IN THIS ISSUE

THE NATIONAL RADIO SHOW
FREQUENCY MODULATION
STABILISED POWER PACKS
THERMION'S COMMENTARY

AN A.C. MAINS MIDGET
SUPER-MODULATION
TONE CONTROLS
D.C. SUPPLIES
CONSTRUCTORS!!
HERE'S A BARGAIN FOR YOU!

POUNDS WORTH OF COMPONENTS FOR ONLY 5/-

The home constructor should derive a lot of satisfaction from this chassis—it contains so much of value to him. It might even have the very component he has been looking for.

HOW TO DESIGN "NEAR UNIT" APPARATUS USING THIS CHASSIS AS A BASIS

1. Lower Section of Unit already fitted with 10-pin. Plug Strip-fitting sockets of the ex-U.S.A. TUB Tuning Units for conversion to Receiver.
2. This leaves room at right of panel to take the ex-R.A.F. RP Units 27 or 38 used as converters feeding into Receiver.
3. Centre Instrument Panel Strip will take English type M.A. and Voltage and other meters having 20 range, without further drilling.
4. When the internal aluminium chassis is removed, the top section of the frame will take another TUB unit for conversion to Transmitter.
5. Leaving the top right-hand—Antennae Tuning Panel and space behind it ready made for this or for fitting other apparatus required.

Average Contents
(all new and unused)
10-pin. Plug Strip
520,000 K. 1-watt Resistors
4 100 ohm 1-watt Resistors.
2 000 v. 1 mf. Condensers
9 High-voltage Condensers 600 to 1000
1 3-way Switch.
2 H.F. Chokes.
1 Relay Switch.
1 Ceramic Valve Holder.
2 Lamp Fuse with holder.
Spring Terminals.
Parafilm Panel 8" x 5".
Aluminium Panel, block finished.
Large number Multi-coloured sleeved leads.
Very strong steel framing.
Innumerable Nuts and Bolts.
Soldering points.
Stand-off Insulators, etc.

The whole outfit, weight 18 lb., sent to any address for only 5/-, plus 2/3 for packing and carriage.

SPECIAL OFFER: 4 for 22/-, carr. paid
Satisfaction guaranteed or money refunded.

The NEW LONDON ELECTRON WORKS Ltd.
6 EAST HAM LONDON E.6
Telephone: Grangewood CO6-1363

The solder for all HOME TELEVISION CONSTRUCTOR SETS

Designers of television constructor sets know that the efficiency of their equipment depends on the solder used by the constructors—that's why they recommend Ersin Multicore for trouble-free, waste-free soldering. Ersin Multicore, the only solder containing three cores of extra-active, non-corrosive Ersin Flux, is obtainable from all leading radio shops. Ask for Cat. Ref. C15018, 18 S.W.G. 60/40 High Tin Television and Radio Alloy. The size 1 Carton contains 37 feet of solder, costs 5/-.

Ersin Multicore Solder
In case of difficulty in obtaining supplies, please write to:
MULTICORE SOLDER LTD.,
MELLIER HOUSE, ALBEMARLE STREET. LONDON. W.1 • R.Gent 1418

Three heads are better than one!

For Standard and Microgroove recordings
Microgroove recordings Green Spot.
Modern standard recordings Red Spot.
Older Standard recordings Yellow Spot.

These pickup heads are fitted with an easily replaceable armature system complete with a semi-permanent sapphire. Downward pressure 10-12 grams for standard recordings, and 5-7 grams for microgroove recordings.

Prices: With one Head £1.10.0, plus £1.10.0 Purchase Tax. Extra Heads each £1.10.0, plus £1.10.0 Purchase Tax. Spare Armature System with sapphire 14s. 8d. including Tax.

Licensed under Letters Patent No. 563000 and/or 61/483.

A. R. SUGDEN & CO. (ENGINEERS) LTD.
Well Green Lane, Brighouse, Yorkshire.

LONDON ELECTRON WORKS LTD.
6 EAST HAM LONDON E.6
To avoid radio ailments

**EVERY GOOD RADIO DOCTOR PRESCRIBES**

OSMOR 'Q' COILPACKS

As specified for conversion of the Type 25 and of the TR.1196, Type 18 and Wartime Utility receivers, and others.

These mighty midget coilpacks will cure your radio troubles and ensure better performance in every way. Easy to assemble, with only five simple connections, the pre-aligned 'Q' Coilpack saves hours of frustrated grappling with complicated circuits. All types available for mains and battery sets, complete with full instructions and circuit diagrams.

Send 5d. (stamps) for free circuits and new illustrated lists of Coils, Coilpacks, and all Radio Components.

OSMOR RADIO PRODUCTS LTD
(Dept. P.I.T.), BRIDGE VIEW WORKS, BOROUGH HILL, CROYDON, SURREY.

Telephone: Croydon 1259

3-Valve Battery Radio only 37/6
with Miniature Loudspeaker

Covers medium waveband, Home, Light, etc. All parts and 3 new valves included in kit. (Requires only standard size batteries extra.) No technical knowledge required. Simple as ABC. Complete kit of parts with easy plans supplied.

INSTRUMENT Co. (Dept. P.W.)
6, High St., Thame, Oxon.

FASTER SOLDERING with Wolf Electric SOLDERGUNS

Only Wolf solderguns have all these time and money-saving advantages —

**OFF-Straight Easy-Grip Handle**
**PERFECT CONTROL**
**LOW CURRENT CONSUMPTION**
**QUICKER HEAT-UP**
**MAINTAINS CORRECT HEAT**
**LOCALISED HEAT**

MODELS FOR EVERY PURPOSE FROM FINE INSTRUMENT TO HEAVY INDUSTRIAL SOLDERING

H ave you TRIED AUTOMATIC SOLDERING?

Win new efficiency and economy with Wolf Automatic Soldergun. Its auto-feed, trigger solder-feed action and perfect balance make it indispensable to all modern assembly. TYPE 51

Also

Wolf Electric SOLDERING IRONS

For all who, for special reasons prefer the conventional straight type handle.

Identification as regards elements and bits to Wolf Solderguns but with round hard wooden handle with heat deflecting skirt.

It pays to Solder with Wolf Electric SOLDERGUNS & SOLDERING IRONS

* Obtainable from all high-class stockists and ironmongers

WOLF ELECTRIC TOOLS LIMITED - PIONEER WORKS
HANGER LANE - LONDON W.3 Telephone: PERIVALE 3631-4
The advent of Television has added considerably to the complexity of servicing problems. A wise choice from the "Avo" range of precision Instruments will enable you to diagnose and remedy faults with maximum speed and economy.

Write today for your FREE copy of the latest Comprehensive Guide to "Avo" Instruments.

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.
Dept. P 36, Winder House, Douglas St., London, S.W.1. Phone: VIC. 3494-9

COSMOCORD LTD., ENFIELD, MIDDLESEX. TELEPHONE: ENFIELD 4022
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, Igranie and Petz 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.
Broadcast Receiving Licences

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

<table>
<thead>
<tr>
<th>Region</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>London Postal</td>
<td>2,370,000</td>
</tr>
<tr>
<td>Home Counties</td>
<td>1,657,000</td>
</tr>
<tr>
<td>Midland</td>
<td>1,767,000</td>
</tr>
<tr>
<td>North Eastern</td>
<td>1,915,000</td>
</tr>
<tr>
<td>North Western</td>
<td>1,621,000</td>
</tr>
<tr>
<td>South Western</td>
<td>1,672,000</td>
</tr>
<tr>
<td>Welsh and Border Counties</td>
<td>732,000</td>
</tr>
<tr>
<td>Total, England and Wales</td>
<td>11,134,000</td>
</tr>
<tr>
<td>Scotland</td>
<td>1,117,000</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>208,000</td>
</tr>
<tr>
<td>Grand Total</td>
<td>12,459,000</td>
</tr>
</tbody>
</table>

The above total includes 897,000 television licences.

Junction Transistor

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 Iraqi 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 7s for a call of three minutes plus 2s 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-
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 1923 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 site, at Langdon Crescent, Barking Road, all the electrical installation work is being carried out by Rushleigh Thripps & 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 600 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 1933 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.

**Patent Office Library**

Readers are reminded that the Patent Office Library, at 23, 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 23 to December 1, 1951.
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]

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 "Amine" aerial, specially designed for short-wave reception and transmission, and car radio aerials for scuttle mounting. The "Amine" 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...
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 new 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 9½ in. by 4½ in. by 5 in. The tube in this instrument measures only 1⅛ in. 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, valves, 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 released models is a console with push-pull output, 10 in. loudspeaker and flywheel tuning, priced at 43 gns. including tax.

[Stand No. 62]

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 Ecko 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]

Cullaro, Ltd.

A PART from the simpler types of motor-driven turntable, Messrs. Cullaro 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-

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

A 3-speed record changer from the Cullaro 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.
APT 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 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.
APT 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 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

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.
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.

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.

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.

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 disc 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 331/2 or 45 r.p.m. discs—a turn of the knob presenting the correct needle.

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.

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
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 10in. 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, 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] 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 "crawler" 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.60, 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. 23] 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.

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.

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.

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 misplaced.

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 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.

This Pye receiver has the speaker fret broken by the tuning dial, covering three wavebands. It is Model 33TQ.

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 autochanger 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]

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 104863, 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]
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 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 (3½ and 7½in./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. 58]

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. maims, with a single turnframe 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 stylus. [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 test meter 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.

A selection of Westinghouse "Westalite" rectifier units, including meter, R.F. and L.T. components.
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 circuits. 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. 55]

Valradio, Ltd.

A S 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]

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 metalised 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 174 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 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 interstage coupling to serve exactly the same purpose (Fig. 2). In the Fig. 1 arrangement, of course, the resistor

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

---

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

---

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 .05 μF. 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.
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 straightforwardly 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:

<table>
<thead>
<tr>
<th>Flat:</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key:</td>
<td>0</td>
<td>o</td>
<td>D</td>
<td>A</td>
<td>E</td>
<td>F</td>
</tr>
<tr>
<td>Sharp:</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

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 electromotive 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 electromotive 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 dissects is a disisser, not a dissenter. 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 £.

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.
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 ke/s. produces sidebands of 2.5 ke/s. on either side of the carrier frequency, compared with the sidebands of about 8 ke/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 C4 and C5 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)

Figs. 1 and 2.—On the left an Amplitude-modulated carrier, and on the right a Super-modulated carrier.
The abbreviated ranges of two popular types given here are representative of the wide variety of T.C.C. Condensers available.

**VISCONOL CATHODRAY' CONDENSERS**

Cap. Range: 0.0005mfd. to 1 mfd.
Voltage Range: 750 to 25,000 at 60°C.

