Supreme precision in construction allied with outstanding genius makes McMichael Receivers without equal for results achieved. Such perfection results in ideal selectivity, enabling the maximum number of stations to be obtained without interference, and with greater volume than usual.

The McMICHAEL
SUPER RANGE
PORTABLE FOUR


CASH PRICE
22 GNS.
(Including all Equipment and Royalties), or by our special "Deferred Payments on Hire Purchase Terms" system, 5s down and 10 monthly payments of £3 1s. 6d.

Owing to the high degree of selectivity in this, and our other Screened Grid Portable Receivers, we are able to guarantee complete selectivity between all main B.B.C. stations under the new scheme of wavelengths.

The ideal combination of the latest valves and the most advanced circuit for portable and self-contained receivers—hear the McMichael Super Range Four (either model) demonstrated at any high-class radio store, or call at our London Showrooms.

L. MCMICHAEL LTD
Manufacturers of Wireless and Scientific Apparatus
WEXHAM ROAD: SLough: BUCKS.
London Showrooms: 174, STRAND, W.C.2. (Telephone: Holborn 2466.)

The McMICHAEL
SUPER RANGE FOUR (Table Model)

Containing a circuit of exactly similar design to that of the Portable Model, but fitted in a handsome Walnut Cabinet, mounted on a turntable. Designed with a self-contained frame aerial, this receiver is intended for use in the home where an outdoor aerial and earth are not necessary or desirable. An additional aerial and earth can be used to add to the normal and very remarkable range.

CASH PRICE
26 GNS.
(Including all Equipment and Royalties.)

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.
THE TRANSFORMER THAT PUT A1 IN RADIO

Telsen Transformers have set a standard of performance second to none in the history of Radio Component manufacture. They give equal rendering of the Treble and Bass notes and have been accepted as standard by many of the leading Set Manufacturers. Fit one in your set—notice the perfect rendering of all notes throughout the entire musical range; you will then appreciate Wireless in all its glory.

Radiogrand 12/6
Ace 8/6
Ratios 3-1 & 5-1.
Ratios 3-1 & 5-1.

TELSEN ELECTRIC CO. LTD.
Miller Street, Birmingham.
THE NEW
CELESTION
LOUD SPEAKER
MODEL Z.20

PERCY HARRIS, a foremost
radio expert, writes in the
"Wireless Constructor"—"Z20,
renowned for brilliancy and
quality . . . . speech and music
particularly good . . . . a
handsome instrument."
Gloriously realistic in tone . . . .
holding undisputed rank as
the finest of all loud speakers.
Model Z.20 is designed specifically to
give the finest possible results with any
set from a Two-Valve to a Power Am-
plifier. Crowned with the Celestion
hall-mark—a beautifully designed and
hand-polished cabinet.
In Oak . . . . . . £7.15.0.
Mahogany . . . . . . £8.5.0.
Walnut (to order). . £9.0.0.
Other Celestion models from £3.15.0.

CELESTION
The Very Soul of Music

WRITE FOR AN ABSORBING FREE
BOOK ON "SOUND RE-CREATION"

London Showrooms:
106, Victoria Street, S.W.1

Write to: Celestion Ltd.,
Dept. C
Kingston-on-Thames

THE BENJAMIN ELECTRIC LTD.
BRANTWOOD WORKS, LONDON, N.17

Certainly-experiment
with your set

BUT NOT WITH
the COMPONENTS

Always use the best—

BENJAMIN

VALVEHOLDERS.
Clearer Tone . . . . . . 2/-
Vivodler . . . . . . 1/6
5-Pin Holder . . . . . . 1/6
Pentode . . . . . . 2/3

SWITCHES.
Push-Pull . . . . . . 1/3
Rotary . . . . . . 1/6

TURNTABLE.
Ball-bearing and equipped with
hinged and folding legs . . . 7/6

Send P.C. for fully illustrated leaflet
No. 2003.

THE BENJAMIN ELECTRIC LTD.
BRANTWOOD WORKS, LONDON, N.17

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.
Eliminating troublesome complications, the Lewcos 3 Valve Kit, designed for use with either D.C. or A.C. valves, enables a safe and satisfactory all-mains receiver to be built in fifteen minutes. Highly satisfactory results of quality and strength, combined with selectivity and sensitivity, are provided by this receiver.

SEND TO-DAY FOR BOOKLET R.58.

This free booklet fully describes the construction, assembly, working and performance of one of the most efficient circuits ever conceived.
Use a NON-SPILLABLE battery in your home—

It is so fatally easy for a few drops of acid to spill when changing over ordinary low tension accumulators. You may already have experienced the vexation of discovering damage to carpet or furniture on which acid has dropped.

The C.A.V. Non-spillable accumulator contains acid—but in a jellied form. You cannot spill it, and it does not flow, so you can use it in any position. Because of its advantages over the free-acid type of non-spillable accumulator, its compactness, its safeness, it is the ideal battery for portable receivers. It is also the battery to relieve you of all anxiety. Why not use one with your home receiver?

Our latest Radio Battery catalogue No. T3 will gladly be forwarded upon application.

We have recently introduced an entirely new range of rechargeable high tension accumulators—built like car batteries. May we send you details?

NEW
ELECTRAD
SUPER-TONATROLS

Those new Electrad variable non inductive high resistances will safely carry complete 2 watts at any position of the contact, yet they are only of the same size as the manufacture's elements in circuit. The all-metal construction with the all-metal element fitted to an insulating base obviates the necessity of using either a current paper element or fast wire. The action is amazingly smooth, long lived and both mechanically and electrically perfect.

The Super-Tonatrol embodies new ideas of design which guarantee greater safety which more than fulfils all expectations. Available are made in seven resistance ranges, taking care of all possible requirements.

List Price,
No. 1 A, 25,000-ohm potenti- each meter
2 A, 50,000-ohm potenti- metal
3 A, 75,000-ohm rheostat
4 A, 10,000-ohm rheostat
5 A, 15,000-ohm potenti-
V.A.
6 A, 25,000-ohm pick-up volume control
7 A, 50,000-ohm fourth terminal pick-up fader volume control

Write for full particulars to the Sole Makers:
H. CLARKE & Co. (MCR) Ltd.,
ATLAS WORKS,
OLD TRAFFORD, MANCHESTER.

MINIMUM LOSS

Hard and tough, almost unbreakable, "Atlas" Pirtoid Tubing is a unique and far superior material for High Frequency Transformers, Aerial Coils, etc. Drills and taps like hard wood or bone. "Atlas" Pirtoid Tubing can be obtained in any usual diameter, thickness of wall and length.

ROTHERMEL CORPORATION Ltd.
24, MADDOX ST., LONDON, W.1.

'Phone: Mayfair 0578-9.

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.
Go home and listen to the MADRIGAL

Here at last is a musical instrument so near to perfection that reproduction, whether of a full orchestra or individual soloist, is so faithful that it is difficult to realise that the invisible ether alone is the sole medium between the "Madrigal" and the source of transmission. Eminent musicians and scientists agree that the "Madrigal" will be standard radio for many years, and they are safe in their decision.

The moving coil loud speaker within the pedestal has been selected for its perfect fidelity in reproduction of all sounds within the frequency range of Broadcast transmission. The absence of any aerial or earth, or even a frame aerial for the local station and Daventry, makes the instrument non-directional. The rubber-tyred castors enable it to be wheeled into any room at will, and a single connection to any lamp-holder or power point provides all the power. There are no batteries dry or wet.

The consumption of current is ridiculously low: less than a 50-watt lamp for both speaker and set. The cabinet work is a delight to the eye.

It is impossible here to give more than a brief survey of the many points which are of interest to every Radio Listener, but you can learn all about the instrument by asking your dealer for one of the artistic coloured folder of the "Madrigal," in which are included the latest test reports from the Press. That you will ask for a demonstration after reading it, is inevitable.

The MADRIGAL

The Instrument with the Golden Voice

The "Madrigal" Receiver only, in walnut or mahogany, handsomely figured and polished. Price, including all valves and royalties, for A.C. or D.C. Mains: £30:0:0
Pedestal only, with moving coil loud speaker for D.C. £15:15:0
Pedestal only, with moving coil loud speaker and rectifying equipment for A.C. £18:18:0

Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.

Patent No. 317366

12, HYDE STREET, LONDON, W.C.1.
FOR ELIMINATOR CIRCUITS

You cannot afford to use any but the best Condenser in an eliminator circuit.

HELSBY CONDENSERS are made and guaranteed by a firm with 30 years' experience in condenser making, from small telephone and radio condensers to Power Condensers weighing upwards of 2 tons.

Guaranteed working voltages:
- Type M 150 volts D.C.
- Type 2A 350 volts D.C.
- Type 3A 450 volts D.C.
- Type 4A 600 volts D.C.

All Helsby Condensers are vacuum dried and impregnated with a special non-hygrosopic material which renders them moisture proof.

