **5/6.** Superhet for four valves and rectifier, **5/6.**

Engraved Glass Dials.—16-50 and 180-550 metres, **2/6.** 180-550 and 800-2,200 m., **2/6.** 16-50, 180-550 and 800-2,200 m., **2/6.** Dial back plate, **2/6.**

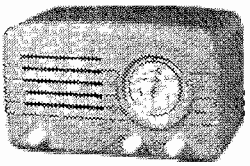
Coils.—T.R.F. 180-550, 800-2,200 metres, **5/6** per pair. Superhet 16-50, 180-550, 800-2,200 metres, **10/6** per set.

Cord Drive Accessories.—Drum, 2¾in. dia., **1/6**; Driving head, **1/6**; Double Pointer, **4d.**; Spring, **3d.**; Nylon Cord, **6d.** per yard.
A set can be built into this cabinet for less than **£6.** Constructional data, **1/6.**

SERVICE DATA.—100 service sheets, covering British receivers which have been sold in big quantities, and which every service engineer is ultimately bound to meet. The following makers are included: Aerodyne, Alba, Bush, Cossor, Ekco, Ever-Ready, Ferguson, Ferranti, G.E.C., H.M.V., Kolster Brandes, Lissen, McMichael, Marconi, Mullard, Murphy, Philco, Phillips, Pye, Ultra. Undoubtedly a mine of information, invaluable to all who earn their living from radio servicing. Price **£1** for the complete folder.

Our folder No. 2 consists of 100 data sheets covering most of the popular American T.R.F. and superhet receivers, "all dry," etc., which have been imported into this country. Names include Sparton, Emmerson, Admiral, Crossley, R.C.A., Victor, etc. Each sheet gives circuit diagrams and component values, alignment procedure, etc., etc. Price for the folder of 100 sheets is **£1.** Post free.

LITTLE COMPANION CABINET



This modern design bakelite cabinet in ivory, blue or brown is ideal for an all-mains receiver. Complete with back, **19/6.** Postage and insurance, **2/6.** **Metal Chassis,** punched out with speaker cut-out, **5/6.** **Metal Assembly** for holding dial and pilot lights. Complete with long- and medium-wave dial, **2/6.** **Moulded Perspex Window,** **1/9.** Matched knobs (set of three), **2/-.** A complete T.R.F. Receiver can be built into this cabinet for under **£6.** Constructional data, **1/6.**

TWO-GANG, 75 pFd. TRIMMER.—We have an excellent selection of trimmers, air spaced, and mica/compression types. The one illustrated is more than a trimmer, as it can be used to tune many short-wave circuits, it is actually a two-gang, 75 pFd. air-spaced variable condenser. The spindle length is approximately ¼in. Price **4/9** each.

MISCELLANEOUS BOOKLETS

These give circuit diagrams and details of ex-Government receivers and equipment. In practically all cases the information has been extracted from official publications. Separate booklets for each piece of equipment. Booklets available covering the following:

R1155, R208, R109, TR1196, TR18, BC348, BC312, R1116, R107, R103, BC221, BC342, Pre-Amp. from RF27, Pre-Amp. from Unit 208A, T.V. Receiver from 1½-metre superhet for London or Birmingham, T.V. Receiver from 3170, etc., T.V. Receiver from 194 strip, Dual band T.V. Receiver. Price of any of these booklets is **1/6** each—all post free.

Orders under **£2** add **1/6,** under **£1** add **1/-.** Postable items can be sent C.O.D., additional charge approx. **1/-.** Post orders to Ruislip. Good stocks of all items at time of going to press. Early closing Wednesday (Ruislip), Saturday (City).

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★ **A 4-VALVE T.R.F. BATTERY PORTABLE "PERSONAL" SET,** available as a Complete Kit of Parts or by purchase of the Components separately. The complete price details, including an individual Component Price List, are included in our set of Assembly Instructions, which is obtainable for **9d.** In addition, these detailed Assembly Instructions also show the complete circuit, with a Practical Component Layout, which in themselves make the assembly of the set quite simple.