<table>
<thead>
<tr>
<th>Cap. (µF)</th>
<th>Max. Wkg. at 60°C</th>
<th>Dimens. (Overall)</th>
<th>Type No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>'0005</td>
<td>25,000</td>
<td>5 in. 12 in.</td>
<td>CP.57.HOO</td>
</tr>
<tr>
<td>'001</td>
<td>6,000</td>
<td>2½ in. 3 in.</td>
<td>CP.55.QO</td>
</tr>
<tr>
<td>'001</td>
<td>12,500</td>
<td>3 in. 1½ in.</td>
<td>CP.56.VO</td>
</tr>
<tr>
<td>'01</td>
<td>6,000</td>
<td>3 in. 1½ in.</td>
<td>CP.56.QO</td>
</tr>
<tr>
<td>'1</td>
<td>7,000</td>
<td>6½ in. 2 in.</td>
<td>CP.58.QO</td>
</tr>
<tr>
<td>'25</td>
<td>5,000</td>
<td>5½ in. 2½ in.</td>
<td>CP.59.MO</td>
</tr>
</tbody>
</table>

**MOULDED MICA CONDENSERS**

Stacked Foil. Capacities from 50 to 10,000 pF.

**MOULDED SILVER MICA CONDENSERS**

Capacities from 10 to 10,000 pF.

**WAX PROTECTED SILVERED MICA CONDENSERS**

Capacities from 5 to 12,000 pF.

THE TELEGRAPH CONDENSER CO. LTD.
Radio Division: North Acton, London, W.3. Tel: Acorn 0061

By request

At the request of many of our constructor friends, we give here full details of the famous range of Stentorian chassis.

<table>
<thead>
<tr>
<th>Type</th>
<th>Cone dia.</th>
<th>Flux Density (Gauss)</th>
<th>Pole dia.</th>
<th>Gap length</th>
<th>Flux face</th>
<th>Total Flux</th>
<th>Speech coil impedance (Ohms)</th>
<th>Handling Capacity (Watts)</th>
<th>PRICES</th>
</tr>
</thead>
<tbody>
<tr>
<td>*S.257</td>
<td>2½&quot;</td>
<td>7,000</td>
<td>.375&quot;</td>
<td>.033&quot;</td>
<td>.093&quot;</td>
<td>5,285</td>
<td>3</td>
<td>.125</td>
<td>18</td>
</tr>
<tr>
<td>*S.357</td>
<td>3½&quot;</td>
<td>7,000</td>
<td>.625&quot;</td>
<td>.035&quot;</td>
<td>.125&quot;</td>
<td>11,500</td>
<td>3</td>
<td>.125</td>
<td>19</td>
</tr>
<tr>
<td>S.507</td>
<td>5&quot;</td>
<td>7,000</td>
<td>.75&quot;</td>
<td>.040&quot;</td>
<td>.125&quot;</td>
<td>14,000</td>
<td>3</td>
<td>.125</td>
<td>20</td>
</tr>
<tr>
<td>*S.607</td>
<td>6&quot;</td>
<td>7,000</td>
<td>.75&quot;</td>
<td>.040&quot;</td>
<td>.125&quot;</td>
<td>20,000</td>
<td>3</td>
<td>.125</td>
<td>21</td>
</tr>
<tr>
<td>S.607</td>
<td>6&quot;</td>
<td>7,000</td>
<td>.75&quot;</td>
<td>.040&quot;</td>
<td>.125&quot;</td>
<td>20,000</td>
<td>3</td>
<td>.125</td>
<td>22</td>
</tr>
<tr>
<td>S.810</td>
<td>8&quot;</td>
<td>10,000</td>
<td>1&quot;</td>
<td>.043&quot;</td>
<td>.187&quot;</td>
<td>39,500</td>
<td>3</td>
<td>.25</td>
<td>23</td>
</tr>
<tr>
<td>S.912</td>
<td>9&quot;</td>
<td>12,000</td>
<td>1&quot;</td>
<td>.043&quot;</td>
<td>.187&quot;</td>
<td>47,400</td>
<td>3</td>
<td>.25</td>
<td>24</td>
</tr>
<tr>
<td>S.1012</td>
<td>10&quot;</td>
<td>12,000</td>
<td>1&quot;</td>
<td>.043&quot;</td>
<td>.187&quot;</td>
<td>47,400</td>
<td>3</td>
<td>.25</td>
<td>25</td>
</tr>
<tr>
<td>S.12135</td>
<td>12&quot;</td>
<td>13,500</td>
<td>1½&quot;</td>
<td>.050&quot;</td>
<td>.25&quot;</td>
<td>106,000</td>
<td>15</td>
<td>.25</td>
<td>26</td>
</tr>
</tbody>
</table>

Further details of these speakers and of the famous Concentric-Duplex models gladly sent on request.

*All chassis material is of Mazak-3 except those marked with an asterisk which are of Drawn Steel.*

LOUDSPEAKER CHASSIS

VU120, VR92

7/6). With "Inexpensive Television." Complete with case, metal valve, valve holder, T.V. inc. 75c.

GERMANIUM CRYSTAL DIODES, complete with full wiring circuit and diagrams, 4/6.

MIDGET 0005 mfd., TWO GANG TUNING CONDENSERS, Size only 21m. x 11m. x 11m. Capacity guaranteed, standard length 3m. spindles, complete with mounting bracket, less trimmers, 5/6. Complete with "built-in" trimmers, 2/6 each, plus 6d. post. Two gang 50m. with four geared push button unit attached, 6/6.

R8545 RECEIVERS, Absolutely brand new, in sealed manufacturers' packing cases. Incorporating 15 valves type T.E.6, EF39, EA50, R.3515, R.3517. Complete 45 m/s. I.F. Strip, high-efficient, 175,000, pots, etc., etc. 50m. only, plus 10/- packing and carriage. Whilst they last 1!

RECEIVER R.3555, as specified for "Inexpensive Television." Complete with 8 valves VR86, and 1 ea. UF60, VR87. Complete with a copy of "Inexpensive T.V." ONLY 55/- (carriage 45d., 7/6).

5 HARROW ROAD, LONDON, W.2

We are situated at the junction of Edgeware Road and Harrow Road facing Edgeware Road Tube Station.

OPEN ALL DAY SATURDAY.

PADDINGTON 1008/9

-0401

No. 28 "WALKIE-TALKIE" TRANS/RECEIVER, Complete with Thorst Mike, Phones, Junction Box and Antenna kit, in canvas bag, range 1/4 to 9 Mks.

NEW CATALOGUE NOW AVAILABLE

PRICE 9d.

If unable to call please send stamp for Current Comprehensive Component List.

FREQUENCY CONTROL CRYSTALS.

By American G.E. Co. Octal base fitting. For receiving frequencies 2,500 kc/s., 3,000 kc/s., 4,600 kc/s., 6,200 kc/s., 8,000 kc/s., 7/6 each. Also 2125 G. in pin spacing, 5/0.0 cent. each. 5/0. All guaranteed 6/6.

BARGAIN IN "SIMPLE WIRELESS" KIT.

R.3515 I.F. STRIP. A complete I.F. strip comprising 6 EF39 tubes, each, tuned to 13.5 m/s., 1 EAF6 diode detector, and 1 EF86 or EF86 output or video stage. A few modifications only are required to adapt this unit, which will give pictures of extremely good quality. Price complete with valves, and foncorgoof modification instructions, is 45/-, plus 5/- carriage and packing. Limited quantity only.

TRIMMER KIT. "Quadrad." A complete kit to complete every radio man. This famous kit can be supplied by us at 3/6 only! Comprising 1, 2, 3, 5, 6. 6 A.A. box spanners, 6 screwcutters trimmers (vertical and horizontal), 4 spanners, valve-outlet, and Thickness gauge. Attractively finished in white ivory. All neatly laid out in black crockle box. An absolute bargain.

A SIGNAL TRANSMITTER at minimum cost.

An easy-to-build unit that can be used for both P.M.G., I.F. and Audio signal tracing, without any switching or adjustment. Highly sensitive, the complete do-it-yourself, responds to signals picked up from an ordinary receiver aerial. The circuit is that of the Author's patent, 3-stage resistance-coupled audio frequency amplifier, with a 5-in. speaker. In the Output of the Power Amplifier stage.

We shall be pleased to supply a complete kit for the construction of the above, right down to the last detail, for the low price of £3/18/6. Concise instructions and circuits are supplied. There is no question of the costs of a preferred, circuit and instructions only can be supplied for 1/6 post free. All kits may be purchased in this country. This is a highly efficient instrument, and a MUST for every radio man.

S.440-B V.H.F. TRANSMITTER CHASSIS.

Partly stripped by the M.O.S. Co. and complete with all valves, tuning coils and crystal but otherwise intact. A line base for V.H.F. Tvs or 144 mtrs. orig. 85-85 mcs. values type 3E234, 3675 56V, housed in louvered case finished grey-black. Delivery 2 x 7 l/m.

CLYDESDALE'S 27/6

PRICE ONLY

FAIRLY AVAILABLE
dicate Receiver Unit at... ... ... ... ... ... £2.10.6.

With valves previously advertised.

The 8-51-B Power Unit at...

... ... ... ... ... ... ... ... ... ... ... ... £2.12.6.

Input 200-260 V.A.C. Output 125 V. 2.2 A., and 3/3 V. D.C. 60 m.

Valve rectifier, etc., as previously advertised.


5-way diecast cover cable socket at...

... ... ... ... ... ... ... ... ... ... ... ... 1/- each.

AERIAL INSULATORS 10/12.

Black plastic chain insulators, 5 links each. 31m. long 11m. wide. Total length 75m.

CLYDESDALE’S 1/6 per pair

PRICE ONLY

POST PAID

MULTICORE CABLE.

1-core, metal braided and PVC covered...

... ... ... ... ... ... ... ... ... ... ... ... 10/- per yd.

3-core, metal braided and PVC covered...

... ... ... ... ... ... ... ... ... ... ... ... 10/- per yd.

7-core, metal braided...

... ... ... ... ... ... ... ... ... ... ... ... 10/- per yd.

12-VOLT MOBILE AMPLIFIER UNIT.


CLYDESDALE’S 15/-

PRICE ONLY

CARRIAGE PAID

Order direct from:

CLYDESDALE SUPPLY CO. LTD.

1, Bridge St., Glasgow, C.5. Phone: SOUTHERN 2706/9

applied' to the 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 snap. 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) over-run 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.—900 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 14 in. by 8 in., the baseboard being the same width but deeper—say 14 in. by 12 in. The panel should be of ebonite or fibre (bakelite, etc.), while the baseboard can be wood 3/4 in. 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-valves to multi-valves. The following table gives a representative selection:

<table>
<thead>
<tr>
<th>Type of Set</th>
<th>Current (mA)</th>
<th>Resistor (ohms)</th>
<th>Required Voltage drop (volts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-valve (Detector)</td>
<td>1</td>
<td>140,000</td>
<td>80</td>
</tr>
<tr>
<td>Short-wave Converter</td>
<td>2</td>
<td>50,000</td>
<td>140</td>
</tr>
<tr>
<td>Two-valve</td>
<td>5</td>
<td>20,000</td>
<td>120</td>
</tr>
<tr>
<td>Three-valve</td>
<td>10</td>
<td>7,000</td>
<td>150</td>
</tr>
<tr>
<td>Four-valve or Superhet</td>
<td>20</td>
<td>3,500</td>
<td>150</td>
</tr>
<tr>
<td>Five-valve or Amplifier</td>
<td>30</td>
<td>2,300</td>
<td>150</td>
</tr>
</tbody>
</table>

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 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 106,000-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 rate 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.