If unobtainable from your dealer, write to us giving his name and address.

BRITISH INSULATED CABLES LTD
PRESCOT - LANCs.
Makers of PRESCOT and HELSBY cables

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.
REPLACE IT WITH A BURTON!

Every Burton component embodies every latest improvement! It is at Burton's Progress Works where these improvements are first discovered, first experimented with and first utilized—others follow. Examine your set! Replace any defective part with a Burton!

BURTON DIFFERENTIAL CONDENSER.
A new addition to the famous range of Burton Condensers. Scientifically designed, with metal brackets, interleaved with Bakelite leaves, this condenser makes shorting an impossibility. It means easier tuning, better selectivity and better detection. The price is only 5/-

BUY BURTON COMPONENTS

BURTON RESISTER CONTROLS.
Supplied in 3, 6, 10, 15, 30 and 60 ohm resistances. Price 2/9

The FERRANTI A.C. Mains Receiver

PRICE, including Valves:
In Oak £25. In Mahogany £26. In Walnut £26
Royalty 1/- extra.

Handsome both in appearance and in the sense that 'handsome is as handsome does'; for the reproduction is very nearly true to life, and manipulation is of the simplest.

Available for Alternating Current only. Voltages: 200/250, 40 cycles or over.

FERRANTI LTD. HOLLINWOOD LANCASHIRE

Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.
IF YOUR SUPPLY MAINS ARE D.C.

You can use an A.C. All Electric Receiver
By Employing The M.L.-D.C. to A.C.

ROTARY TRANSFORMER

Recommended and used by
Philips Radio,
Marconiphone,
Burndret,
Kolster-Brandes,
M.P.A., Etc., Etc.

Can be supplied to run from any Voltage 12-250 V.D.C.

40 WATT Model £13-0-0
85 WATT Model £19-0-0

M-L MAGNETO SYND. Ltd., Radio Dept., COVENTRY.
Telephone: 5001.

DURING RADIO WEEK

Will Day Ltd., as always, are co-operating with British Radio manufacturers, and all wireless receivers, component parts and accessories can be obtained immediately. Deal with a firm that has a real British reputation second to none.

ALL MAINS RECEIVERS

Dubilier - 3-valve £25
39. Marconi 3-valve £21
Lotus - 3-valve £21

ALL TYPES SUPPLIED on easy payments.
Details and catalogue on request.

WILL DAY LTD.
19, LISLE ST., LONDON, W.C.2.

Phone: Regent 0212-22.

Mention of "The Wireless World" when writing to advertisers, will ensure prompt attention.
All who prefer Quality in Cigarettes

Say Player's Please

Pertrix once —

Pertrix always

The Battery without CRACKLE

Once use a "Pertrix" H.T. Battery and no other will content you. Being devoid of the ordinary sal-ammoniac electrolyte, "Pertrix" possesses these unique qualities:

(a) It cannot develop "crackle."
(b) It cannot lose power when out of circuit.
(c) It gives on every test—60% longer life.

PERTRIX
SUPER
H.T. BATTERIES

PERTRIX Ltd., Britannia House, Shaftesbury Avenue, London, W.C.2
Factory—Britannia Works, Redditch, Worcs.

Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.
Go home and listen
Radio Week 12th to 18th January

Easily operated by connecting to any A.C. Mains light socket—no batteries needed—this Lotus All Electric 3-valve S.G.P. Set is highly selective and covers a good range of British and Continental stations. Cash price £2 (Royalties paid, and including valves). The same circuit is used in the Lotus 3-valve S.G.P. Battery Model—Cash price £13.15.0.

For home construction get the Lotus 3-valve S.G.P. Battery Model Kit at £7.12.0. See and hear these sets at any wireless dealer's or write to-day for the Lotus Sets Catalogue and Hire Purchase terms.

Go home and listen
Radio Week 12th to 18th January

Easily operated by connecting to any A.C. Mains light socket—no batteries needed—this Lotus All Electric 3-valve S.G.P. Set is highly selective and covers a good range of British and Continental stations. Cash price £2 (Royalties paid, and including valves). The same circuit is used in the Lotus 3-valve S.G.P. Battery Model—Cash price £13.15.0.

For home construction get the Lotus 3-valve S.G.P. Battery Model Kit at £7.12.0. See and hear these sets at any wireless dealer's or write to-day for the Lotus Sets Catalogue and Hire Purchase terms.

National Radio Week
JANUARY 12th to 18th, 1930.

Get the Experts to Advise You:

The R.G.D. Radiogramophone

For the highest possible quality and tone for both radio and record, with ample volume, incorporating the latest developments in moving coil speaker; operates entirely from electric mains, A.C. any voltage, or D.C. 200 volts or over.

Mahogany
£80

A Pick-Up of Distinction.

The R.G.D. Magnetic Pick-up is designed after years of experiments, and we believe it to be as perfect as possible. No record wear, perfect tracking, a scientific instrument, specially developed for moving coil speaker reproduction. Price £3 in bronze, £3.3.0 in oxidised silver.

Place your order now to ensure delivery and we shall be pleased to supply literature on application.

The Radiogramophone Development Co.,
St. Peter's Place, Broad Street, Birmingham.

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.
DUBILIER FOR DURABILITY

MICA CONDENSERS. Type B775
10 & 15 1.80 & 3.51
Intermediate capacities at proportionate prices.

DUBILIER FIXED CONDENSERS
Dubilier Condenser Co. (1925) Ltd., Ducon Works, Victoria Road, North Acton, London, W. 3

"Go Home and Listen"
Radio Week, Jan. 12-18

KUKOO

The SUPER SPEAKER UNIT

Without fear or favour we claim the "Kukoo" unit to give results equal to Moving Coil. Radio Experts and Music Critics are agreed that for faithful reproduction over all transmitted frequencies it leads the field.

Do Not Believe Our Claims only—READ THIS PROOF!

Sole Patentees & Manufacturers—
THE SHEFFIELD MAGNET CO.
BROAD LANE, SHEFFIELD

Phone—20866.
Grams—Magnet 20866 Sheffield.

AII Advertisements for " The Wireless World " are only accepted from firms we believe to be thoroughly reliable.
Radio Week Programmes (Jan. 12th–18th)

are being particularly appreciated by the fortunate possessors of trouble-free radio equipment, in which

The

Westinghouse Metal Rectifier

is now playing such a prominent part. Once this rectifier is installed it can be forgotten, because it has nothing to wear out, no fragile filaments, chemical action, or moving parts.

The majority of modern A.C. mains receivers, eliminators, and battery chargers incorporate this rectifier. See that your new equipment includes it.

For those who prefer to make up their own sets, our book "The All-Metal Way, 1930" will be invaluable. It contains 32 pages of circuits and instructions covering all types of A.C. Mains Units. Send a 2d. stamp with your name and address.

The Westinghouse Brake & Saxby Signal Co. Ltd., 82, York Road, King's Cross, London, N.1.
13 ELECTRICAL INSTRUMENTS IN 1

The "AVOMETER"

MEASURES
AMPS, VOLTS and OHMS
without calculation of any kind.

NO EXTERNAL SHUNTS OR MULTIPLIERS.

The 13 ranges of the "AVOMETER" are as follows:

- 0-12 Milliamps
- 0-120 Milliamps
- 0-12 Amperes
- 0-120 Milliamps
- 0-12 Amperes
- 0-120 Milliamps
- 0-120 Volts
- 0-12 Volts
- 0-120 Volts
- 0-1000 Ohms
- 0-10,000 Ohms
- 0-100,000 Ohms
- 0-1 Megohm

BRITISH THROUGHOUT.

No printing matter can possibly convey the numerous uses to which this Instrument can be put. One of the largest firms in the world informs us that "THE VALUE OF THE 'AVOMETER' CANNOT POSSIBLY BE APPRECIATED UNTIL IT IS IN ACTUAL USE."

This concern has purchased over 80 "AVOMETERS" and is still ordering.

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT Co., Ltd.,
WINNER HOUSE, ROCHESTER ROW,
LONDON, S.W.1.
Phone: VICTORIA 4359.

Price £8.8.0
DEFERRED PAYMENTS ARRANGED.

Radio's Supreme Power

ARE YOU PROUD OF YOUR NEW SET?
DO IT JUSTICE AND FIT THE BEST POSSIBLE BATTERY

Grosvenor Batteries give continuous and satisfactory service because they incorporate a new vitalising element which is unique to Grosvenor.

66 v. from 7/6 Super Capacity [66 v. 20/-
99 v. 11/6 for Multi-Valve
Sets - - - - 99 v. 32/6

GROSVENOR BATTERY CO., LTD., 2-3, White St., MOORGATE, LONDON, E.C.2. Phone Met. 6865

Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.
Locked top and bottom—braced to a girder-like rigidity—the elements of the NEW Cossor Screened Grid Valve are definitely immovable. This Cossor system of Interlocked Construction ensures a remarkable degree of strength—far greater than ever before attained in any valve. As a result the NEW Cossor Screened Grid Valve has an exceptionally long life—it is shock-proof, noise-proof and break-proof. Use the NEW Cossor Screened Grid in your Receiver—it is Britain’s strongest and most dependable Screened Grid Valve.