★ **A MIDGET 4-VALVE SUPERHET, PERSONAL SET,** covering Long and Medium Wavebands and designed for Mains or Battery operation. This receiver is designed to operate on A.C. mains or by an "All-dry" Battery; either method is selected by means of a Rotary Switch. It is so designed that the Mains Section is supplied as a separate section which may be incorporated at any time. The set, therefore, can be made either as an "All-dry" Battery Personal set or as a Midget Receiver for Combined Mains/Battery operation. The set can be supplied either as a Complete Kit of Parts or by purchase of the Components separately. The Assembly Instructions, which include Wiring Diagram and Practical Component Layouts, are available for **1/9.** This also includes a separate Components Price List

★ **THE MIDGET A.C. MAINS 3-VALVE RECEIVER,** as designed and published by "Wireless World," covering Long and Medium Wavebands. Cost of all Components to build this set is **£4/17/9.** A reprint of the complete Assembly Instructions, including Practical Layouts, is available for **9d.**

★ **THE "WIRELESS WORLD" MIDGET A.C. MAINS 2-VALVE RECEIVER.** We can supply all the components including Valves and M/Coil Speaker, to build this set for **£3/10/0.** Reprint of the original Assembly Instructions and Circuit may be obtained for **9d.**

★ **THE "SUMMER ALLDRY" BATTERY PORTABLE,** as published in the June issue of "Practical Wireless." We can supply from stock all of the Components to build this Midget 3-Valve Receiver. A reprint of the complete article and circuits, including Practical Layout and Component Price List is available for **1/-.**

★ **A COMPLETE KIT OF PARTS** to build a **MIDGET "All-dry" BATTERY ELIMINATOR,** giving approx. 69 volts and 1.4 volts. This eliminator is suitable for use with 4-valve Superhet. Personal Sets. It is easily and quickly assembled and is housed in a case size 4¾in. x 1¾in. x 3¾in. Price of Complete Kit, **42/6.** In addition we can offer a similar complete kit to provide approx. 90 volts and 1.4 volts. Size of assembled unit 7in. x 2¾in. x 1¼in. Price **47/6.**

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(*Continued from page* 466)

Fig. 2 shows some networks for accomplishing both processes. The first two circuits show the network used in the modulator circuit of the transmitter, emphasising the upper audio frequencies so that, at the receiver, it is possible to attenuate the noise without unduly reducing the high-frequency components of the audio signal. The third (de-emphasis) circuit in the diagram is usually connected to the grid of the first A.F. valve.

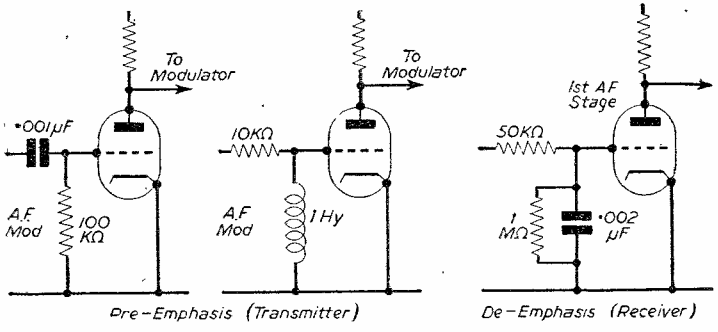

Fig. 2.—Pre-emphasis and de-emphasis networks.

The amount of pre-emphasis is normally defined in terms of the time constant (R.C.) chosen to obtain the desired frequency-amplitude characteristic and the figure 100μsec, which is quite normal time constant for this type of unit, has been selected by some broadcasting authorities as a standard value.

The diagram in Fig. 3 shows graphically the improvement in the signal-to-noise ratio that results from the use of 100μsec pre-emphasis. The broken line represents the signal-to-noise ratio with no pre-emphasis, while the full line shows the effect of applying it. It can be seen that the improvement at 15 kc/s is about 10 times. This improvement cannot be carried too far, since undue emphasis of the upper frequencies in relation to the lower ones would result in over modulation of the carrier at high frequencies before it occurred elsewhere.

It must be remembered, however, that the advantages of pre-emphasis are only realised with wide audio band F.M. When a narrow band is used, such as in communication systems, nothing is gained by the use of pre-emphasis; in fact, it may actually produce a loss. It is not used, therefore, on the narrow band systems such as police radio and military F.M. equipment.

Second Advantage

The second advantage of frequency modulation is that, for a given effective signal strength at the receiver, less power is taken from the mains supply by an F.M. transmitter than its amplitude-modulated counterpart.