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)
THE receiver described in this article is 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- and below-chassis wiring details will be given next month.
ns Midget

T. VALVES AND A 2\(\frac{1}{4}\)IN. SPEAKER

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 2\(\frac{1}{4}\)in. speaker.

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 1\(\frac{1}{4}\)in. long. Using very thin card (postcards will do) cut a strip \(\frac{3}{8}\)in. wider than the window space and of length sufficient to go round the wooden core and overlap to form a joint which must be placed as shown in Fig. 4. Remove the card and cut down the four creases on each side for \(\frac{1}{16}\)in. 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 \(\frac{3}{8}\)in. 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...
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.

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
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 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 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 1 in. 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 core 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 1 in. only. Take care that filings, etc., do not penetrate into the condenser.

(To be continued)

LIST OF COMPONENTS
Volatges are Working Voltages.

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>1500 1/10 W.</td>
</tr>
<tr>
<td>R2</td>
<td>47 KΩ 1/10 W.</td>
</tr>
<tr>
<td>R3</td>
<td>2.2 MΩ 1/10 W.</td>
</tr>
<tr>
<td>R4</td>
<td>470 KΩ 1/10 W.</td>
</tr>
<tr>
<td>R5</td>
<td>670 KΩ 1/10 W.</td>
</tr>
<tr>
<td>R6</td>
<td>6.8 KΩ 1/2 W.</td>
</tr>
<tr>
<td>R7</td>
<td>22 KΩ 1/2 W.</td>
</tr>
<tr>
<td>VR</td>
<td>50 KΩ variable</td>
</tr>
<tr>
<td>VC1</td>
<td>TC1 Twin gang condenser</td>
</tr>
<tr>
<td>VC2</td>
<td>TC2.00037 uF, maximum</td>
</tr>
<tr>
<td>C1</td>
<td>0.005 µF, 500 v, Metalmite T.C.C.</td>
</tr>
<tr>
<td>C2</td>
<td>0.04 µF, 150 v, Hunts W99</td>
</tr>
<tr>
<td>C3</td>
<td>0.04 µF, 150 v, Hunts W99</td>
</tr>
<tr>
<td>C4</td>
<td>100 µF, Ceramic</td>
</tr>
<tr>
<td>C5</td>
<td>0.04 µF, 150 v, Hunts W99</td>
</tr>
<tr>
<td>C6</td>
<td>100 µF, mica</td>
</tr>
<tr>
<td>C7</td>
<td>0.01 µF, 500 v, Metalmite T.C.C.</td>
</tr>
<tr>
<td>C8</td>
<td>0.005 µF, 500 v, Metalmite T.C.C.</td>
</tr>
<tr>
<td>C9</td>
<td>10 µF, electrolytic Micropack 25 v.</td>
</tr>
<tr>
<td>C10</td>
<td>0.01 µF, electrolytic B.E.C. 1/2 in. long</td>
</tr>
<tr>
<td>C11</td>
<td>0.02 µF, electrolytic B.E.C. 1/4 in. Diameter</td>
</tr>
<tr>
<td>C12</td>
<td>0.01 µF, 500 v, Metalmite T.C.C.</td>
</tr>
<tr>
<td>T1</td>
<td>See text</td>
</tr>
<tr>
<td>T2</td>
<td>See text</td>
</tr>
<tr>
<td>V1</td>
<td>9003</td>
</tr>
<tr>
<td>V2</td>
<td>9001</td>
</tr>
<tr>
<td>V3</td>
<td>4EL91 (V4 may be EY91)</td>
</tr>
</tbody>
</table>

Fig. 9.—The output transformer and its fixing clip.
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 VR165/30; 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.

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 $6,290,000,000,000,000,000,000$ 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 was 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

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.

---

**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.
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. 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 1 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>
<thead>
<tr>
<th>Type</th>
<th>Rk.</th>
<th>I max.</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF37</td>
<td>100 KΩ</td>
<td>5</td>
<td>400</td>
</tr>
<tr>
<td>EC31</td>
<td>50 KΩ</td>
<td>20</td>
<td>300</td>
</tr>
<tr>
<td>EL32</td>
<td>50 KΩ</td>
<td>25</td>
<td>400</td>
</tr>
<tr>
<td>EL33</td>
<td>50 KΩ</td>
<td>30</td>
<td>90</td>
</tr>
<tr>
<td>EL37</td>
<td>25 KΩ</td>
<td>50</td>
<td>200</td>
</tr>
<tr>
<td>PenA4</td>
<td>50 KΩ</td>
<td>30</td>
<td>100</td>
</tr>
<tr>
<td>QVO3-24</td>
<td>25 KΩ</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>QVO4-20</td>
<td>25 KΩ</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>6F1</td>
<td>50 KΩ</td>
<td>10</td>
<td>110</td>
</tr>
<tr>
<td>6P25</td>
<td>25 KΩ</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>HL41</td>
<td>100 KΩ</td>
<td>2</td>
<td>500</td>
</tr>
<tr>
<td>P61</td>
<td>100 KΩ</td>
<td>10</td>
<td>120</td>
</tr>
<tr>
<td>Pen44</td>
<td>20 KΩ</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>Pen46</td>
<td>25 KΩ</td>
<td>50</td>
<td>110</td>
</tr>
<tr>
<td>SF41</td>
<td>25 KΩ</td>
<td>10</td>
<td>110</td>
</tr>
<tr>
<td>SF61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6J7</td>
<td>50 KΩ</td>
<td>6</td>
<td>700</td>
</tr>
<tr>
<td>6SH7</td>
<td>50 KΩ</td>
<td>10</td>
<td>200</td>
</tr>
<tr>
<td>6AG7</td>
<td>50 KΩ</td>
<td>25</td>
<td>90</td>
</tr>
<tr>
<td>L63</td>
<td>100 KΩ</td>
<td>4</td>
<td>400</td>
</tr>
<tr>
<td>KT8</td>
<td>25 KΩ</td>
<td>50</td>
<td>200</td>
</tr>
<tr>
<td>KT36</td>
<td>50 KΩ</td>
<td>25</td>
<td>95</td>
</tr>
<tr>
<td>KT71</td>
<td>50 KΩ</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>KT63, 6F6</td>
<td>50 KΩ</td>
<td>30</td>
<td>400</td>
</tr>
<tr>
<td>KT81</td>
<td>30 KΩ</td>
<td>35</td>
<td>80</td>
</tr>
<tr>
<td>MH4</td>
<td>100 KΩ</td>
<td>4</td>
<td>300</td>
</tr>
<tr>
<td>MKT4</td>
<td>50 KΩ</td>
<td>30</td>
<td>350</td>
</tr>
<tr>
<td>ML4</td>
<td>100 KΩ</td>
<td>12</td>
<td>200</td>
</tr>
<tr>
<td>N78</td>
<td>50 KΩ</td>
<td>35</td>
<td>80</td>
</tr>
<tr>
<td>PX4</td>
<td>50 KΩ</td>
<td>45</td>
<td>180</td>
</tr>
<tr>
<td>PX25</td>
<td>25 KΩ</td>
<td>75</td>
<td>120</td>
</tr>
<tr>
<td>Z93, EF50</td>
<td>100 KΩ</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Z66</td>
<td>100 KΩ</td>
<td>7</td>
<td>100</td>
</tr>
</tbody>
</table>
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 feedback 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 $R_k$ 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 mA., out of an old receiver, and the established output is 50 mA. 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.

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 manoeuvrable 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.

---

**TABLE II**

Gas stabiliser tubes

<table>
<thead>
<tr>
<th>Type</th>
<th>Regulation</th>
<th>Striking V.</th>
<th>Operating V.</th>
<th>I max.</th>
<th>I min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST11</td>
<td>5</td>
<td>140</td>
<td>100</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>NE5</td>
<td>250 ohms</td>
<td>110</td>
<td>90-110</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>4687</td>
<td>300 ohms</td>
<td>140</td>
<td>90-110</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>4687A</td>
<td>290 ohms</td>
<td>125</td>
<td>83-86</td>
<td>8</td>
<td>1</td>
</tr>
</tbody>
</table>

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

---

**NOW READY!**

The Entirely New 12th Edition of The Famous Standard Work

**THE PRACTICAL WIRELESS ENCYCLOPAEDIA**

By F. J. CAMM

Price 21/- or 21 10 by post from:

GEORGE NEWNES LTD., Tower House, Southampton Street, Strand, W.C.2.
The New Windsor Television Wobbulator

MODEL 260A

The first self-contained electronic instrument providing visual alignment facilities for television receivers. Simple, compact and efficient—its use will save many hours of valuable time in the service department.

FEATURES
- CARRIER FREQUENCY: 5-70 Mc/s.
  10-140 Mc/s (on 2nd harmonic).
- BANDWIDTH: 0-5 Mc/s total.
  0-10 Mc/s (on 2nd harmonic).
- SWEEP FREQUENCY: 50 c.p.s. sinusoidal, return trace blacked out automatically.
- OUTPUT: Adjustable from 0-10 mV. approx. Fixed and variable attenuators are fitted. Output impedance 75 ohms.

£36.15.0

Please write for further details and information on other Windsor and Taylor products.

Taylor Electrical Instruments Ltd.
419/424 Montrose Avenue, Slough, Bucks
Telephone: Slough 21381 (4 lines) "Grams & Cables: Taylins, Slough"

Build a professional-looking Radio at less than half today's price

The Kits are housed in attractive Bakelite Cases, size 12in. x 5in. x 6in. Each Kit is complete in every detail, nothing has to be made or improvised. Easy to follow, point-to-point diagrams are supplied, making construction very simple. They are for use on 200-250 volt mains, and both A.C. and Universal Models can be supplied. The Dials are illuminated, and the receivers present an attractive appearance. We regret the necessity for the increase of prices due to continually rising costs and increased P.T.

Premier Radio Co.
Morrison & Co. (Radio) Ltd.
Callers to: 207, Edgware Road, W.2. Ambassador 4033 and Paddington 3272 (Open until 6 p.m. on Saturdays.)