2-volt type now available.
The NEW Cossor 220 S.G. (2 volts 2 amp.)
Anode volts 120-125. Impedance 500,000.
Amplification Factor 200. Price 22/6

Cossor 4 and 6 volt Screened Grid Valves are also available with similar characteristics at the same price.


Mention of “The Wireless World,” when writing to advertisers, will ensure prompt attention.
A WIRELESS LICENCE SCANDAL.

WIRELESS receiving licence costs but 10s. a year, and this is not a large sum when we consider the hours of programmes to which it entitles us. The Wireless World has always supported the authorities in their insistence that the licence should be regularly paid, and we have approved of the attitude of the Post Office in bringing to book those who deliberately neglect to pay the annual fee. We have gone to considerable trouble to explain to readers who have written to us, and we have approved of the attitude of the Post Office in bringing to book those who deliberately neglect to pay the annual fee. We have gone to considerable trouble to explain to readers who have written to us, and we have approved of the attitude of the Post Office in bringing to book those who deliberately neglect to pay the annual fee.

Our Statement Officially Approved.

The Post Office has officially approved of the wording of the paragraph in which we have expressed the position as follows: "A single receiving licence will cover the installation of more than one set, provided that the sets are all in the same house, flat, etc., that is to say, tenants of separate flats or sub-let premises in the same building are not entitled to share the benefits of one licence, nor may extensions be made from a licensed set whereby the occupiers of other houses, flats, etc., may listen without taking out separate licences."

In view of this statement of the position officially approved by the Post Office, we were astonished to read in the daily Press recently that the Post Office had agreed that a single 10s. licence was sufficient to cover a wireless receiving installation which supplied 200 separate luxury flats apparently for the reason that they happened to be all within one building.

An Irregular Decision.

We cannot believe that this is a proper interpretation of the licensing position, and we draw special attention to this case because we feel that it should at once be looked into by the Post Office, and, even if fresh regulations are necessary to meet the situation, they should be made in order that individual tenants of the flats may be called upon to pay separate licences for broadcast listening.

We believe that legally the Post Office would find it difficult to enforce the payment of a licence fee on apparatus capable of receiving wireless broadcasting but which, in fact, was not being used by the owner for that purpose. This seems to point to the monopoly of the Post Office covering the use of apparatus for the purpose of listening rather than the ownership of the apparatus, so that we contend that in a building where one receiving set is installed it is even more important that the licence should be paid by those residents in the building who have separate loud speakers or telephones which they use for the purpose of listening than that the receiving installation itself should be licensed. Furthermore, it might be argued that under the Telegraphy Act, 1869 (Sections 4 and 5), the Post Office is entitled to a rental in respect of the extension lines to the individual flats.

If the Post Office attempts to justify their action in accepting one annual payment of 10s. for a licence for the installation in question which supplies 200 luxury flats, then we regard the position as little short of a scandal. The cottager and even the family living in one room is, under the present regulations, required to pay the 10s. licence, however difficult it may have been to raise the necessary money for the wireless set and to pay the annual licence, and this being so, why should residents in luxury flats enjoy the advantages of broadcast reception with first-class quality from an ideal and expensive receiving set without being called upon to contribute in any way towards the cost of programmes, whilst the poorer members of the community enjoy no such privilege?
WHILE it is now nearly three years ago since this journal first introduced moving-coil loud speaker designs little attention has been drawn to the possibility of dispensing with the field-energising current by the adoption of permanent magnets. In consequence the moving-coil loud speaker is restricted in its use to where electric supply mains are available, as the current demanded by the electro-magnetic field cannot be maintained by a portable accumulator. Attempts to use permanent magnets have proved unsatisfactory inasmuch as the flux density produced has invariably been inadequate. There is little point in using a weak field and hoping to make up for the loss of signal strength by the use of a generous winding on the moving coil, fed with the output from several parallel-connected power valves. In so doing the behaviour of the loud speaker may become less linear over the frequency range due to an increase in the mass, inductance and capacity of the winding, the current consumed by the output stage can only be provided by the use of supply mains, while the smallness of the gap and the largeness of the coil impose a limit beyond which one cannot go.

A minimum flux density of 10,000 lines to the square centimetre has been assessed in respect of the electro-magnetic type of field, and to produce this value in a gap of sufficient width and area requires a field winding dissipating up to some 30 watts. In this case the gap has a width of 2 mm. and an area of about 20 sq. cms. To halve the width of the gap about one quarter of the field wattage is needed to produce the required field strength. Similarly with permanent magnets, to halve the area of the gap will nearly double the amount of available magnetic flux, while to halve its width will, in a well-designed magnet, increase the flux nearly four times. A compound permanent magnet that is intended to produce a high flux density across a small gap is by no means easy to design. Special forms of cobalt steel must be utilised to create the necessary high flux within a magnetic circuit of reasonable size and cross-section. Precautions must be taken to ensure that the flux can be carried by the iron where the cross-section narrows towards the gap, while the magnetic leakage is governed by the shape, and saturation is kept to a minimum so that the field is concentrated within the space to be occupied by the moving coil. Many instances have come to the writer's notice of attempts to construct a compound permanent magnet in which it was hoped that the total flux when added would produce the required density at the gap. Measurement has shown, however, that the flux density is much lower than was anticipated, while the performance of the finished loud speaker was inferior in quality to an electro-magnetic type working from a given output stage.

It was not until the Exhibition of last September that attention could hopefully be turned to the possibilities of a reasonably compact permanent magnet. Many readers must have examined with interest the moving-coil loud speaker magnets, then just produced, and shown at the stand of Swift Levick.1 These magnets

Permanent Magnet Moving Coil Loud Speaker.

were of only moderate size, of unique shape as regards casting and machining, and were stated to possess flux densities of the order of 5,000 lines to the square centimetre. Subsequent development by way of a small increase in size and cross-section, minor modifications in shape and the insetting of mild-steel poles to convey the concentrated flux to the gap, has now resulted in the production of magnets of an assured flux density of 8,000 lines to the square centimetre when the gap width is 1.5 mm. and the area 7 sq. cms. This area permits of a pole diameter of 1½ in. with a gap length of ¾ in. We now have a permanent magnet which promises to satisfactorily replace the electro-magnet. As width of gap has so great an effect on flux density the dimensions decided upon must be no larger than is required to just accommodate the coil. On the other hand the reduction of diameter reduces the area of the gap, with consequent increase of flux, but the number of turns on the moving coil must be increased in proportion to the reduction of their diameter.

Coils for Small Gaps.

Our problem is now that of filling the gap to the utmost with the moving-coil winding, for if there is any space to spare this should obviously be taken up by decreasing the width or area of the gap. There is no question that the best method is that of building the moving coil as a single layer of edge-wound strip, as has long been done by the Gramophone and Western Electric Companies. Somewhat special tools are required to effect this, but the resulting coil is exceedingly stiff, requires little support, and can be relied upon to maintain its shape. For lightness the strip used may be aluminium, carrying a single covering of silk or enamel, wound so that it stands edgewise on its former. Another winding that suggests itself is three layers of No. 36 enameled wire, operated like the strip-wound coil, through an output transformer. For the home constructor there is another possibility in that with reasonable care he can wind a high-resistance coil, thus obviating the dangers of distortion incurred by the output transformer. A high-resistance coil designed to handle a given value of signal watts occupies a slightly greater volume than the corresponding low-resistance winding actuated.

Components used in the construction of the model having the 2 mm. gap. The surround material is secured without stretching to the cardboard rings and the spare material is cut away after the diaphragm has been attached.
Permanent Magnet Moving Coil Loud Speaker.—

through a transformer owing to the increased ratio of insulation and space to conductor. Nevertheless, there is just sufficient room for a high-resistance winding possessing the maximum number of turns for the undistorted power output specified for a valve that will give ample volume for home conditions.

Test reveals that a 1,300-turn coil of No. 48 enamelled wire gives practically faultless results when fed from a P.625 valve. It is owing to the fact that No. 48 enamelled wire is the finest that can be conveniently handled that it has been adopted, though its signal-carrying capacity is considerably in excess of that produced in the anode circuit of the P.625 valve. Incidentally, the output from a valve such as the L.S.6A can be carried by the winding. It might be noted here that the vast improvements that have taken place in the past year in the power output of L.F. valves makes it possible to produce adequate signal strength with less distortion, coupled with a more compact moving-coil winding.