In the power amplifier stage of an A.M. transmitter, the D.C. must be sufficient to allow 100 per cent. modulation without serious distortion. This means that the D.C. must be twice the value necessary to maintain the carrier at its unmodulated output.

It was emphasised earlier, however, that a frequency-modulated carrier has a constant amplitude. It follows, therefore, that the maximum power required from the supply by an F.M. transmitter is half that of an A.M. transmitter having the same unmodulated output power.

Looking at it another way, we can say that for a given mains power F.M. can give a signal at the receiver of effectively twice that for a corresponding amplitude-modulated system. This is equivalent to a further increase in signal-to-noise ratio of two to one at high modulation depth.

Third Advantage

The third advantage, namely, the reduced amplitude compression, also partly arises from the increased signal-to-noise ratio.

For an amplitude-modulated system, the maximum modulation depth for a reasonably distortionless A.F. output is about 90 per cent., while a minimum value of at least 5 per cent. is necessary if noise interference is to be avoided during quieter passages. This means that a voltage change of 18 to 1 is the maximum permissible. This is a power ratio of approximately 320 to 1, or 25 decibels. The amplitude contrast from pianissimo to fortissimo by a full orchestra is of the order of 70 db., but since this would sound unnatural in a normal room a certain amount of compression is necessary. However, a power ratio greater than 25 db. is desirable and it can be raised to about 45 db., by the use of frequency modulation.

(*To be continued*)

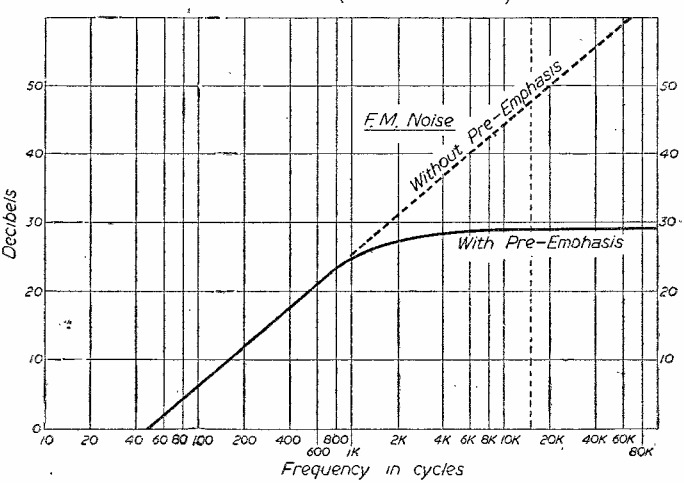

Fig. 3.—Graph showing the improvement in signal with pre-emphasis.

Programme Pointers

THIS MONTH MAURICE REEVE DEALS WITH SOME RECENT PROGRAMMES

IT was a great mistake to cancel the published programme and substitute the Robinson-Turpin repeat broadcast plus the B.B.C.'s apologia for the false impressions given on the original occasion. Not only were many people annoyed at being deprived of what they were looking forward to, but they were incensed at being sacrificed on the chopping block so that those concerned in the fight broadcast could indulge in a face-saving retreat. It all left a nasty taste in the mouth.

The Promenade Concerts are on again; mammoth symphonic battleships sailing along of a night-time in the pellucid waters of Kensington, each monster following on almost bow to stern. I attended an excellent programme, the highlights of which were Vaughan Williams's sixth Symphony and John Ireland's piano concerto—finely played by Kendal Taylor. Alas, the hall was but a quarter full; our "Tschaikowsky-soaked population" was presumably in revolt and had probably taken itself off to the South Bank in high dudgeon.

There is no doubt about it; it is sacrificial to all concerned to perform these British masterpieces. I know what the remedy is, but I won't give it here.

"Tunes for Everybody"

There is an excellent and wholly admirable concert series, put over four or five times a week, of a light symphonic character, but bearing the extraordinarily imbecile name of "Tunes for Everybody." Why "tunes" in the name of all that's marvellous? Here are some of the works performed in these programmes which I take at random from those copies of the "Radio Times" which are nearest to hand as I write: César Franck's Symphonic Variations for piano and orchestra, Saint-Saëns' "Africa," for ditto, Bartok's Roumanian Folk Dances, Tchaikowsky's Serenade for Strings, Weber's Euryanthe overture, Beethoven's Egmont overture, a Handel-Beecham suite, and so on and so on.