Our postal service is again in operation
Please note: Our only address is
207 Edgware Road, W.2
Phone: Ambassador 4033 and Paddington 3272

TRF

Superhet
Valve line up: 6K8, 6K7, 6Q7, and CV1510 Beam Power Output in the A.C. Model. The A.C./D.C. Output Valve is 12A6. Both use Metal Rectifiers. Waveband coverage is 16-50, 190-540 and 1,000-2,000 m. Price £7/19/6 (carriage and packing 2/6). With Walnut or Ivory Cabinet.

Circuit diagrams only can be supplied at 1/6 each. Cabinets only available at 17/6,
GERMANIUM DIODES. The very latest type. Dimensions: .519ths x .369. Wire ends.

LASKY'S PRICE 43 each. Postage extra.

TANNY HAND SETS. Comprises cartoon microphone and m/c earphone. Microphone has "push for on" switch. Supplied with connecting cord.

LASKY'S PRICE 10 6 per set. Postage 1.6 extra.

SAFETY FIRST. Fused test probes. DAILY insulated pencil type with retractable point. Contact is only made when desired by pressing top. Each prod contains a cartridge type fuse, and spring, normally listed at 0.6 kit.

LASKY'S PRICE 411 per pair (one red, one black). Postage 6d. extra.

MINIATURE OUTPUT TRANSFORMERS. For use in home receivers with 194 and 284 valves.

LASKY'S PRICE 9. Postage 9d. extra.

SPECIAL FILAMENT TRANSFORMERS. Primary 200-2000 volts 50 c.a.s. Secondary 90 volts. 2 amps. with following tappings: 3, 4, 5, 6, 8, 9, 10, 15, 20, 30, 40, and 50 volts.

LASKY'S PRICE 9.6 extra. Postage 1.6 extra.

2-VOLT BATTERY VALVES. New and unused. Screen Grid 46. Pentode (K25) 5 G. Postage 3d. per valve extra.

V.F.P. AQORN VALVES. New and unused. Type 656, pentode. Price 3 G. Type 2A2, pentode. Price 811. All have 4.5 volts 0.15 amp. heaters.

RESISTANCES. ALL VALUES. All sizes. 5 ohms to 50 meg. ohms. Send us your order. 1/2d. each watt, 7/2d. each; 1/2 watt, 9d. each; 1 watt, 11d. each.

CHASSIS AMPLIFIER TYPE JRA 3. 10-12 watts. Uses an L60 feeding 2 KT10s in push-pull. Rectifier type L52. Size: 6 x 17 x 2 ins. chassis. BRAND NEW AND UNUSED. Send 2d. stamp for a copy of the complete data.

LASKY'S PRICE 15.19. Carriage and packing 10 extra.

TABLE MICROPHONE STAND. Two sections, chrome plated. Gold-cright finished hands, chrome plated. Price each.

LASKY'S PRICE 1. Postage and packing 9d. extra.

SELENIUM RECTIFIERS BY S.T.C. Type 8W86. Diode valves at 5 ma. and 1,200 volts on pulse circuits.

LASKY'S PRICE 96 each. Post extra.

LASKY'S, PRATT'S RADIO, 1070 Harrow Road, London, N.W.10

Phone: Ladbroke 1731.

April, 1950

E.M.I. INSTITUTES, Postal Division, Dept. 32.

43 GROVE PARK ROAD, CHISWICK, LONDON, W.4.

Please send, without obligation, your FREE BROCHURE I have marked the subjects which interest me.

[Items listed for purchase with prices]

-- POST THIS COUPON NOW --

E.M.I. INSTITUTES - The College backed by an industry

PRACTICAL WIRELESS

October, 1951
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 whatever. 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 frequency of the modulating 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 frequency 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)
LITTLE COMPANION CABINET
This modern design bakelite cabinet in ivory, blue or brown is ideal for an all-mains receiver, complete with back, front, bottom, and sides. Postage and insurance, 2/6.

Punched Metal Chassis, bored out with speaker cut-out, 5/6.

Metal Assembly, for holding dial and slot lights, complete with long- and medium-wave dials. £4.50. Moulded Perspex Window, 1/9. Matted knobs (set of three), 2/6. A complete T.R.F. Receiver can be built into this cabinet for under £6. Constructional data, 1/6.

TWO-GANG, 75 pF. 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 pF. air-spaced variable condenser. The spindle length is approximately 1 in. Price 4/9 each.

MISCELLANEOUS BOOKLETS
These five 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:

- R155, R230, R109, TR145, TR168, BC320, BC321, BC115, R107, R111, BC24, BC342, Pre-Amp, from BP77, Pre-Amp, from Unit 32A, T.V. Receiver from 1941, R.250, E.W.V. Receiver from TR175, etc., R.T.V. Receiver from TR174, Dual band T.V. Receiver. Price of any of these booklets is 1/6 each—Post Free.

Orders under 5/0 add 1/6, under 1/0 add 1/4. Postable items can be sent C.O.D., additional charge approx. 1/4. Post orders to Ruislip. Good stocks of all items at time of going to press. Early closing Wednesday (Ruislip), Saturday (City).

152-153 FLEET STREET, E.C.4

(7) ELECTRON HOUSE, WINDMILL HILL, RUISLIP MANOR, MIDDX.

BUILD YOUR OWN MODERN RECEIVER for HALF the normal cost

A MIDGET 4 STATION "PRE-SET" SUPERHET. A.C. mains. The set is designed for reception of stations on Medium Waveband and one on Long Wave by the turn of a Rotary Switch, no tuning being necessary. The set can be supplied either as a Complete Kit of Parts, or by purchase of the Components separately. The Complete Assembly Instructions, showing the Wiring Diagram and Component Layout, and Point to Point connections, together with a Component Price List, available for 1/6.

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 6d. 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. Both the Wiring Diagram and Practical Component Layouts, are available for 1/6. This also includes a separate Components Price List.

THE MIDGET A.C. MAINS 3-VALVE RECEIVER, as designed and published in "Wireless World," covering Long and Medium Wavebands. Cost of all Components, to build this set is £4.17. A reprint of the detailed Assembly Instructions, including Practical Layouts, is available for 6d.

THE " WIRELESS WORLD " MIDGET A.C. MAINS 2-VALVE RECEIVER. We can supply all the components including Valves and M.C. Speaker, to build this set for £3/10/0. A reprint of the complete article and circuits, including Practical Layout and Component Price List is available for 1/6.

A COMPLETE KIT OF PARTS to build a MIDGET " All-dry " BATTERY ELIMINATOR, giving approx. 60 volts and 1.5 volts. This eliminator is suitable for use with 4-valve Superhet, Personal Sets. It is easily and quickly assembled and it houses in a case size 4in. x 2in. x 5in. Price of Complete Kit, 4/6. In addition we can offer a similar complete kit to provide approx. 30 volts and 1.5 volts. Price of assembled unit, 2in. x 2in. x 2in., Price 4/7/6.

For 5/0/0. A Complete Kit of Parts, including Drilled Metal Chassis and Valves, bound in 4 by 2 Fast Hicks FULL AMPLIFIER for operation on A.C. Mains. Incorporates Volume Control and is built to a kit with a six inch T.V. Receiver. The complete set of Assembly Instructions, including Practical Layouts, is available for 9/6.

SOME POPULAR CIRCUITS for the HOME CONSTRUCTOR

* THE MIDGET A.C. MAINS 3-VALVE RECEIVER, as designed and published in "Wireless World," covering Long and Medium Wavebands. Cost of all Components, to build this set is £4.17. A reprint of the detailed Assembly Instructions, including Practical Layouts, is available for 6d.

* THE " WIRELESS WORLD " MIDGET A.C. MAINS 2-VALVE RECEIVER. We can supply all the components including Valves and M.C. Speaker, to build this set for £3/10/0. A reprint of the complete article and circuits, including Practical Layout and Component Price List is available for 1/6.

* A COMPLETE KIT OF PARTS to build a MIDGET " All-dry " BATTERY ELIMINATOR, giving approx. 60 volts and 1.5 volts. This eliminator is suitable for use with 4-valve Superhet, Personal Sets. It is easily and quickly assembled and it houses in a case size 4in. x 2in. x 5in. Price of Complete Kit, 4/6. In addition we can offer a similar complete kit to provide approx. 30 volts and 1.5 volts. Size of assembled unit, 2in. x 2in. x 2in., Price 4/7/6.

* For 5/0/0. A Complete Kit of Parts, including Drilled Metal Chassis and Valves, bound in 4 by 2 Fast Hicks FULL AMPLIFIER for operation on A.C. Mains. Incorporates Volume Control and is built to a kit with a six inch T.V. Receiver. The complete set of Assembly Instructions, including Practical Layouts, is available for 9/6.

* Send 9d. P.O. for our NEW STOCK LIST, showing many KITS OF PARTS for Sets and Battery Chargers and " hundreds " of Wireless Components. When ordering specify cost of postage and packing.


PRACTICAL WIRELESS October 1951
DUKE & CO.

NEW 1194 RECEIVER CHASSIS.—A few hundred only, containing: 30 fixed condensers, 30 resistors, 24 trimmers (Ger. made), 3 IFs, 3 tuning coils, 5 Yatex 8-way switches, 7 relays, 2 switches, 2 tubes (OL and IV). If made to work, set tunes Tele- vision. Below £10, otherwise, not guaranteed. 6/-, plus post 1/-.

TYPE 65/1100 SUPERHET RECEIVER.—Latest model, of superhet type, 4-in., backs, new, 10 000 circuits. BEDSIDE NEW switches, v/control, v/holders and all condensers, in 468 sets, or C.O.D. Or £5/12/6. £3/3/6.

NEW SPEAKERS.—2-in., and 6-in., 12/-, slightly damaged, or perfect, 16/-, with transformer, leads, tubes, post 13/-.

BEDSIDE RECEIVERS.—In bakelite cabinet, 4 valve T.F.F Universal or A.C. for only £5/-12/-6. In coil cabinets, 6/- extra. OR assembled, 35/- extra. New and improved circuits. An amateur can build these with practically no knowledge. The ONLY set now available at this price. Post and packing, 25.

MICRO SWITCH.—Spst, 3/8 each. Also mercury micros, 1/4 each.

T.V. LENSES.—New, made by a reputable manufacturer, 6-in., 9-in., or 10-in., 50/- 12-in., 75/-.

AERIALS.—7-in., 10-in., in 3 sections, 4½ each. Tubular, copper plated steel. Carr. 2/6. AERIAL BASES.—Rubber, with fitting to take 12-ft. aerial, 1/- 6d, plus post. CABLE MOUNTS.—40 ft. for 4-in. coil. Covered in hide or moquette, 5/-, 16/-, or 31/- each. 4½-in., 30/-.

RELAYS.—30 ohm, new, 1/- 6d. break, 1 make 3, 1/6. pattern, 19/- each. AERIAL THERMALS.—5 amp, 5/- each.

DUKE & CO.

MATCHBOX RADIO RECEIVERS


KIT OF PARTS. Fully illustrated instructions and kit containing everything necessary for building the matchbox receiver. Price, 11/-, post free.