A thin paper ("detail paper," thickness 0.004in.) former is constructed to carry the winding. It is made exact to size by wrapping round a smooth brass cylinder. Dimensions for cutting out the paper, which should be of a thin, smooth, non-shiny variety, are given in the diagrams. Two layers are wrapped round the brass cylinder, a thin coating of seccotine completely covering the faces which adhere together. Secotine must be kept away from the interior and outside surfaces to obviate the sticking of the former to the cylinder and to permit of a subsequent treatment with shellac varnish before winding on the wire. As the turns are to be put on in a bank-wound fashion across the former, and not layer by layer, the cross-over lead of No. 42 or 44 wire is taken through under the end of the paper before sticking on the end strips which form a support to the winding. A spindle and crank handle such as can easily be made up is used to rotate the cylinder, and care must be taken to see that the former and end pieces run true on the cylinder or otherwise the wire may ride over the edges when winding is...
Permanent Magnet Moving Coil Loud Speaker.—

The reel carrying the No. 48 wire is lightly mounted in line with the former and away from the operator. By the use of fine “blue-back” emery the enamel covering of the wire is removed and is lightly soldered, without need for twisting, to the lead out wire already provided. Allowing the wire to lightly pass through the fingers of the left hand and turning the crank with the other 200 turns are run on into one-sixth of the winding space. With care there is little danger of breakage, and a magnifying lens is useful for examining the condition of the winding. Owing to the careful attention required in handling the wire it is helpful to note down each 100 turns as completed in order to guard against an error in counting. If on completing the winding space there is room for another 100 turns, or if the former is filled with 100 turns short of the required number, there is no need to leave a space or, alternatively, to cramp the turns, but to aim at filling the former with an approximate winding. Test the former frequently to make sure that it can be released from the smooth brass centre-piece. Test the winding, also, for continuity, on completion, with a milliammeter and 1.5-volt cell. The current will be 0.75 mA. It is worth while making a pair of coils while the winder is set up.

Right Angle Cones for 1.5 mm. and 2 mm. Gaps.

Impregnate the winding with good shellac varnish, leaving it on the cylinder to dry and frequently sliding it to ensure freedom, taking care not to burr up the ends of the former or to crush it while forcing it free. When thoroughly dried out in front of a fire cover the winding, end-pieces with a single layer of shellac impregnated absorbent tissue paper.

What is known as "two sheet" (thickness 0.010in.)
Permanent Magnet Moving Coil Loud Speaker.—

The axes of coil and diaphragm will coincide. While still holding the coil with the aid of the brass cylinder the joints are turned back on to the seccotine-coated rim of the diaphragm, and after, perhaps, a quarter of an hour they will be found to hold in position. The blade of a penknife can be used to press them down, following round from point to point until the seccotine has hardened. One loose or split point will give rise to rattle.

A pair of cardboard rings are cut and secured with seccotine, coinciding on the two sides of the surround material. While leather is still regarded as one of the most satisfactory materials for constructing the surround thin rubberised cloth ("Britcam") is used in this instance as it is convenient to work and can be made to lie flat without tensioning. With the card rings securely fixed the diaphragm is attached concentrically, the edge being "ironed" down. When dry, cut a rough hole in the centre of the rubberised cloth and then follow round carefully with the sloping edge of a razor where diaphragm and surround meet, being careful that the grain in the cloth does not cause the edge of the razor to wander from the circle. In planning the diaphragm and its aluminium flange allowance has been made to permit of the insertion of spacing washers so that the coil winding can be brought centrally within the gap.

The provision of centring is, of course, essential in so small a gap. Any form of attachment by paper spider effectively ties down the movement of the coil, and if loosely mounted is of little use. The centring adopted consists of a brass ring and baize pad so that the coil actually rides on the edge of the baize which fits into the centre of the coil former. This form of centring does not produce an increasing restriction on the movement with increase of amplitude. At the same time it allows the coil to take up a position in the gap as determined by the surround apart from the centring device. Leading-out wires are seccotined down to the sides of the diaphragm under strips of tissue paper some 1/16 in. in length and then taken on to terminals carried in insulating bushes on the aluminium frame.

To ensure good results attention must be given to the circuit of the receiver, and experience shows that a single H.F. stage with either neutralised triode or screen-grid valve, transformer-coupled to an anode-bend detector and followed by a resistance-coupled L.F. stage, is about the best when using a good outside aerial. This circuit, with suitable values, is given. Such a set is a local-station receiver, and it will quickly be realised that good-quality reception cannot be obtained from distant stations if only for the reason that a sensitive set introduces background noises. Owing to the impedance of the loud speaker being somewhat low in value, the use of a pair of parallel-connected output
Permanent Magnet Moving Coil Loud Speaker.—Valves gives an appreciable increase in volume. Two P.625 valves produce a sensitive output stage in view of the comparatively high amplification factor and the relatively low impedance. If the grids are fully loaded the power output of the pair of valves is nearly two watts when combined with the moving coil described, while with a single valve this output is more than halved.

To those accustomed to the use of a moving-coil loud speaker where the field excitation is derived from a rectifier this loud speaker is to be specially commended. Although the background ripple coming from a rectifier used to energise a field magnet may be practically inaudible, its removal makes a vast difference to the quality of reception, particularly as quite large 50-cycle amplitudes may be built up without an appreciable sound resulting. Moving-coil loud speakers are, moreover, particularly responsive to these low frequencies, whereas a reed-driven cone invariably gives no response below 100 cycles. Tinged over the frequency range with audio-oscillator and calibrated microphone using volt-ampere as a means of measuring the amplitudes transmitted and received, the finished speaker reveals a characteristic as good as any other model, possessing, at the same time, the well-defined brilliance only to be found in speakers of the moving coil type. The base response is as good at 40 cycles as at 200, while a falling off does not occur until a frequency of 6,000 is reached, which is a condition with all types of loud speakers and, incidentally, of the associated amplifier as well.

AN OPTICAL PICK-UP.

The drawing illustrates an ingenious method of converting the movements of a gramophone stylus into a fluctuating electrical current of corresponding value (patent No. 314,126). At the centre of the diaphragm C is a small spot of deposited silver, acting as a reflector to a beam of light projected from a lamp L. The lamp is mounted in the centre of a disc D carrying a series of light-sensitive cells G. The movements of the stylus S as it follows the track of the grammophone record vibrates the diaphragm C, and so varies the intensity of the light reflected back on to the cells G from the "spot" mirror, thus giving rise to corresponding current changes in the circuit of those cells. The component parts shown are all mounted on the tone arm.

INDIRECTLY HEATED VALVES.

The sensitised cathode of a valve is energised by heat generated when the current from A.C. mains is applied to a condenser of which the cathode forms one plate (Patent No. 307,325). A highly refractory dielectric is used, such as zirconia, thoria, or silica. The sensitised cathode is in the form of a tube containing the dielectric, which contacts in turn with two semi-cylindrical metal plates to which the alternating mains voltage is applied. The arrangement in effect forms two condensers arranged in series, the external cathode being the common or central plate, so that it remains at a constant potential.

In another arrangement (Patent No. 307,326) the sensitised cathode is heated by ionic bombardment set up across the gap between its inner surface and a central auxiliary electrode, the A.C. mains being directly connected across the two. The tubular cathode forms an electrostatic screen for the other electrodes.

SAFEGUARDING POWER OSCILLATORS.

During normal operation the passage of grid current automatically maintains the grid of a transmitting valve at a safe negative bias. Should the valve cease to function, the negative grid charge tends to disappear, and if no precautions were taken this would in most cases cause the transmitter to burn out. In order to prevent such a contingency, the arrangement shown in the figure has recently been protected (Patent No. 308,085).

The ordinary grid condenser C and grid leak G L are supplemented by a choke L, and by one or more discharge tubes D D, D, designed to flash over at a voltage corresponding to the minimum "safe" grid potential of the oscillator valve O. So long as the transmitter is in operation the correct working grid bias is maintained, any excess voltage escaping via the tubes D-D. Should the valve cease working, so that the grid current stops, a rectifier valve R comes into action and provides sufficient negative grid bias to prevent any damage to the power valve.

A CONSTANT-COUPLING CIRCUIT.

It is well known that in the ordinary type of back-coupled receiver the coupling factor tends automatically to increase for the shorter wavelengths, and to fall off for the longer waves, even if the spacing between the two coupling coils is maintained constant. A simple method of ensuring a constant degree of reaction in this type of receiver, even over a wide variation in tuning, is illustrated in the accompanying diagram (Patent No. 283,121).

The plate or reaction coil L, is shunted by a resistance R in series with a condenser C,. When the input circuit L C is tuned to a short-wave station, the shunt circuit R C tends to bypass a larger proportion of the plate current than when the set is tuned to a long-wave station. The effective current flowing through the reaction coil L, is accordingly regulated so as to offset automatically any fluctuation in the degree of reaction as the tuning of the input circuit is altered.
Hints on the Operation of Ganged Filter Circuits.

By W. T. COCKING.

(Concluded from page 35 of previous issue.)