Now, the "Everyman Dictionary of Music"—Eric Blom—defines a "tune" as "another word for melody, more colloquial and therefore often considered vulgar, but a perfectly good English term for its purpose. . . ." Are these works collections of tunes or melodies, easily whistle-able and mentally retainable, or are they masterpieces or near-masterpieces of music, in which the "tunes" are no more, if as, important as the harmony, the form and the character? As Blom says, the label "tune" only vulgarises them and causes listeners to view them through distorted lenses. When we hear them in symphony concerts, our programme notes tell us they are something entirely different. We all know what is meant; popular classics in which the melodious or the tuneful element is the most prominent. But to tell the listening public that the Egmont overture is a "tune" for everybody seems to be very wide of the mark. Themes have been mistaken for tunes.

An Improvement

I have to report, with pleasure, a great improvement in recent "We Beg to Differ" programmes. The questions, for the most part have been, as they say, "right up their street," with the result that everyone's enjoyment was raised to somewhere near its former pitch.

"Any Questions" is also going along well and at a pretty high level. Here again, questions about women and their beauteous or utilitarian qualities make the best entertainment. Being an exclusively male panel, we get much more objective thinking on the subject. A recent question, "Is her hair a woman's crowning glory, or if not, what?" was very funny indeed.

"Tell us a Tale"

I didn't care for "Tell us a Tale" as much as some critics appeared to. To me it was like the blurbs on books—a ramp to boost the sales of mostly old-fashioned titles which have been lagging behind for too long. After a little encomium praising the character and qualities of the book concerned came a page or two of it "acted" by some squeaky little voices sounding like "Children's Hour" badly needing tuning.

A Brick!

In the Sunday evening feature, "Torpedo Eight," done as well as these always are, there was an awful brick dropped in the narrative. I cannot quote textually, but I can preserve the meaning by saying: "these men didn't fly the ocean to enjoy the thrills and excitements of a trans-Atlantic crossing: they went out to seek the enemy early one morning *while you and I were enjoying a comfortable breakfast.*" Whilst some of us were so fortunate as to have comfortable breakfasts throughout the war, the writer, Kenneth Poolman, should have borne more in mind the fact that, *in toto* as a nation, we had been having mighty *un*comfortable breakfasts for three years at the time the action described took place.

Good Regular Feature

"Let Justice be Done" is one of the best regular features. It presents all the thrills of the thriller, but taken from the world of reality instead of from the imaginative sphere. At the same time, it teaches us something about the law and legal procedure, which cannot do anyone any harm.

Social Document

"The Second Mrs. Tanqueray," Pinero's sensational play of the 'nineties, and successfully revived in Edwardian times, is nothing more than a powerful social document to-day. The comparative failure of a recent revival seems to prove this. The stage machinery and the plot unravelling fairly creak, so unlike contemporary Shaw or Wilde. But it did not prove ineffective radio material.

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).

VCR138

SIR,—Concerning the VCR138 (June issue PRACTICAL WIRELESS), Mr. Leal appears to have been misinformed with regard to this C.R.T.

It is, in fact, a direct equivalent of the CV1138, but not of the ECR35. Apart from the fact that A1 is connected to contact 5 and not strapped to A3 on contact 10, the deflection sensitivity is different. The figures for both tubes are shown below.

	X plates	Y plates
VCR138 ..	.14 mm/v.	.33 mm/v.
ECR35 ..	.3 mm/v.	.66 mm/v.

—W. J. MAY (High Barnet).

"Old Sets Disowned"

SIR,—Under "Comments of the Month" in the July issue I noticed the following: "All manufacturers submit their sets to a soak test, under load, and are then re-checked to see whether any of the vital components, such as resistances, condensers and transformers, have broken down or altered in value."

This may or may not apply to television sets, but it certainly does not apply to radio sets, and I would suggest that this statement is likely to mislead the public into a false sense of security. In these days when the vast majority of employees are thinking of their wage-packet and an eye on the clock, the amount of testing of radio sets after assembly can be taken as nil, otherwise why do so many sets arrive at their destinations faulty? Not long ago a well-known manufacturer delivered a set to me. It was a five-valve three-wave mains, and on unpacking for test I found the mains transformer primary was completely O/C. Are you going to ask me to believe that this set was tested at all after assembly?

What about all the sets that leave the factories with noisy volume-controls? The volume-control position can only be described as disgusting. A service engineer told me recently that he had to fit six volume-controls to a set before he found one which wasn't noisy.—A. WHETTON (St. Austell).