JOHN O'BIRNE (W), 137, COTHAM ROW, BRISTOL, 6

ORDERS BY POST ONLY

OUR 16TH YEAR

MONEY-SAVING OFFERS

Ex Air Ministry Communication Receiver Type R1155.—Brand New in Wood Transit Case. Aerial Tested before despatch. Supplied with 10 valves and re-print of Wireless World 5-page data describing easy connection for Civilian use. Range 18.5-7.5 mcs., 7.5-3 mcs., 1,000-600 kcs., 200-200 kcs. 200-75 kcs. Suitable Power Pack described below. OUR PRICE, £10 10s. Carriage per pair, train, 7/-.

1155 Power Pack and Output Stage.—Neat black cradle case, size 12-in. x 8-in. x 6-in, with 5 in. L5 built-in. Connections terminate in a Jones Plug which simply plugs into your 1155 and set is instantly all-A.C. operated without any modifications. Specially made by us and match in appearance with 1155. Stands on top of set. PRICE £6 10s., plus carriage 3/-.

12 Volt Car Radio.—Comprises a type 455 receiver expertly modified by us and fitted with volume control for immediate operation from car battery. Tunes medium waveband. Has a remarkable performance. Power is obtained from the dynamotor incorporated which is very quiet in operation. Dimensions are 11in. long, 4½in. wide, 5½in. deep. No aerial is supplied, but any car aerial will suit. (Not available for 6 volts.) Exceptional value at £6 10s., carriage and packing, 2/-.

H.P. RADIO SERVICES LTD., 55, County Road, Liverpool, 4, and at Liverpool Airport


DIMMER SWITCHES, variable resistors, approx. 50 ohms at 1 amp., in bakelite cases, 1/-, post 3d. 30/-.

LONDON RELAYS TYPE 852. 9-10v, 150 ohm coil, 2-3mg., robust make contacts, new 2 1/2 each, post 4d., 2/- 4d.

GATELOCK PARMEKO RADIO TRANSFORMERS.—Filter, 150-220-280/-, output 250-200-150/-, at 50 ma., 5/-, 3 amp., brand new, B.W., post 1/- 3/-.

VOLT METERS.—0-100v., A.C. moving coil with internal rectifier and divisors, 1 ma. 220-10-90-30-10/- with 1/10th sub-divisions. Specification, coil, style flush panel mounting new, 20/-, post 3d. 14/- 3/- 19-10) DUAL COIL SETS, low range "Q," high range "M," 120-300-500 kcs. Consists of 5 coil sets, 5-gang switch, trimmers, etc. New unused, 1/-, post 1/-, 17/-.

GERMAN IUM CRYSTAL RECTIFIERS with wire ends, brand new, 4/- each, post 3d. 4/-.

171. TRANSISTOR TUNING UNITS TYPE 852, range 7-70-10,000 kcs. Requires 1 transistor, 10/-, 3/- flat, 21/- flat, with black cradled front panel. Unused, 13/- 6d, post 1/-.

TURNTABLES.—12/- for small wire coil, 17/- for larger coil, 3½-4½gm. ranges (med. and low). With circuits, 3/-, post 3d.

All above, plus carriage and packing, 2/-.

JOHN FARMER (Dept. A.3), 194, HARBORNE PARK RD., HARBORNE, B'HAM 17

Tel. : Harborne 1000

PRACTICAL WIRELESS CIRCUITS

Many of the components and valves needed for the construction of various circuits described in this issue can be obtained from us. A Special List giving full details will be sent upon request.

M. WATTS & COMPANY

8, BAKER STREET, WEYBRIDGE, SURREY.

Telephone : Weybridge 2542.

AUDIOLTD.

37, HILLSIDE, STONEBRIDGE, LONDON, N.W.10.

CABINETS ! CABINETS !

LARGE AND SMALL

MAHOGANY, TWIN SPEAKER, 2ft. 10½in. x 1ft. 4in. x 11in. £1.00. Carr. 5/-.

WALNUT-BIRCH, 1ft. 6in. x 11in. x 10in., at 15/-, carr. 2/6.

WALNUT-SYCAME, 1ft. 6in. x 11in. x 10in., 16/-, carr. 2/6.

ALL CABINETS WITH SPEAKER FRETS.

COIL PACKS L.M.S.G.

Kit of Coils and all Components with Wiring Diagram, 15/-, p.p. 1/-. Aligning if required, 2/6.

Open Saturdays, 9-6.
(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.

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 kHz 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 polluted 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 “Techaikowsky-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-Beethoven 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 retamable, 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 enthusiasm 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 uncomfortable 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.
Electradax Bargains

MICROPHONES. No. 3 Hand Mike R.A.F. Model, comprising double button fine Granules, in bakelite case with switch in handle. 12s. 6d. Quality Mikes. Moving Coil in Chrome case, new £6, Crystal Mike, new £5.

HEATER ELEMENTS. 24 volts 75 watts flat copper plate with insulated connector fitted one end 4in. x 2in. x 1in., 1½ each. RESISTANCES. Variable wire wound double tube 152 ohms 2 amps, 301-, single tube 5 ohms 10 amps 21½, 300 ohms 3 amps, 151-, small Dimmer Resistances totally enclosed 100 ohms ½ amp. for 12 volt circuit, 2½ volts, 3½, 7½, 15 volts.

TRANSFORMERS. B.T.H. 230 volts c/s. input, 30 volts 6 amps and 2 volts 20 amps. output, 45½,- carr. 5½/- extra. Foster double wound Transformer, 100 watts 230 volts to 50 volts 2 amps, 25½,- carr. 2½.- Write for special Transformer list.

HAND MAGNETO GENERATORS ex.G.P.O. P.M. steel magnet, armature driven by gearing in handle. Output approx. 75 volts 225 m.A. C. 8½, p. 1½ each. HEADPHONES. Few only S. G. Brown type ‘A’ with headband and cord, 35½-.

PLUGS. Pye type coaxial Sockets, right angle entry, 1½.- Plugs 101HT 628 or 528, 9d. each. Patch cords, 2½/- each.


ELECTRADAX RADIOS
214, Queenstown Road, Battersea, London, S.W.8
Telephone: MACaulay 2159

The G Call Book

Available now, the most complete and up-to-date list of British amateur call signs and addresses, compiled from the Summer 1951 edition of the Radio Amateur Call Book, with the latest amendments.

Limited Edition
Price 4s. 6d. post free.
Early orders advisable.

Also Available.
The Foreign Section, Radio Amateur Call Book, listing amateur stations throughout the world less the United States, 140 pages.

Price 8s. 6d. post free.
The Radio Amateur Call Book. Complete, 400 pages, 100,000 amateur station addresses covering the whole world.

Price 20/- post free.

Subscriptions accepted for any American Technical Publication.

GAGE & POLLARD
55, Victoria Street, London, S.W.1
Abbey 5034.
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 of 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 8 and not strapped to A3 on contact 10, the deflection sensitivity is different. The figures for both tubes are shown below.

<table>
<thead>
<tr>
<th>Tube</th>
<th>X Plates</th>
<th>Y Plates</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCR138</td>
<td>0.14 mm/v.</td>
<td>0.33 mm/v.</td>
</tr>
<tr>
<td>ECR35</td>
<td>0.3 mm/v.</td>
<td>0.66 mm/v.</td>
</tr>
</tbody>
</table>

—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).

**Quality Straight Three**

Sir,—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 L.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).

**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).

**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 L.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).

**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
Further particulars out group
Mallard
BRIGHTON AND DISTRICT RADIO
of pick-up weight point radius, with
The first such as
design
more,
sapphire stylus
almost models of our
thermion's readers,

Amateur Radio Society:

Quarterly meetings are held
to exchange ideas and

The Wirral Amateur
quarters attached to the Wirral

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
Mon. Sec.: R. T. Parsons, 14, Carlyle Avenue, Brighton, 7.
AFTER an informal August the club starts the autumn season on a very full programme. During September and early October, there will be talks and demonstrations of gear by G5QZ on tape recording and by the Decca Co., who are bringing some of their equipment for sound recording and reproducing. On September 12th there will be one of several of the Midland TV film strips. The club is holding a dance in mid-October.

READING RADIO SOCIETY
Mon. Sec.: L. A. Henford (G2RHS), 30, Boston Avenue, Reading, Berks.
The activities of the society for the past two months include:
Reading Hobbes Exhibition in which the society took an active part, a display of equipment includes a complete 160-meter phone station and a Hecker, 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 200 contacts being made.
Lecture and demonstration by Dr. Lemon on Radio Control of models—made very interesting by his working models.
Dr. Lemon has now in the course of construction a helicopter which will have a wing span of approximately 250 cm, and is to be radio controlled.
G2AHY (Mr. Woodhouse) is still going strong with his instructurs meetings held every second Saturday of the month.

CHESTER AND DISTRICT AMATEUR RADIO SOCIETY
Mon. Sec.: J. Lloyd, 124, The Vale, Chester.
RECENTLY the association of North Western Radio Societies was formed by representatives from the following societies:
The Wirral 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 out group activities.
Support from other North Western Radio Societies is invited. Further particulars can be obtained from the loci, secretary.
The British National Radio School
ESTD. 1940

To get into the B.N.R.S.
CASH IS NOT ENOUGH

We must first be convinced that you are going to BENEFIT!
Write and tell us of your background and AMBITIONS
and we will advise, not lure.

Brit.R.E., City and Guilds, P.M.G. (Theory only) Examinations
Course, also what we sincerely believe to be the best
RADAR Course ever written.
Six months' trial period without obligation to continue.

Please mention this ad, and send for free booklet to:

STUDIES DEPARTMENT
BRITISH NATIONAL RADIO SCHOOL
52 ABBEY ROAD, LONDON, W.1.
Phone: REGent 3333.

GRIPS the SCREW
and drives it HOME

Grips smallest grub screw or large wood screw, firmly, instantly, and
drives quickly home! Saves time and labour.

POST FREE-
HAILEY SUPPLY CO. (W.7) PAID
PO Box 21, Royston Rd., Dunstable, Beds.

MODERN ELECTRICS LTD.
Decca 3-speed A.C. gram units, complete
Dual PICK-UPS for above, for L.P. and standard recordings
Cosmonet G.P. 20—we still have a small stock of these famous
PICK-UPS, price...£3 11s. 5d. G.P. 19 Spare Heads—L.P. and
standard for the above £2 3s. 4d.
GARRARD, PLUG-IN type
HEADS, for 65A and 70A.
GARRARD ADAPTORS to convert older models.
Recording TAPE, by E.M.I. and SOUNDMIRROR, price..£1 5s. Od.
Recording TAPE, by G.E.C. £1 10s. Od.
Recording TAPE, by DUREX £1 15s. Od.
(per 2,000ft. reel)

Just released—"MAGNETIC
RECORDING," by Chief
Engineer, Brush Development Co. The
most comprehensive publication on Tape and Wire recording.
26/- post free.
MODERN ELECTRICS LTD.
164, Charing Cross Rd., W.C.2
TEMPLE BAR 7587.