In Fig. 6 are given full details of the medium-wave coils which have been used in experiments with the band-pass filter. While it is not claimed that they are the best which can be made, in practice they give extremely good results, and they have the merits of being both compact—an important point—and inexpensive. The inductance of each coil is 240 microhens, and the calculated H.F. resistance at 500 metres is 5 ohms; the tuning condenser should have a capacity of 0.00035 mfd.

The Use of Trimming Condensers.

Each coil consists of 76 turns of No. 26 enamelled wire on a 2 in. diameter ebonite former. The formers are placed side by side in the position indicated, and as close as possible without the wire of one coil touching the former of the other; and in a position such that the distance between the end turn of one coil and the end turn of the other is exactly one inch. The value of coupling given by this arrangement has been found to be very satisfactory under all conditions; in some cases, however, a different value may give better results, and the effect of varying the coupling should certainly be tried. The two ends of the coils which come together in this method of mounting should, of course, be the low-potential (earthed) ends in order to reduce the possibility of capacity coupling.

In order to obtain the best results from the filter circuit it is essential that the two condensers in each filter be ganged; and, if this is done, there is no difficulty in ganging all the tuning condensers and making a single-control set. Ganging filter circuits is quite a different proposition from ganging the condensers of the usual cascade tuning circuits; the difficulties encountered are the same, but they are present in a very much smaller degree. Slight imperfections in the ganging do not make very much difference to the signal strength; instead, they make the tuning curve asymmetrical.

The greatest difficulty with ordinary tuning circuits lies in the aerial circuit, owing to the extra capacity thrown on to it by the aerial. Since the inductances of all the coils can very easily be made almost identical, the chief point in ganging the condensers of any set is to make the stray capacities across each tuned circuit the same. In the ordinary tuning arrangement this is difficult; each circuit usually has a very different minimum capacity. With filter circuits, on the other hand, the capacities are more evenly divided; indeed, sometimes the circuits are so nearly alike that almost perfect ganging can be achieved without the least trouble.

In certain cases, when volume control is carried out by means of a high-resistance potentiometer shunted across the secondary coil of the aerial filter, it is found that this circuit has the highest minimum capacity of any. Therefore, the capacity across every other coil must be increased; and this is best done by connecting in parallel with each tuning condenser a small adjustable condenser with a maximum capacity of about 50 mmfd. In any circuit this method of matching the minimum capacities may be adopted with good results. While it is easiest to connect an adjustable condenser in parallel with each tuning condenser, it is wasteful, for in every case there is at least one circuit in which an extra condenser is unnecessary. By adopting the following procedure it is quite a simple matter to find out which circuits have low minimum capacities, and these are the only ones which need additional condensers: Tune in a station on about 500 metres by adjusting each section of the gang condenser separately. Tighten the couplings between them, and tune in a station on as short a wavelength as possible. Loosen the couplings, and, having noted the positions of the rotors, tune in the station to its best on each condenser separately. That circuit which requires the vanes of its tuning condenser to be enmeshed the least has the highest minimum capacity. Therefore, unless capacity can be
High Selectivity.

removed from this circuit, all the other circuits must have a small condenser connected across them.

The operation of adjusting the capacities of these equalising condensers is quite simple. Set them all at minimum, and tune-in a station on the higher wavelengths (500 metres or so) by altering the positions of the rotors of the ganged condensers. Tighten up the couplings, and tune-in another station at the other end of the scale. This time do not loosen the coupling, but tune it in to its best by the small adjustable condensers. Now return to the longer wavelengths, and aerial lead a series condenser for adjusting the minimum capacity of this circuit, and to include a different condenser for each waveband.

**Tuning Appears Flat with Band Pass Filter.**

All these equalising condensers are shown in the circuit of Fig. 7, and also the recommended method of switching for waveband changing. Reaction is shown, but can, of course, be omitted if desired. The reaction winding should consist of a few turns of thin wire, wound at the earthed end of the secondary coil of the anode filter. Care should be taken to ensure that

![Diagram of circuit showing ganged filters, equalising condensers and a suggested method of waveband switching.](image)

Fig. 7.—Circuit showing ganged filters, equalising condensers and a suggested method of waveband switching. C, ganged tuning condensers 0.00015 mfd.; C1, equalising condensers of 50 mfd. and C2, series aerial condensers.

again tune-in a station by altering the positions of the rotors. Tighten up the couplings and go back to the short wavelengths; tune-in a station on the adjustable condensers. Repeat this until no adjustments are necessary at any part of the scale. Usually it need only be done two or three times, but the oftener it is carried out the more perfect will the ganging be.

**The Series Aerial Condenser.**

The operation of ganging, if carried out on these lines, is by no means difficult, and, fortunately, once the condensers are properly ganged on the medium waveband, the ganging still holds good when the long wave coils are switched in. This is provided that the long-wave coils all have the same inductance and self-capacity, which is usually the case. The only circuit likely to give trouble in this respect is the primary coil of the aerial filter. There will be no trouble if the aerial winding is suitable, but, unfortunately, this is different for every aerial; the best remedy is to include in the it has a very low capacity to the tuned winding, otherwise either howling will result on the long waveband or the ganging of the last tuning condenser will be affected. This is not peculiar to the filter circuit, for it will occur with any circuit in which the reaction winding has a large capacity to the tuned grid circuit. On first operating a set employing band-pass filters the results may at first seem a little peculiar. As the single tuning control of a properly designed set is rotated a station will suddenly be heard, it will remain at constant strength over a condenser movement of several degrees, and then, as the control is further rotated, it will suddenly disappear. At first the tuning seems very flat, for when listening to a station quite a large movement of the dial produces little or no change in strength; but on each side of this band the station is suddenly cut out. The effect is due, of course, to the relatively flat-topped tuning curve obtained with these circuits. When trying out a new set it may be said that, after all the condensers are properly ganged, if a station can be tuned-in sharply
High Selectivity.

at one distinct setting of the dial, the coupling between the coils is too loose. On the other hand, if a station can be tuned-in sharply at two distinct settings of the dial the coupling is too tight. The coupling is correct when every station is audible over a small range of dial settings, but cuts off sharply outside that range. If it is noticed that the selectivity is less on one side of a station than it is on the other, it is a sign that the ganging is imperfect; the remedy is obvious.

The most satisfactory layout for a set using filters is undoubtedly one which is more or less symmetrical. The aerial circuit filter can be enclosed in a metal box, and the anode circuit filter in another box of the same dimensions. The layout of components in each box should be the same, in order to keep the stray capacities as far as possible alike in each circuit. The H.F. valve can very well be placed between the screening boxes. With a layout of this kind there is very little danger of instability, due to the anode circuit coils coupling with those of the grid circuit, but it is, of course, necessary to insert the usual decoupling devices in the battery leads.

Remarkable Selectivity and Good Quality.

The writer has found that a set built to the diagram of Fig. 7, with a layout on the lines indicated, gives very good results when followed by a two-stage L.F. amplifier (one R.C., one transformer). The coils used in the experiments were made to the specification given earlier in this article, and all four tuning condensers were ganged. As an indication of the selectivity obtainable, it may be said that with a P.M.12 valve for the H.F. and a slight amount of reaction to counteract the detector damping, Toulouse can be received at full loud speaker strength without any jamming from Brookmans Park, although it is only about nine miles away. This could not be done with the same H.F. valve and two tuned circuits, at the same distance from the old London station. The separation of 2L0 from Toulouse is only 55 km., so this indicates a very high order of selectivity, and the valve used has both a low A.C. resistance and a lower amplification factor than the A.C./S.G., for which the calculations were carried out.

On the long waveband it is not possible to receive Koenigsruherhausen without jamming from both sXX and Radio-Paris. This is hardly surprising, since the separation is only 99 km., Radio-Paris, however, is quite clear of Daventry. The most noticeable improvement on the long waveband is the exceptionally good quality.

On both wavebands the amplification is noticeably less than with the same valve used with only two tuned circuits; this is inevitable, and represents the price which has to be paid for the high selectivity and good quality.

The loss in amplification, however, is not serious, since by the use of the indirectly heated cathode screen-grid valve the amplification can be made the same as, or nearly equal to, that with a battery type valve with two tuned circuits. It may be said, therefore, that the filter circuit offers real advantages, not only for the improvement in quality but also in providing the high selectivity necessary under modern broadcasting conditions. In addition, a not inconsiderable advantage which it offers is the greater ease with which a really single-control receiver can be made.

International Amateur Telephony.

The Federal Radio Commission of U.S.A. has recently granted permission for the use of amateur telephony on 14,100 to 14,300 kc. (21.28 to 20.98 metres) by those holding extra first-class operators' licences or otherwise able to show special technical qualifications. The privilege, however, is in every case subject to the endorsement of the licence by the A.R.R.L., as the waveband is so restricted that the Supervisors of the League wish to limit the right to amateurs of demonstrated technical ability.