Alternative I.F. Couplings

SIR,—Re the August issue of PRACTICAL WIRELESS I agree with C. Broadbent (Huddersfield) that a T.R.F. circuit would be superior in quality to the superhet, but I think there is one point that he misses. The superhet is far more selective, and for this reason I am experimenting with the suggested circuit for a three-valve superhet for a stand-by receiver.

I have recently built a T.R.F. set with two H.F. stages, and even that does not give the Light Programme free of interference from unwanted foreign stations (medium wave).

For selectivity, the suggested three-valve circuit will, I hope, prove successful, while the absence of I.F. stages should keep the cost low.

I thank Mr. W. Nimmons for the interesting article in the June issue of PRACTICAL WIRELESS.—D. GRANT (Upper Tooting, S.W.17).

Quality Straight Three

SIR,—I have just noticed a mistake in the circuit diagram of the "Quality Straight Three." The mistake may be my own, but I would like to rectify it.

In the circuit diagram C12 is shown on the diode side of the A.V.C. dropping resistor, instead of the R.F. grid side of this resistor R7. The value of this condenser is .05 μF. This will, in effect, attenuate the A.F. output to the D.D.T. grid and so reduce volume.—W. GORHAM (Henlow).

High-fidelity

SIR,—I have been looking through a number of back issues and am impressed by the endeavours which have been made to improve the quality of reproduction. There are two sides to this problem—first, do the B.B.C. programmes justify the expenditure, in view of the poor quality which they push out from recorded programmes, etc., and, secondly, even assuming that one or two programmes do reach a high level, can one do justice to it in the home? I see one speaker is listed at over £200—and surely this cannot be used in the home to reproduce a good orchestra, and when turned down in volume to suit the home, surely an ordinary single speaker will give results which are comparable, remembering that all the time you are only having a "reproduction" and not the real thing. What do other readers think of this problem?—G. HARDING (Wembley).

Gramophone Needles

SIR,—It is with considerable bewilderment that I have been following the recent controversy that has arisen in your columns over the use of sapphire

styli. By now, I would imagine the instigator, one of "Thermion's" readers, will have thrown away all his records in despair.

I am prepared to tolerate "Thermion" and his opinions on the matter, but the appearance of an article in the August issue, in an attempt to support his views, prompts me to comment.

The original query, "Can sapphire cause wear?" has got to be answered. In the words of Dr. Joad, "It all depends what you mean by sapphire." If by sapphire is meant the type one can buy resembling a steel needle but with a sapphire tip, then the answer's a most emphatic "Yes!" Used in the older type of pick-up it can reduce the life of a record to but a few playings.

Yet if we read the advertisements for the latest models of our pick-up manufacturers, they are almost without exception fitted with sapphire styli. Why, then, do they entrust their reputation to such a "doubtful" article? The whole answer is that a sapphire stylus is not the be-all and end-all of minimum record wear. Other factors are equally, if not more, important. Armature mass, point size, vertical and lateral compliance, pick-up weight and resonance, to mention the most important. The stylus point is only an integral part of the modern pick-up design and cannot be dismissed in a few paragraphs such as your article attempts.

The photographs are interesting but unconvincing. The first three show the sapphire styli, 1 millimetre point radius, with wear after only 15 playings and pick-up weight of only 8 grams. Not surprising at all. A 1 millimetre stylus would track the bottom of a standard record groove, and anyone who has seen the bottom of a groove will wonder that even the diamond came through unscathed. One of the essential details of a sapphire stylus is that the point radius should be large enough to ride on the groove walls; 2.5 millimetres is such a size, shown in the second three photographs. However, in this case the pick-up weight is increased to 38 grams, no small wonder that again the sapphire is battered into submission. Very few modern pick-ups of recent design are in excess of 20 grams.

In both instances no mention is made of the type of stylus mount, condition of test records, or pick-up used. Judging by the weight of the latter probably an obsolescent pattern.—R. WILLIAMSON (Norwich).

Ex-Service Equipment

SIR,—On three occasions I have purchased ex-Service complete (unused) receivers and have found on careful examination that they have been modified. It appears that they must have been stock from a "repaired equipment depot" or some similar store and have been modified for some special purpose. Has any reader discovered any reference number or code number which might be found on such equipment, to avoid the risk of making a slight modification and then finding the equipment does not work as intended due to such modifications having been carried out in the Service. I know the letters A, B, etc., are often added to the type number to indicate a modified or later version, but I should think there is some other indication for what might be called "adapted" equipment.—B. BRADLEY (Stoke Newington).