RADIO G200 ANNOUCEMENTS

VALVES, per return post, At 3/-: 694, 12B8, V178, V190.
At 5/-: CV96, 2XX, H5L, 12817, HV12, 6H6.
Pentode—972, 973 (G.R. rectifier, 10 v. 6.5 A heater), 6417, 68B.
At 6/-: V585, 8TV20, 6T6, G647, 6L4P, 6FI1, AC105, Ferris, CAGT, 675, 706S, 6K6, 6A6, 6G7, 607, 6DQ8, 1250T, 1251T, 1257T.
At 8/-: 6C1, 6L7, 6SH7, PT262.
At 10/-: 6C5, 6L6, 6V6, 522, 6G6.

RADIO UNLIMITED
ELM ROAD, LONDON, E.17
(Tel. Key 4813)

LOUDSPEAKERS.—New and boxed. 21in., 10 ohm, 1230, 8 in., 250 ohm, £1.10.6.; 12/6; 3 in., 12/6-11in., 2 in., 6/6; 8 in., 15.6.
MAINS TRANSFORMERS.—Leading makes. 300-250-2v., £4. 100 Mains, 30/-, post 5/-.
CONDENSERS.—Mall, 70 M.A., 300 ohms, 5/11.
VALVES.—6H2, 4 G.KT, E88D, E89D, 6.6 each; CV115, CV116, CV117, CV118, 6E8, 6E9, 6F9, 10 each. £15,000 Surplus and B.A.V. types in stock. List available.
CONDENSERS.—AGC, 0.22 mfd., 250 volts, 5 or 6 each.

THE MODERN BOOK CO.—
The Radio Handbook, by "Editors and Engineers." 1941 edition, £1 15s. 6d.
G.C. Call Book: Radio and Amateur Stations of the United Kingdom. 4/5, postage 1/-.
Radio Amateur Stations of the World (exclusive of the U.S.A.) 8/6, postage 2/-.
Theory and Design of Television Receivers, by A. Deutsch. 55s. postage free.
The Principles of Television Reception, by A. W. Keen. 30/-, postage 6d.
RADIO ELECTRON 22, Frances Street, Scutthope, Lines, Radio Amateur's Handbook, £1 12s. 6d., 3rd edition, 5/-, postage 4d.
Time bases (Scanning Generators), 225 x 0.25, 12V. £3 15s. 6d.; £2 15s. 6d.
Magnetic Recording, by J. B. Jern. £3 5s. postage 8d.
Receivers, by "Amateur Radio" £6 9s. postage 10d. We have the most selection of British
and American radio books in the Country. Complete list on request.
19-23 PRAED STREET
(Dept. P10), LONDON, W.2.

RADIO UNLIMITED
ELM ROAD, LONDON, E.17
(Tel. Key 4813)

LOUDSPEAKERS.—New and boxed. 21in., 10 ohm, 1230, 8 in., 250 ohm, £1.10.6.; 12/6; 3 in., 12/6-11in., 2 in., 6/6; 8 in., 15.6.
MAINS TRANSFORMERS.—Leading makes. 300-250-2v., £4. 100 Mains, 30/-, post 5/-.
CONDENSERS.—Mall, 70 M.A., 300 ohms, 5/11.
VALVES.—6H2, 4 G.KT, E88D, E89D, 6.6 each; CV115, CV116, CV117, CV118, 6E8, 6E9, 6F9, 10 each. £15,000 Surplus and B.A.V. types in stock. List available.
CONDENSERS.—AGC, 0.22 mfd., 250 volts, 5 or 6 each.

TRANSFORMERS

M.T.1—300-350 v. 80 m.f.
M.T.2—450-550 v. 100 m.f.
M.T.3—30 v. 2 a.; tagged every 3 volts. All primaries tapped for 250 to 350 v.

THE DOUGLAS COIL CO.
BRINKLOW, RUGBY.
RADIO SUPPLY CO.

15, Wellington Street, Leeds, 1

BRAND NEW GUARANTEED GOODS

ALPHA OFFERS

BRAND NEW AND BOXED

GV9G, BV9GT, 52AM, FT4, 184, 1116,
150V, PW1000, 6PS, 1821...

THE Fidelia

Phone: 3095

September, 1951

CARLTON COIL WINDING CO.

"A name you can trust—and remember"

Medium-wave Coil Units for BC93, BC104, HCO9, etc., State Which Model Required. mains Transformers for R.C.R., R.C.B., BC21, BC25.


CARVCO WORKS, CHURCH ROAD, BIRKENHEAD.

-PAHISTIC WIRELESS-

G. E. C.

GERMANIUM CRYSTAL DIODES

LATEST, SMALLEST

SUPREME CRYSTAL DETECTOR.

Midget Size, 5/16in. x 3/16in.

Wire Ends for Easy Fixing, 2d. each, postage 2d.

Wiring instructions included. Simple but high quality Crystal Set included. Technical Details and Selected Types

SILICON CRYSTAL VALVE

3½ each, postage 2d.

Fixing Brackets 3d. Extra

COPPER INSTRUMENT WIRE

ENAMELLED, TINNED, LITZ,

COTTON AND SILK SCREENED

Most gauges available.

B.A. SCREWS, NUTS, WASHERS,

soldering tags, eyelets and rivets.

SILICON CRYSTAL VALVE

INCORPORATING THE SILICON

CRYSTAL VALVE

Adjustable Iron Cored Coil.

RECEPTION GUARANTEED

Polished wood cabinet, a real CRYSTAL SET, NOT A TOY.

POST RADIO SUPPLIES

33 Bourne Gardens, London, E.4

RADIO BUILD

THIS RADIO & SAVE POUNDS!

Yes, you can now build radios a completely new and easy way! Our range of aluminium chassis are completely pre fabricated for ALL components. These and our various Construction Sheets and ALIGNED AND BRAZED Tuning Units enable ANYONE, whether novice or expert, to build a variety of first quality domestic receivers, feeders, units, amplifiers and test gear with the sure knowledge that failure is impossible. We can supply all parts at lowest prices.

Full details in the E-type Superhet (as illustrated) and eleven other sets including parts and complete lists of parts in the NEW EDITION of our famous "Home Constructor's HANDBOOK" which has been acclaimed the world over. From the vast spewd model and 300 from letters in our files, there is no doubt this book satisfies EVERYBODY interested in radio. So, if by chance you haven't had your copy you really are missing today's best value! Send to us NOW for the latest issue, price 2½. (Worth many times this nominal price.)

Mail only—to Dept. W.S.,

RODING LABORATORIES

(OF ILFORD)

694, LEA BRIDGE ROAD, E.10

FIRST-CLASS RADIO COURSES

GET A CERTIFICATE!

QUALIFY AT HOME—IN SPARE TIME

After brief, intensely interesting study—undertaken at home in your spare time—YOU can secure your professional recognition, and prepare for YOUR share in the post-war boom in Radio. Let us show you how!

FREE GUIDE


We shall be glad to forward particulars of our remarkable Guarantee of SUCCESS OR NO FEE.

Write now for your copy of this invaluable publication. It may well prove to be the turning point in your career.

FOUNDED 1885—OVER

150,000 SUCCESSES—

NATIONAL INSTITUTE OF RADIO ENGINEERING

(Dept. 461), 146, HOLBORN,

LONDON, E.C.1

ALPHA RADIO SUPPLY CO.

5 & 6, Vince's Chambers, Victoria Square,

LEEDS, 1
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 Aldinissel. The principal theme, the "Invitation Waltz," is now recorded by Charles Williams and his Concert Orchestra on Columbia DB2905. On the reverse side is "Shopping Centres," 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 "Eugene Onegin" waltz is a most welcome addition to the repertoire. On the other side of this record, Columbia DB2899, 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 Dvorak's "Slavonic Dances on Columbia DX1411. 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 DX1765/6—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. DB21300 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 variety which a good performance produces.

The Greek pianist, Gina Bachauer, who has given a number of successfully Wigmore Hall recitals, has recorded Liszt's "Rhumbased Espagnole" on H.M.V. C7854/5. 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. B10108. 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. B10116. It includes the attractive song, "Would You," as well as a highspot dialogue sequence between Vera-Ellen and David Niven.


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 Today" on Columbia DB2902.

"By the Kissing Rock" is the latest hit song from Donald Peers and the Song Pedlars on H.M.V. B10107. 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, "Satin and Lace," on H.M.V. B06102, followed by "I Am Sorry," and "I Apologise," on Columbia FB3614. 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.
THOUSANDS enjoyed them this summer. Did you build your own "Personal Portables" or even make "A Portable Television" and beat the B.B.C. for colour? For $1.30 min. 12 volt. 4000x, 6000x, minimum 12 volt. your choice. 3 1/2 in. 72 volt, low price, 4 in., solid job, 3 1/2 volt. 9 volt. New, boxed. P.O. P. B. 3817; E.A. 3817. Moving Coil Meter, 3 1/2 m.a. 3 in. Ferranti meter in slip-in front bale. housed in felt-lined carrying case, with chrome handle. bargain at 29.6. LMS Green, B'ham. Units, Potms., subscriptions. B. 9/6. In. 12 volt. 10 screw, and 6 A, 1m.a. 1/1. 0-500 microamps. 10 volt. Ferranti 2 in. M/C. 0-50 m.a. 7 6, and 0-200 m.a. both types 10 each. Pye 45 MO/S TV Strips, less valves, at 38.6, plus 1/6 post. Indicator Units, complete, with VCR. VCR Status, foot, tube, mi-metal shield, holder, mounted in 21 volt 2-deck chassis, in metal box, 18 volt. less new, condition. original transit case. 47,6. Plus 6/- carriage. S.A.E. with all prices. RADIO MAIL, 74, Mansfield Rd., Nottingham.

MATCHBOX SET, very high efficient dual wave, satisfaction guaranteed, full parts stocked. Matchbox sized Crystal Set Kits, complete特价 with lid & Air TONE. CO. Hillworth, Longdon, C/o.

SOUTHERN RADIO's Wireless Bargains.—Walkie-Talkie (Transmitter-Receivers), mark 1, with microphone, with 5 valves, throat microphone, 16 feet, £3. 5/-; bandwidth, fit field use, powerful superhet receiver, modulated transmitter. Guaranteed ready for the air, less batteries. £3 10/ -.

R.S.BLS Television Units, complete with 21 valves, 6 stage 14 mos L.P. strip, ideal for TV conversation, brand new in original wooden cases. £3 10/-.