The Editor of our esteemed contemporary, QST, fears that the language barrier will prove a difficulty in transatlantic conversations, but he is, unduly pessimistic when he writes: "Even when we talk to our cousins in the far-flung lands of the British Empire we cannot be too sure that our harsh American accent will convey much intelligence to the carefully attuned British lympman. We may need a new international abbreviation to mean 'I hear you perfectly, but I haven't the slightest idea what you are talking about!'. We suspect that Mr. Warner is trying to 'pull our legs' but hasten to assure him that, provided his followers do not indulge in too high flights of ultra-Americanism, we do not anticipate any great difficulty in understanding them.

INTERNATIONAL AMATEUR UNION.

It may be of use to our readers if we give a list of the various branches of the International Amateur Radio Union. The affiliated societies are:-

Chile.-Chilean Radio Society.
France.-Radio Union Internationale de Langue Francaise.
German.-Deutsche Amateur Radio Gesellschaft.
Great Britain.-Incorporated Radio Society of Great Britain.
Ireland.-British and Irish Relay League.
Italy.-Associazione Radiotelegrafia Italiana.
Netherlands.-Nederlandse Vereniging voor Internationaal Radioamateurisme.
Norway.-Norwegian Radio Relay League.
Spain.-Radio Union Espanola.
Sweden.-Svenska Amateurtelselaget.
U.S.S.R.-All-Union Radio Federation.

New Zealand.-New Zealand Amateur Radio Union.
South Africa.-South African Wireless Club.

American Time Signals.

A slight alteration in the code of signals from stations in U.S.A. will be made as soon as the transmitting clocks have been altered. The new code will consist, as before, of the transmission of a dot for each second of the five minutes preceding the actual time signal, omitting the last four dots (at the 56th, 57th, 58th, and 59th second) of the 55th to 58th minute, and the nine dots immediately before the dash which indicates the hour; the 29th dot in each minute is also omitted. The new feature will consist of the omission of the dot at the 51st second of the first minute of the signal, at the 52nd second of the second, the 53rd second of the third, and the 54th second of the fourth minute. The dots following these gaps indicate the number of minutes to go before the final dash.
CURRENT TOPICS

Events of the Week in Brief Review.

1 IN 2!
Cambridge is believed to be the most "wireless" town in Britain, according to the local Post Office authorities. The number of wireless licences exceeds 15,000, representing one licence for about two-and-a-half inhabited houses.

SHORT-WAVE BED-TIME STORIES.
Even the tiniest listeners are discovering the value of short waves, to judge from an innovation at the Radio Experimental Station, Paris. This station now transmits a Children's Hour on 31.65 metres. It is intended specially for the benefit of children in the Colonies.

WIRELESS FOR WAR VETERANS.
The Daily News, which was instrumental in securing wireless for the principal London hospitals, completed another happy enterprise on Wednesday last, when Viscount Cowdray presented a wireless installation to the Chelsea Pensioners' Hospital, the cost having been borne by readers of the newspaper. The installation, on which nearly £700 has been spent, includes 576 points for headphones.

HAVE YOU TRIED IT?
"Sonorous perspective effects" are claimed by M. P. Hemardinquer, a French wireless amateur, in experiments he has conducted with two pick-ups and two identical gramophone records played simultaneously. By slightly retarding one record and carefully adjusting its volume, M. Hemardinquer states that a genuine stereoscopic effect is obtained, especially when two loud speakers are employed.

SHORT WAVES AND A SOLAR ECLIPSE.
General Ferrie, the chief of the French military wireless service, has just completed a radio expedition to Indo-China in May last during the total eclipse of the sun.

During the period of totality there was a considerable diminution of signal strength on the short waves and 30 seconds elapsed between the direct signal and the receipt of the charge "echo." The General made no attempt to explain the delay, writes our Paris correspondent.

LONG WAVES FROM ICELAND.
"Utviprassad!" will be the password of Iceland's first broadcasting station, to be opened at Reykjavik in the early summer. The aerial power will be 16 k.w. and the wavelength 1,200 metres.

A USE FOR "JUNK."
Most amateurs find it necessary to start a junk box within a few weeks of beginning their wireless career. Many of the components which make up these museums contribute to this most practical effort are cordially invited to send their surplus apparatus, be it ever so old, to the Hon. Secretary, Manchester Station Wireless for the Blind Fund, Town Hall, Manchester, or to the Stretford and District Radio Society, 6, Derbyshire Lane, Stretford, Manchester.

I.E.E. ANNUAL DINNER.
The annual dinner of the Institution of Electrical Engineers will be held at the Hotel Cecil, Strand, W.C.2, on Thursday, February 6th, 1930, under the Presidency of Col. Sir Thomas P. Purves, O.B.E.

INDEX AND BINDING CASES.
The index for Volume XXV of The Wireless World is now ready, and copies are obtainable, price 3d. (post free 4d.), from the publishers, Dorset House, Tudor Street, London, E.C.4. Binding cases for the volume can also be supplied, together with the index, price 2s. 1d., post free.

RADIO TRAIN CONTROL.
The London and North-Eastern Railway has recently conducted experiments in the use of wireless for handling goods trains in shunting yards, the object being to provide a means of communication between the engine-driver and the operator in charge of the control tower from which shunting operations are directed.

The results, which are not yet published, are being considered by the Ministry of Transport, and are expected to be dealt with in an official report on various methods of automatic train control.

WAR IN THE ETHER.
In defiance of the cheerful theory that broadcasting makes for international amity comes a disturbing report from a Stockholm correspondent indicating a radio feud between Sweden and an unnamed "Central European country."

The message tells of the establishment of a special control station in the little town of Eskilstuna, in Central Sweden, with the object of overcoming interference to Swedish listeners from outside sources. "It has been found," says the report, "that a wireless transmitting station in a certain capital of a Central European country has not respected the International Radio Convention, which it had signed, but arbitrarily changed its wavelength, with the result that it conflicted
In last week's issue a tuned circuit was considered where the inductance and capacity portions were connected truly in parallel so that the alternating voltage applied between the ends of the circuit was common to each branch. Under these conditions it was found that when the circuit was tuned to resonance with the frequency of the applied voltage and that once the oscillating current flowing round the closed loop had been built up to a steady R.M.S. value or constant amplitude, no current whatever was drawn from the source of supply.

The system was likened to a pendulum or weight-loaded spring in vacuo where all sources of energy loss had been eliminated. Once the mechanical oscillations are started they will continue indefinitely without diminution under conditions like this where there is no loss of energy. Similarly in the imaginary perfect tuned circuit the oscillations of current round the closed loop would theoretically persist with undiminished amplitude even after the closed circuit has been disconnected from the source of E.M.F. This obviously must be so as there is no means of escape for the stored energy. Oscillations of any kind, electrical or mechanical, which continue with undiminished amplitude are called undamped oscillations. If the oscillations are self-maintained, as explained above, they are called free oscillations and their frequency is called the natural frequency of the circuit (or mechanical system). In the case of undamped free oscillations the natural frequency is the same as the resonant frequency of the circuit, being given by \( f = \frac{1}{2\pi \sqrt{LC}} \) cycles per second.

The Effect of Resistance.

Now in practice it is impossible to obtain any vibrating system, whether it be mechanical or electrical, which is absolutely free from energy loss. For instance, in the case of a pendulum, even if it is suspended in a vacuum, there are some small losses in the suspension spring when the pendulum is in motion. The result is that as soon as the driving impulses are withdrawn the oscillations will begin to die away at a rate depending on the magnitude of the energy losses. If the pendulum is suspended in air at ordinary atmospheric pressure instead of in a vacuum the air resistance to the motion of the bob would have a considerable damping effect and the decay of oscillations would be very much more rapid. Where it is required to maintain the oscillations at a constant amplitude in spite of incidental losses, it is necessary to give the pendulum a small impulse once every swing to make good for the energy lost per swing. This is what is done by the driving mechanism of an ordinary clock.

Turning now to the electrical circuit, we find that the same conditions have to be fulfilled. The inductance coil \( L \) is bound to have some resistance and this is always far greater than that possessed by the condenser and connecting leads. For this reason we are justified in assuming that the whole of the resistance in the circuit is concentrated in the inductive branch. The actual circuit under consideration is shown in Fig. 1 (a), where \( L \) is the inductance of the coil in henrys and \( R \) is its resistance in ohms; \( C \) is the capacity of the condenser in farads.

Suppose that an alternating voltage whose R.M.S. value is \( E \) is applied to the ends of the circuit and that the circuit is tuned to resonance. As before, an oscillating current will traverse the closed loop, but heat will now be generated in the coil, due to its resistance. This means that the circuit is absorbing energy from the source of supply, and should this supply be cut off the oscillations would die away in the same manner that a clock pendulum will come to rest when the clock spring runs down. At the present time we are not concerned with the decay of oscillations but with the conditions obtaining when the oscillations are being maintained by the source of E.M.F. We require to know the general behaviour of the circuit when it is tuned to resonance with the frequency of an applied E.M.F. of constant amplitude.
Wireless Theory Simplified.