News from the Clubs

BRIGHTON AND DISTRICT RADIO CLUB

Hon. Sec.: R. T. Parsons, 14, Carlyle Avenue, Brighton, 7.

AFTER an informal August the club starts the autumn season with a very full programme. During September and early October, there will be talks and demonstrations of gear by G5ZQ on tape recording and by the Decca Co., who are bringing some of their equipment for sound recording and reproducing. On September 18th, there will be the first of several of the Mullard TV film strips. The club is holding a dance in mid-October.

READING RADIO SOCIETY

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

THE activities of the society for the past two months include: Reading Hobbies Exhibition in which the society took an active part, a display of equipment includes a complete 160-meter 'phone station and a Heliscriber, both these items being fully operational.

NFD. This year two sites were run and both stations worked without a hitch throughout the 24 hours, some 193 contacts being made.

Lecture and demonstration by Dr. Lemon on Radio Control of models—made very interesting by his own working models.

Dr. Lemon has now in the course of construction a helicopter which will have a wing span of approximately 7ft. and also be radio controlled.

G2AHY (Mr. Woodhouse) is still going strong with his instructional meetings held every second Saturday of the month.

CHESTER AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: W. G. Lloyd, 124, Tarvin Road, Chester.

RECENTLY the association of North Western Radio Societies was formed by representatives from the following societies: The Chester and District Amateur Radio Society; The Liverpool and District Short Wave Club; The Merseyside Radio Society; The Wirral Amateur Radio Society; The Wrexham and District Amateur Radio Society.

Quarterly meetings are held to exchange ideas and to carry our group activities.

Support from other North Western Radio Societies is invited. Further particulars can be obtained from the hon. secretary.

THE LEICESTER RADIO SOCIETY

Hon. Sec.: L. Milnthorpe (G2FMO), 3, Winster Drive, Thurmaston, near Leicester.

AT a special meeting, which was held in the club room, Holly Bush Hotel, Belgrave Gate, Leicester, in July, the name of the society was changed from "Leicester Ham Radio Society," to the "Leicester Radio Society," and it is intended to promote a well-balanced interest in all aspects of radio. The winter session commences with a film show, which will be given on the first Monday in October, and in November there will be a talk on "Frequency Modulation." Mr. C. L. Wright (G3CCA), was elected editor of the forthcoming society magazine, and will welcome contributions from other societies. New members will be made very welcome on meeting nights, at the club room, on the first and third Monday of the month. Full details of membership and forthcoming activities may be obtained from the hon. secretary.

SOUTH MANCHESTER RADIO CLUB

Hon. Sec.: E. R. Taylor, 12, Marton Avenue, Didsbury, Manchester, 20.

DUE to circumstances beyond our control, the club premises at Church Schools, Northenden, are no longer available. Instead, meetings will be held at the café attached to the Tatton Arms, Northenden. The secretary's address is as above; as and when permanent accommodation is found, members will be notified.

BRENTFORD EVENING INSTITUTE TRAINING COURSES

WE are asked to give the following details of Special Courses, commencing in the autumn at the Brentford Evening Institute, Boston Manor Road, Brentford, Middlesex.

(a) *Radio Amateurs Examination Course.* Designed to prepare intending transmitting amateurs for the City and Guilds Examination, held yearly.

Instructor: E. J. Pearcey, G2JU.

(b) *Television and Radio Theory.* Specially designed for the Service Engineer.

Instructor: J. Gibbons.

Both courses will be held on Wednesday evenings, from 7-9 p.m., and the commencing date is Wednesday, September 19th, 1951. Courses continue for eight to nine months.

Fee for each course is 10s.

Enrolment is usually during the preceding week, but late entries can also be accepted.

Impressions on the Wax

Review of the Latest Gramophone Records

THOSE who have seen Christopher Fry's adaptation and translation of "Ring Round the Moon," the long-running French play at the Globe Theatre, London, will have appreciated the incidental music composed by Richard Addinsell. The principal theme, the "Invitation Waltz," is now recorded by Charles Williams and his Concert Orchestra on *Columbia DB*2905. On the reverse side is "Shopping Centre," which is the signature tune of "Picture Page," that popular TV feature introduced by Joan Gilbert. It is written by the well-known light-music composer, Philip Green, who has many film scores to his credit.