GW3C Portable, new with all parts £3 10/-. LUXE CABINET KITS. £3 10/-. Lufbra Fly Cutters, 14/6. Lionet "Bug" Keys, genuine U.S.A. automatic mike key. type A—hi only, 1/6. Lufbra Fly Cutters, 1/6. Throat Microphones, magnetic type complete with long lead and plug. £3 10/-.

RINGBELL Cabinet for General Receivers, B.C. 4/5/4/5, 14 feet, with adaptors. 9/6. Moving Coil, D.C. Magnetic, brand new. £2 10/6, 6-5ma, 0-30ms, 0-20 volts, 9/6 each; 14ma, 15/- each. Hand Generators. 8 volt. 5 amp. with 3 va., £5 10/6, speakers, Celestion 21 in. P.M. MOVING coil, £5 10/6. Plastic Transparent Map Cabinets, 1/16 inches, ideal for maps, charts, display etc. with clear plastic identifiers, with Graphic Overlay modifications. A-N type 1 complete in all shapes. £5 10/6. GENUINE Tuba and mica, all useful sizes up to 2 mfd. 16/- per 100. Resistances, 100 m.m. up to 470 m.m. £10 10/6. WESTCOTT, type WX6 and W12. 1/- each, 11/- doz. Full list of radio supplies. £1 10/6.

RADIO SUPPLY LTD. 11, Little Newport St., London, W.C.2. (Gerrard 9633.)
EDE'S STUDIOS, Chelsea. Good quality components, dismantled from Ekco radios. Speakers, transformers, chokes and etc.; see last minute and open orders. Price List on request. No Offer: Ekco Round Type A.C.D.C. 2-band superhet Type AD 50, complete, less valves, 35/-, 5/- AC type AG17, 35/-, 5/- catt. Terms on application. EDE'S STUDIOS 255. Fulham Rd., Chelsea, S.W.3. (Phone: PLAXMAN 5207.)

TAPE RECORDINGS, ETC.

DISC RECORDERS for the amateur. Tuning and Engine Motors, Disc, Styli, EDE'S ELECTRONICS, 89, Mill Vale, Bromley, Kent.

TAPE AMPLIFIER: Magic Eye level, mixing input 10W, £15.8, Branksome Drive, Pilton, Bristol.


LYONS RADIO LTD.

2, GOLDHAWK ROAD, Dept. M.P. SHEPHERDS BUSH, LONDON W.12

Telephone: SHEPHERDS BUSH 1729

TRANSMITTERS TYPE T.1403A.—This Tx. is a 150-watt output of 40W on W/T or 10W on R/T over the frequency range of 2 to 7Mc. crystal or M.O. operation. (Plug-in M.O. Unit if required by 1956). Circuit comprises a Pierce (VR55) tuned buffer (EL33), PA (807), MOD (EL33). Contained in metal case with hinged lid at top. All controls clearly marked on front, twin-metered, panel. Meters indicate amplifier and aerial current. Overall dimensions: 10 x 15 x 14in. Price £75. Requirements: H.T. approx. 600v. D.C. at 200mA, and L.T. 6,3v. A.C. at 3A. Supplied in all standard conditions and approved circuit diagram and instructions. Price £12, carriage £1 (10/- returnable on crate).


POWER UNITS TYPE T—These units, incorporating metal rectifiers, were originally designed for the purpose of supplying L.T. for the R1155 and T1154 and H.T. for the T1154. Installed for long life, 10A, 50 ccts. Outputs 220v, D.C. at 110mA. Nominal 6.3v. D.C. at 1OA, Size 17in. high x 19 in. x 12in., and weight approx. 100lbs. Fuse-holders on outside of case are broken but easily replaceable, otherwise the units are in first-class order. PRICE £5-7-6, carriage 15/-.


T. G. HOWELL, 29, McWilliam Rd., Brighton. 7

NORMAN H. FIELD

68, HURST STREET

BIRMINGHAM 5

THREE IN ONE TRANSFORMER 6/- Each.

1. Use as P.P. Modulation Transformer. P.P. 211'a to 211-100 watts. Makes ideal Output Transformer P.P. 60 to 600 to match High Impedance Relay Spec'd.

2. 200 volts 60 cycles Input-200/- at 100 m.A. Output: Suitable for H.T. Eliminators and Lowest Voltage Power Supply. Can also be used 300 volts Half-Wave at Lower Current. And at 3.

3. 230/-115 volts AUTO Step-Up or Step-Down Mains Transformer 76 watts rating. U.B.A. mains.—Fully shrunked.

SIMPLE : EFFICIENT : GUARANTEED

BATTERY AMPLIFIERS. All Input with 400E and 250E valves. 150 volt. £12/6.

115D. LOOF AERIAL 8/-

CHOKEs. 60 ohms, 200 m.A., 3in. x 2in.-2in. (For Viewmaster) 2/-;

2 volt REGULATORS. Lead-inside, approx. 10 a.h.

NIFF ACCUMULATORS. 2.5 volt 15 m.A. Metal Cased.


CONDENSERS, 6 mfd. 2,500 volts 2/6.

POST 3/-

Please include something for postage, Money Back Guarantee.

Mail Order Dept., 64-65 Church Lane, Wolverhampton.

WALNUT Radiogram Cabinets of distinctive stamp designs. R. SHAW, 69, Failon Rd., E.11.


SITUATIONS VACANT

APPLICATIONS ARE INVITED for Radiobeechmechanic vacancies at various Air Ministry establishments in the United Kingdom and Northern Ireland. Duties include maintenance and repair of ground and airborne radio-radar equipment. Knowledge of radio circuitry essential. Rate of pay on appointment in Provinces as Class II Mechanic at age 25 or over £6/5/- a week rising by annual increments of 5/- to £7/4/- for 44 hour week. Slightly lower rates for entrants between 21 and 25 years. Class I Mechanic at age 25 £6/15/- a week rising by 5/- to £8/5/-.

Annual leave 16 working days with pay for 5-day week in addition to annual public holidays. Favourable sick leave conditions and promotion prospects. Applications should be addressed to the OFFICER COMMANDING - IN-CHIEF, Headquarters, Maintenance Command, Royal Air Force, Andover, Hampshire.

2 VOLT BATTERY SUPER-HE-T. 69-9501. Chargers takes No. 12 Tx/Rx. Tested and ready for use, 32/-.

TRI916 RECEIVER (less valves), 10/-.

CIRCUIT, 1/-, with conversion data.

New IN34 CRYSTAL DIODES, 5/6.

P.M. SPEAKERS. W.B. 2/- and 3/- 14/6, 16/-, 18/-, with trans. 21/6.

MULTIMETERS. 21in. Supplied as kit with black bakelite cases, 6 x 4 in. x 1in. and resistors for D.C. & D.C. ranges 0-6, 0-30, 0-150, 0-300, 0-600v., and 60mA. Scale also read 2v. OHMS 0-5,000 with 1v. battery. 24/6.

MOVING Coil MICROPHONES with switch, 6/6. Trans. to match, 5/-.

12x. AC/DC MOTORS 5 x 3in. fitted with powerful blower fan, 14/3.

SELENIUM RECITIFIERS. H.W. 250v. 120mA. 8/-; F. W. 6 or 12v. 2A. 26/-, 13A, 8/6, 4/-, 5/-.

ARMY CARBON MICROPHONE with switch, 4/6. Trans. to match, 5/-.

TRANSFORMERS: 200-240 volts Tapped 3-4-0-6, 8-12v., 15-30 and 40 volts at 2 amps. 21/3 Post Paid.

200/240v. AC/DC MOTORS. 1/6 h.p. 5/16in. spindle at each end, 3in. x 3in., price 3/-2/-, or fitted with 2in. grindstone, medium grind, 36/-.

Terms. All Carriage Paid. Money back Guarantee if returned within 7 days, unused.

THE RADIO & ELECTRICAL MART

253B. Portobello Road, London, W.11. Phone: Park 6026.

TR 1196 RECEIVERS

Complete with Conversion Data To 5 Valve S/Het.

Less Valves 9/6 Post Paid.

Stamp for Lists. Tel.: St. Albans 5951.

BOLD & BURROWS

12, Verulam Road, St. Albans, Herts.
R1155 COMMUNICATIONS RECEIVER
The famous ex-R.A.F. Bomber Command Set, Covers 5 wave ranges, 10-50 mcs, 17-50 mcs, 10-200 mcs, 200-250 mcs, 200-750 ke, and is easily and simply modified for normal mains use. P.U. DETAILS. These sets are all guaranteed tested and worked for dispatch, and are BRAND NEW IN MAKER'S PACKING CASES. Only £15 11/- 6d (carriage 10/-). A thoroughly-modded ex-allotment pack with output stage, which operates the 6:150 immediately can be supplied for 5/-, or with a built-in transformer, 56.

CLASS D WAVE-METER. Another small quantity has become available since "sell-out." A few months ago, and intending purchasing an ex-job quick. This is truly a first-class crystal controlled wave-meter, which has been repeatedly and well tested and recommended in the R.S.G.B. Bulletin. Covers 1-09-0 mc, and is complete with 100.000 kC Crystal, 2 valves ARTTH, 2-6 volt vibrators, and Instruction Manual. Designed for 0-6 D.C. operation, but modification data for A.C. supplied. BRAND NEW IN MAKER'S TRANSIT CASES. ONLY £15 11/- 6d (carriage, etc., 3 6). Transformer for A.C. modulation. 7 6.

MURHEAD D 31m. SLOW-MOTION DRIVE. A really precision product with care of tubes, a boy. \( \text{Tubes, 3/6.} \) 

---

London Central Radio Stores

WALKIE TALKIE (Transmitter and Receiver), Type 38 Mk. II, range 74 to 9 Mcs. Requires 3 v. LT. 120-150 H.T. in working order. Complete with 4 A.P.T., one A.P.T4 valves, I pair throat mikes, I pair headphones and aerial. In metal case, diagram with each set Free. Batteries not supplied, but obtainable from local radio dealers, £3.6. carriage and packing 2/-.

2-VOLT VIBRATORS. Type R6C, 7-Pin Self-Rectifying, 200 volt at 60 mA., made by Electronic Laboratories Inc., 716, 9d. post/packing.

6-VOLT MALLORY TYPE. 650 4-Pin American Base.

12-VOLT MALLORY TYPE. A629C American Base. 4-Pin. Price as above.

Carriage applies only to British Isles, excluding Ireland.

PHILCO SUPER SETS

Large table model in light walnut, large circular dial. Very selective.

125/-

LCC De Luxe model with Bronze speaker grill. Very attractive.

147/-

All-wave De Luxe table model. Large circular dial. Two speed tuning. Normal or Dipole Aerial.

189/-

"Catheder!" Model in light or dark oak. Receives all British and European Stations with ease.

210/-

Standard table model, square cabinet in light or medium oak. An absolute gift, no inspection of these. Wavelength calibrated dial.