We have already seen that a coil of inductance $L$ and resistance $R$ is electrically equivalent to a pure inductance $L$ connected in series with a resistance $R$, and therefore the parallel circuit of Fig. 1 (a) is equivalent to the circuit of Fig. 1 (b), where the coil $L$ has no resistance and the resistance $R$ is non-inductive. Each branch then consists of a simple circuit whose principles have already been dealt with in this series. By combining the known laws of each in the proper manner we can determine the resonant frequency of the circuit and find the impedance at any frequency or when tuned to resonance.

Currents in the Branch Circuits.

The current $I_1$ taken by the coil is given by

$$I_1 = \frac{E}{Z} \text{ amperes} \quad (1)$$

where $Z = \sqrt{R^2 + (2\pi fL)^2}$ ohms is the impedance of the coil. This current lags behind the applied voltage $E$ by an angle $\phi$ where $\cos\phi = \frac{R}{Z}$ as explained on page 523 (November 26th issue) and the simple vector diagram showing the phase difference between the current and voltage for the upper branch of the circuit is given in Fig. 2 (a).

The current $I_1$ in the inductive branch can be considered as being the resultant of two component currents, $I_1'$ in phase with the voltage, and $I_1''$, lagging behind the voltage by $90^\circ$. This idea is clearly shown by Fig. 2 (b), from which it is easy to see that

$$I_1' = I_1 \cos\phi \quad \text{and} \quad I_1'' = I_1 \sin\phi,$$

and from the impedance triangle of the inductive coil, shown in Fig. 3, we see that $\cos\phi = \frac{R}{Z}$ and $\sin\phi = \frac{X}{Z}$.

Referring now to the condenser branch, the current in it is given by

$$I_2 = \frac{E}{X} \text{ amperes} \quad (2)$$

where $X = \frac{1}{2\pi fC}$ is the reactance of the condenser. This current $I_2$ leads the voltage $E$ by $90^\circ$ as shown in Fig. 2 (c).

To find the current taken by the combined circuit, i.e., the current drawn from the supply, we must add by the vector method the two currents $I_1$ and $I_2$ in the respective branches. This is done by drawing the two current vectors $O_1I_1$ and $O_1I_1'$ from a common origin $O$ in their correct phase positions as shown in Fig. 2 (d). We see at once that the two currents $I_1$ and $I_2$ are not opposite in phase as they were in the case of the circuit without resistance, and the resultant therefore cannot be found by simple subtraction. The resultant current is given by $O_1I$, the diagonal of the parallelogram formed with $O_1I_1$ and $O_1I_1'$ as adjacent sides. The impedance of the complete circuit is simply equal to the ratio of voltage to current. The formula giving the current at any frequency is rather complicated, but fortunately we can deal with the circuit from a graphical aspect to get a clear conception of its general behaviour.

Minimum Current at Resonance.

As the frequency is raised the current $I_1$ in the coil decreases, whilst the current $I_2$ in the condenser branch increases; but if on the other hand the frequency is kept constant and the capacity of the condenser is varied, only the current $I_1$ will change. This simplifies matters a great deal and accordingly let us suppose that the capacity $C$ is varied over a wide range, everything else being fixed. The current $I_1$ is directly proportional to the capacity and therefore the resultant current $I_1$ will vary both in phase and magnitude as the capacity is changed. Let OA, OB, OC, OD and OF be several values of condenser current represented as vectors in Fig. 4 (a) corresponding to different values of the capacity, $O_1I_1$ being the fixed current in the inductive coil. The broken line vectors 1, 2, 3, 4 and 5 in the diagram show the resultant currents for the respective capacity values. Of these, No. 3 is in phase with the voltage and is obviously the shortest.

It is thus clear that there is one particular value of capacity which will make the total current a minimum, and this minimum current is exactly in phase with the voltage. When this happens the circuit is tuned to complete resonance with the applied frequency, because all components of current at right angles to the voltage balance out and the circuit as a whole behaves as though it were a pure resistance. The vector diagram showing the conditions for complete resonance is given in Fig. 4 (b).

Maximum Impedance at Resonance.

Since the current is smallest at the frequency of resonance it follows that the impedance of the circuit must be a maximum when tuned to resonance. These conditions are exactly the reverse of those obtaining in a series circuit, where the impedance was found to be a minimum at the resonant frequency. And so the parallel circuit has the property of partially rejecting or refusing to pass currents whose frequencies lie within a band near the resonant frequency whilst allowing currents at frequencies outside this band to pass comparatively freely. For this reason the parallel tuned circuit is very often called a "rejector circuit," especially when used in a filter circuit designed to cut out a powerful local station.
with that of Sweden. The country in question has been officially requested to change its wavelength to conform with the convention, but, so far, without result. The Swedish radio authorities, owing to the lack of space in the maze of etherial traffic, are unable to change their own wavelength. They have, however, given the Swedish radio listeners the comforting assurance that as soon as the latest and most powerful of the Swedish sending stations is completed it will be strong enough to get the better of the disturber of the peace, who will then be forced to surrender to the ultimatum of the victor and adopt the wavelength once allotted to it.

A similar situation recently arose between Great Britain and Spain, but the question was amicably settled through the mediation of the British Post Office. It seems a pity that Sweden cannot adopt the same peaceful tactics.

JAPANESE PROGRAMME DILEMMA.

Japan's broadcasting system, which was inaugurated in 1926, has considerably developed during the past three years. To-day (writes a correspondent) it is run by four separate organisations, which together control over ten transmitters. The principal stations are installed at Hiroshima, Osaka, Sapporo, Sendai and Tokyo, with relays at Daikany, Seoul (in Korea), Nagoya, and on the Island of Formosa. Of these, six are transmitters capable of developing an energy of over ten kilowatts. All studios except one are interconnected by pupinised cable with the capital and main transmitter, the exception being that of Hokkaido, which takes its programme by wireless link.

The system is now providing a regular service to nearly 700,000 listeners, and the licence tax fee has recently been reduced to 1 yen monthly.

The broadcasting organisers experience great difficulty in making up programmes capable of entertaining the various classes of listeners, for in Japan, more, perhaps, see perpetually confronted with the problem of pleasing everybody and have therefore to provide two distinct programmes in the course of a transmission.

WARNING TO WIVES.

Discomfort for the "gude wife" when the Scottish Regional broadcasting station opens is predicted by a Northern newspaper, which says that wives may expect a "shocking" result of electrical energy in the other. "They may find it difficult to pick up metal kitchen utensils without getting mysterious electric shocks," explains the writer. However, he concludes with the comforting assurance that these shocks are not sufficiently strong to do any harm and are only received in certain circumstances. He might have added that the necessary circumstances include living under the aerial and fairly near to the transformers.

FIRK.

We are asked to state that there is no truth in recent reports of the factory of Messrs. A.C. Cossor, Ltd. (manufacturers of Cossor valves and wireless apparatus), had been burnt out. The fire in question took place at the workshop of Messrs. A.C. Cossor and Son, scientific instrument makers. There is no connection between the two firms.

BOOKS RECEIVED.


Le T.S.F.M., 1930, by L. Geysyssère. The design and construction of a modern superheterodyne receiver, with explanation of the nature and function of each component. Pp. 72, with 7 illustrations and diagrams. Published by 'La T.S.F. Moderne,' Paris. Price Fes. 10.

Wireless and Gramophone Trader Year Book and Diary, 1930.—The sixth edition of this most useful book of reference includes all the features which have proved so valuable in the past carefully revised, enlarged, and brought up to date. The Directory Section contains a full alphabetical list of Manufacturers, Agents, Associations, and Publications connected with the wireless and gramophone trades in Great Britain; Wireless and Gramophone Factors; a Classified List of the Manufacturers of Wireless and Gramophone Sets and Accessories, and a list of Proprietary Names of various apparatus. The General Information, Trade Information, Technical Data, and Gramophone Sections have also been considerably enlarged. Manufacturers and traders will especially welcome the abstract of the new provisions of the Marconi Licence. Published by the Trade and Professional Publications Co., Ltd., Salisbury Square, E.C.4. Price 5s. 6d. post free, or at a reduced rate to subscribers to the "Trader" journals.
The Construction of an Electrostatic Earpiece.

Despite the fact that many deaf people suffer agonies from being shouted at, practically all the existing electrical devices for the deaf are based on the principle of amplifying the sound to an extent unbearably to the normal ear.

To find a better means of influencing the inner organs of the ear, Dr. Gustav Eichhorn, of Zurich, has experimented for a number of years with a system which now appears in commercial form under the name of the "Radio-phone." From the results obtained with this interesting instrument the inventor concludes that the flesh surrounding the ear is forced, by an electrostatic effect, to set up oscillations, which are not transferred to the skin of the ear drum, but direct to the organs of hearing.