Music by Tchaikovsky is always popular, and a new recording by Rawicz and Landauer of the famous "Eugen Onègin" waltz is a most welcome addition to the repertoire. On the other side of this record, *Columbia DB*2899, is an arrangement for two pianos of the lively "Pizzicato Polka," by Strauss.

George Szell has been musical director of the Cleveland Orchestra since 1946, and for his latest recording he conducts the orchestra in Dvořák's "Slavonic Dances" on *Columbia LX*1411. There is a great contrast between the various dances, and the pair chosen for this record will always give pleasure to the listener, no matter how many times they have heard them before.

Music from the Ballet

Sadler's Wells Theatre ballet gave "Pineapple Poll" its first performance on March 13th, 1951, at Sadler's Wells Theatre, London. The complete "Pineapple Poll" ballet has been recorded on six records, and Columbia intend to publish two at a time. When the last two records are issued automatic couplings of the whole work will be made available. With each issue is given a synopsis of the particular scene concerned; the present two discs, *Columbia DX*1765/6—first of the series—contain the music from Scene 1.

Gioconda de Vito is considered one of the foremost Italian violinists. I have no hesitation in recommending her unaccompanied recording on *H.M.V. DB*21300 of selected movements from Bach's "Partita No. 2." Only violinists can really appreciate the difficulties of unaccompanied Bach, yet all can enjoy the results, the extraordinary amount of tone and activity which a good performance produces.

The Greek pianist, Gina Bachauer, who has given a number of highly successful Wigmore Hall recitals, has recorded Liszt's "Rhapsodie Espagnole" on *H.M.V. C*7854/5. It is actually an arrangement by Busoni from the original Liszt solo. Both Gina Bachauer and the new London Orchestra give an ideal interpretation.

Variety

In the past Semprini has given us some very pleasant hit medleys. For his latest release this popular piano soloist offers a novelty number, "The Hot Canary," on *H.M.V. B*10108. The coupling "Easy Come, Easy Go" is not the old song of that name, but a brand new British number written by a well-known writer who uses the *nom de plume* of Max Kaye.

A film sound-track recording of novel appeal—a double-side release featuring excerpts of both music and dialogue from the new British film musical, "Happy Go Lovely"—appears on *H.M.V. B*10116. It includes the attractive song, "Would You," as well as a highspot dialogue sequence between Vera-Ellen and David Niven.

Columbia introduces a new series of recordings featuring vocal gems from the big musical "Show Boat" on *Columbia DX*1771. It includes "Make Believe," sung by Lizbeth Webb and Steve Conway, "Can't Help Loving that Man," by Adelaide Hall, "Why Do I Love You?" by Lizbeth Webb and Steve Conway, who also sing "You Are Love" and "Ol' Man River," by Bryan Johnson.

This month Teddy Johnson puts on wax two songs that are among his most-requested items. They are "That Lucky Old Sun" and "It's My Mother's Birthday To-day" on *Columbia DB*2902.

"By the Kissing Rock" is the latest hit song from Donald Peers and the Song Pedlars on *H.M.V. B*10107. The coupling, "Sing a Little Sweeter," is a little song which is already a hit in Scandinavia.

Dance Music

Joe Loss and his Orchestra give dance tempo versions of "With These Hands" (fox-trot) and a quick-step, "Satins and Lace," on *H.M.V. B*06102, followed by "Ivory Rag" and "I Apologise," on *Columbia FB*3614, played by Victor Silvester and his Ballroom Orchestra.

Dance fans will be glad to know that the Parlophone Company hope to be able to make available recordings of Humphrey Lyttelton, Graeme Bell, Freddy Randall and Joe Daniels' actual performances as given at the Royal Festival Hall, London, on July 14th and 16th. Full details and date of issue of the records will be announced later.

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"Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. 'Phone: Temple Bar 4363.
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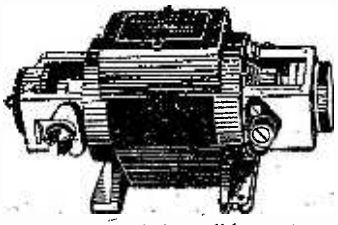

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