95/-

--

have pick-up sockets supplied in A.C. or A.C-I. D.C. cover voltage 200-260 v.; take extension speakers; are tested before despatch; have 5 valves; despatched anywhere. Prices include carriage & packing.

ALL TYPES

Utility 4-Valve Sets A.C. (used), 200-250 volt. Built-in P.M. Speaker, Medium Wave Only. Complete in PineWood Cabinet. Size 13" x 12" x 6 1/2" Limited Number Only, £510.00. Carriage & Packing, 5/-.
## Practical Wireless

### BLUEPRINT SERVICE

#### PRACTICAL WIRELESS

<table>
<thead>
<tr>
<th>CRYSTAL SETS</th>
<th>No. of Blueprint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blueprints, 1s. each.</td>
<td>PW71*</td>
</tr>
<tr>
<td>1937 Crystal Receiver</td>
<td>PW71*</td>
</tr>
<tr>
<td>The &quot;Junior&quot; Crystal Set</td>
<td>PW94*</td>
</tr>
</tbody>
</table>

#### STRAIGHT SETS

**Battery Operated**

| One-Valve: Blueprints, 2s. each. | PW93* |
| Two-valve: Blueprints, 2s. each. | PW76* |
| Three-valve: Blueprints, 2s. each. | PW37* |
| F. J. Camm’s “Sprite” Three (HF, Pen, D, Tel) | PW87* |
| Four-valve: Blueprints, 2s. each. | PW34C* |

**Mains Operated**

| Two-valve: Blueprints, 2s. each. | PW19* |
| Three-valve: Blueprints, 2s. each. | PW23* |
| Four-valve: Blueprints, 2s. each. | PW20* |
| A.C. Fury Four (SG, SG, D, Pen) | PW45* |

#### SUPERHETS

**Battery Sets**: Blueprints, 2s. each.

- J. Camm’s 2-valve Superhet | PW52* |

**SHORT-WAVE SETS**

**Battery Operated**

- One-valve: Blueprints, 2s. Simple S.W. One-valver PW88* |
- Two-valve: Blueprints, 2s. each. Midget Short-wave Two (D, Pen) PW38A* |
- Three-valve: Blueprints, 2s. each. Experimenter’s Short-wave Three (SG, D, Pow) PW30A* |
- The Prefect 3 (D, 2 LF (RC and Trans)) PW63* |
- The Band-spread S.W. Three (HF, Pen, D (Pen), Pen) PW68* |

**PORTABLES**

- Four-valve: Blueprints, 2s. "Imp" Portable 4 (D, LF, LF, Pen) PW86* |

**MISCELLANEOUS**

- Blueprint, 2s. S.W. Converter-Adapter (1 valve) PW48A* |

### AMATEUR WIRELESS AND WIRELESS MAGAZINE

**STRaight Sets**

**Battery Operated**

- One-valve: Blueprints, 2s. B.B.C. Special One-valver AW387* |
- Two-valve: Blueprints, 2s. each. A modern Two-valver WM405* |

**Mains Operated**

- Two-valve: Blueprints, 2s. each. Consoelectric Two (D, Pen), A.C. AW403 |

---

**SPECIAL NOTICE**

These blueprints are drawn full size. The index containing descriptions of these sets are now out of print, but an asterisk beside the blueprint number denotes that constructional details are available, free with the blueprint.

The index letters which precede the blueprint number indicate the periodical in which the description appears.

Thus P.W. refers to PRACTICAL WIRELESS, A.W. to Amateur Wireless, W.M. to Wireless Magazine.

Send (preferably) a postal order to cover the cost of the blueprint (stamps over £d. unacceptable) to PRACTICAL WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

---

**SHORT-WAVE SETS**

**Battery Operated**

- One-valve: Blueprints, 2s. each. S.W. One-valver for America AW429* |
- Two-valve: Blueprints, 2s. each. Ultra-short Battery Two (SG, det Pen) WM402* |
- Four-valve: Blueprints, 3s. each. A.W. Short-Wave World-beater (HF Pen, D, RC, Trans) AW436* |
- Standard Four-valver Short-waver (SG, D, LF, P) WM383* |

**Mains Operated**

- Four-valve: Blueprints, 3s. Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) WM391* |

**MISCELLANEOUS**

- Enthusiast’s Power Amplifier (10 Watts) (3/-) WM387* |
- Listener’s 5-watt A.C. Amplifier (3/-) WM392* |
- Harris Electrogram battery amplifier (2/-) WM399* |
- De Luxe Concert A.C. Electrogram (2/-) WM403* |

---

**Hints Coupon**

The coupon is available until Oct. 1st, 1951, and must accompany all Practical Hints.

PRACTICAL WIRELESS, OCT., 1951
RECORDING EQUIPMENT

BSR INDUCTION MOTORS (All for A.C. Mains)

TYPE FP10.—Specially designed for magnetic Tape and wire recorders; extremely silent, and virtually free from vibration. Minimum stray magnetic field. £38-

TYPE SR1.—A medium power motor suitable for take-up spool drive where fast forward facilities are not required. Each £25-

TYPE SR1.—A motor of the same power as the renowned FP10, suitable for feed spool operation giving fast rewind. Suitable also for take-up spool when fast forward facilities are required. Due to its higher stray magnetic field, this motor is not recommended for capstan drive. Each £32-

D.C. STEP-UP GENERATOR

D.C. voltages from 2 v. to 14 v. give varying outputs. For example: at 6 v. D.C. input of 220 v., the output will be obtained: 12 v. D.C. input of 180 v., 25 a.; at 12 v. D.C. input of 480 v., 40 a. All motors provide sufficient power for use as a grinder, polisher, etc., as a spindle or other small hand tool. From the casting. Approx. r.p.m. at 12 v. D.C. input is 2,000. Unit of manufacturing was approximately £8 to £9. Each one carries full guarantee.

TO CALLERS ONLY—21a. Maudsley CRM121A or Mulford MW/31/17 Cathode Ray Tubes, for £5 cash and 12 monthly payments of £0.25. £1.4.7

TWIN FUSE HOLDERS.—Panel mounting twin fuse holders complete with locking clip. BRAND NEW. 2/- each (plus 6d. postage and packing).

ORDER YOUR VALVES C.O.D.—We will send your requirements at BVA prices by return of post.

SPECIAL! The following are still available at PREVIOUS BUDGET PRICES. Buy now while stocks last.

FLEXIBLE TABLE LAMPS, 45/- (post., pkg. 1/6).

FERGUSON 288A TABLE RECEIVERS, £15. 16 (care., pkg. 10/-).

IVALEX DE LUXE XTAL RECEIVERS, 17/6 (post., pkg. 1/).

IVALEX STANDARD XTAL RECEIVERS, 12/11 (post., pkg. 1/6).

MARCONI T24D AB PORTABLES (A.C./D.C. and battery), £18. 15 (care., pkg. 5/-).

MW/LWTRF COILS BOXED WITH CIRCUIT DIAGRAM, 6/11 pair.

MOS A.1.—Amplifier Kit for A.C. mains

MOS A.2.—Amplifier Kit for A/C/D.C. mains

MOS RFI TUNER. Kit for A.C. mains

Demonstrations—without obligation on all MOS KITS. Both still available from stock.

SPARES FOR MOS KITS

MAINS TRANSFORMERS, 350-0-350 v. 80 mA. 4 v. 5 a. £1

SELENIUM RECTIFIERS, 300-350 v. 80 mA. 2 GANG PLESEFY 0005 VARIABLE CONDENSERS 7/6

A1 CHASSIS ONLY

A2 CHASSIS ONLY

RFI CHASSIS ONLY

OCTAL (IN & OUT) AMPHENOL VALVEHOLDERS per doz. 25 a.m., 25 v. Electrolytic condensers 1/6

8 m.f. 300 v. Electrolytic condensers 3/6

16 m.f. 350 v. Electrolytic condensers 3/6

OUTPUT TRANSFORMERS L.F. CHORIES, 60 a. 6/11

BATTERIES. 60 v. high capacity, 5/3 (2 for £11). 72 v. (Layer) plus 1.5 v., 6/6.

AMPLIFIER 1138A with EBC33, EK32 and EL32, twin inputs, circuit, and our "1138A conversion data." These may be modified into a really fine little public address amplifier. ONLY 16/1. Post and packing 2/3.

MAINS POWER-PACK KIT, providing 200 v. at 30 mA, approx., and 18 v. at 2 a. These are suitable for one with the above unit to make a small self-contained amplifier. 14/6, complete with full instructions. Post 1/6.

MIDGET AMPLIFIERS, 5/-, 6/-, 3 x 3/-, with two 1227s and one 1227H. 13/6. (Carriage 1/6).

TRANSMITTER 21.- Sending speech CW or MCW, these are complete with valves, control panel, and key. The PA coils (not formers) and relays have been stripped by the M.O.S., but may easily be replaced with our circuit and instruction sheet. Tuning 4.2-7.5 and 18-31 m. In first-class condition. OUR PRICE, 25/-.

CARRIER LEVEL ("8") METERS (2 mA). 2" square, flange mounts. New and Boxed. 7/6 (Post 6d.).

VIBRATION PACK 21. Delivering approx. 140 v. at 40 mA, from 6v. input. These include a LT filter, and contain two metal rectifiers, six 12, two 4 µ, two 75 µ condensers, etc., five chokes, transformers, 15%, Solomon for stripping. £8.

ACCUMULATORS. Multi-plate, in unspillable celluloid cases. 7 AH, 2 v. 3/-, 11/-, 4/-, 6/-, 21AH, 2 v., with built-in hydrometers (approx. 58 sot). 15/-.

RECEIVER 1225. Complete with five EF58s, two EF34s, one EB34, these are ideal for 2 metres. ONLY 39/6. 1/6 Post.

POWER PACK 532, with one 5Z4: one VU120 (5KV) high voltage rectifier, two high cycle transformers, choke, etc. £13/3/0 complete with our 80 eps. EHT and HT conversion. (Carriage, 2/3.)

RADIO EXCHANGE CO.
9, CAULDWELL STREET, BEDFORD

Phone: 5568

SUCCESS?

In Radio, Television, and Electronics, there are many more top jobs than engineers qualified to fill them. Because we are part of the great E.M.I. Group we have firsthand knowledge of the needs of employers, thus our Home Study courses are authoritative and based upon modern industrial needs. Alternatively, our courses will prove equally valuable to you in furthering your hobby.

POST THIS COUPON NOW

E.M.I. INSTITUTES—Postal Division, Dept.21, 43 GROVE PARK ROAD, CHELMSFORD, LONDON, W.4.

Please send, without obligation, your FREE BROCHURE.
(I have marked the subjects which interested me):

☐ Mechanical Eng. ☐ Electrical Eng. ☐ Draughtmanship
☐ E.M.I. INSTITUTES—The College backed by an Industry


NAME
ADDRESS

E.M.I. INSTITUTES—The College backed by an Industry