The distinguishing feature of the "Radio-phone" is the inclusion of the listener himself in the plate-circuit of the L.F. valve of the wireless receiver. This is done by connecting the user through the hand holding the device (a) to the positive output terminal of the receiver, while the negative terminal is connected with stranded flex to a thin metallic plate (b) in a special sound-box placed against the ear. The sound-box is provided with a movable cover of cardboard, thin wood or similar non-conducting material, upon which the metallic plate is fastened on the inner side. The individual wires (c) of the flex lead are splayed over the surface of the metal sheet, and upon this connection a second sheet of metal foil is pressed tight.

It is common knowledge that in the telephone-circuit of a wireless receiver we have to deal with the direct current in the plate-circuit and the modulated alternating currents superimposed thereon. Dr. Eichhorn's experiments have shown that the sensitivity of his set, the "Radio-phone" gives signals which are nearly as powerful as those with the usual headphones. If the hand is removed from the metallic surface on the handle no signals can be heard; this is also the case when the polarity is reversed by connecting the sound-box to the positive terminal of the receiver. From this the inventor deduces that the small tin-foil sheet is set in oscillation by the low-frequency currents, the speech and music being amplified to some extent by the sound-box.

In the lower recess in the handle a metal strip making contact with the hand is connected to the positive lead to the receiver. The negative lead is taken through to the metal disc in the sound-box, while across the two leads in the lower recess is a resistance, of about 100,000 ohms (d). This resistance has been found to eliminate fluctuations in sound intensity due to the fact that the polarising potential derived from the valve circuit is not constant. The optimum plate potential depends upon the type of valve used, one working with an anode voltage of between 70 and 100 being recommended.

Curves showing the relation between sound intensity and superimposed D.C. voltage for various A.C. potentials.
Wireless Theory Simplified.

A parallel circuit is used for tuning purposes where it forms part of a circuit which normally has a very high resistance, as, for instance, in the anode circuit of a valve. The details of such a circuit will be discussed later, but it can be mentioned here that the conditions for maximum selectivity are practically the same as those relating to the series tuned circuit, namely, low coil resistance and high ratio of inductance to capacity.

The impedance of the circuit at the resonant frequency is given by the ratio of voltage to current when the circuit is tuned to resonance. Hence dividing the voltage $E$ by this current we get for the dynamic resistance $R_D = \frac{Z^2}{R}$ ohms, where $Z$ is the impedance of the coil.

Now, since in practice the resistance $R$ of the coil is small compared with its reactance $2\pi f L$, the impedance of the coil is very nearly equal to its reactance and we may therefore write $2\pi f L$ in place of $Z$ to give an approximate result. Hence $R_D = \frac{2\pi f L}{R}$ ohms approximately. But at resonance the frequency is very nearly $f = \frac{1}{2\pi \sqrt{LC}}$, and substituting this value of $f$ in the last equation we get dynamic resistance $R_D = \frac{L}{CR}$ ohms. This is an expression of fundamental importance and is not an approximation but an exact formula (see appendix) in spite of our having made two approximations in arriving at the result. It happens that the two slight errors introduced are of opposite sign and balance out.

The conclusion is that the dynamic resistance or maximum impedance is actually inversely proportional to the ohmic resistance of the coil, and proportional to the ratio of inductance to capacity. If the resistance of the coil were zero the dynamic resistance of the circuit would be infinitely great and no current would enter or leave it, as we have already discovered.

Appendix.

I. Resonant Frequency of Parallel Circuit.

From Fig. 4 (b) $I_1 = I_1 \sin \phi$,

$$\omega Z = \frac{E}{R} \tan \phi, \text{ where } \omega = 2\pi f, \tag{1}$$

or:

$$C = \frac{Z^2}{\omega^2} \text{ or } \frac{\omega}{\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}}$$

\[\therefore \text{ Resonant frequency } f = \frac{1}{2\pi \sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}} \]

II. Dynamic Resistance.

$$R_D = \frac{E}{I_1} = \frac{E}{R} \cos \phi = \frac{E}{Z} \times \frac{R}{Z} = \frac{E}{Z_1}$$

But from (1) above $Z^2 = \frac{L}{C}$

$$R_D = \frac{L}{CR} \text{ ohms.}$$

\[\therefore \text{(To be continued.)} \]
LABORATORY TESTS.
A Review of Manufacturers’ Recent Products.

MARCONIPHONE MOVING COIL LOUD SPEAKER UNITS.

These units are now being supplied uncased to provide the home constructor with a model suitable for building into a piece of furniture, or for incorporating in radio-gramophone cabinets.

Two types are available: one with a 10-ohm field winding for use with 6-10 volt accumulators, and the other with a 3,000-ohm field coil intended for mains excitation. The last mentioned would be used on D.C. mains direct, but in conjunction with a rectifier unit for A.C. supplies. Both models are sensibly the same, the only difference being in the method of exciting the field coil. The chassis submitted for test was of the low-voltage type.

Before being given a practical test it was fitted to a large baffle board, 3ft. square, with a hole of suitable size cut in its centre. Measurements showed that when energised from a 6-volt accumulator a current of 0.57 amp. was required. With a 10-volt battery the energising current was a little under 1 amp. Although the sensitivity, when used with a 6-volt accumulator, is noticeably lower than that of a mains excited model of the same make, it is ample for all practical needs, the volume being in excess of that required to fill a room of average size, using a good super-power output valve with a generous high tension supply.

These tests were made with a receiver designed to have a straight line amplifier characteristic. The very low notes in the bass, although not overpowering, were reproduced with full-throated volume. The response of the middle register and the higher frequencies was good, and a slightly better balance of output was obtained by the employment of a baffle of smaller size. As the unit will, in general, be fitted in a cabinet, this is perhaps a minor point. The reproduction of music and speech is crisp and clear. These models are fitted with cone diaphragms 7in. in diameter, which are pressed from stout fibrous material, the centring device being integral with the cone and provided with a stepped ring on which fixes the speech coil. An input transformer is mounted on top of the chassis. A supple surround of soft velvet supports the periphery of the cone.

The makers are the Marconiphone Co., Ltd., 210-212, Tottenham Court Road, London, W.1, and the prices are as follows:—6-10 volt model, £4 10s., and D.C. mains model, £5. A rectifier unit for A.C. mains use costs £4 15s., including valve and royalty.

ELEX INSULATED H.T. CONNECTORS.

The new range of insulated plugs and sockets introduced by Messrs. J. J. Eastick and Sons, 118, Bunhill Row, London, E.C.1, have been designed especially for use in connection with battery eliminators and mains-operated receivers.

Greater care is required in handling the H.T. leads, and consequently the insulation on the plugs and sockets has been very carefully thought out. All metal parts hitherto exposed are fully protected, and the risk of shock due to accidental contact with live leads has been reduced to a minimum. Provision is made also to grip the braided covering on "flex" leads, thereby giving a tidy appearance to the connecting leads.

These "All-Shrouded" plugs and sockets are offered at 6d. per pair.

LOTUS JACKS AND JACK SWITCHES.

The body of these jacks consists of a bakelite moulding on which is mounted genuine nickel silver springs each tipped with a pure silver contact. A faulty connection should be very rare indeed. Hitherto contact with the springs was made by soldering the leads on to tags, but in the latest version the soldering tags have given way to small terminals carried on fantail extension lugs. A single-hole fixing bush is provided.

Five types are available, ranging from a single circuit open jack to a single circuit open double-filament control type. The price is according to type, the cheapest being 2s. and the last mentioned 3s.

These jacks demand a jack plug with a longer stem than is usually fitted so that it is necessary to employ the "Lotus" version. This costs 2s. Loud speaker tags or "flex" can be gripped firmly by the aid of the special cam-lock fitted. The "stem" and the "ball" connections are clearly marked on the bakelite cover.

A range of five jack type push-pull switches from a single-pole make-and-break to a double-pole double-throw is now available, the general design following closely that of the jacks. The same quality material is used throughout. Single-hole fixing is provided and the bush is insulated from all contact springs. These switches cost 2s. 9d. for the single type and 4s. for the D.P.D.P. style. The prices of other types are S.P.D.T. 3s. 5d. and D.P.S.T. 3s. 6d.
A WIRELESS festival, to the fitting accompaniment of open-air and indoor loud speaker reproduction, was held at Southend on Saturday, January 4th, when the Southend and District Radio Society attracted thousands of visitors to their Sixth Annual Radio Exhibition, held at the Boys’ High School, Victoria Circus. The occasion was a triumph for amateurs and professionals alike, and their joint efforts resulted in a contribution of at least £70 to the Victoria Hospital, Wireless Maintenance Fund.

Several magnetic influences were at work. In the first place, many enthusiasts were drawn to the competition stands, on which were displayed some excellent examples of amateur craftsmanship. The casual passer-by was also attracted by the compelling invitation of a battery of loud speakers facing Victoria Circus, these being erected and operated by Messrs. S. H. Davis and Son, of Westcliff. And in the Exhibition Hall itself Mr. F. H. Haynes, Assistant Editor of *The Wireless World*, provided a continuous demonstration of quality reproduction, with loud speaker “points” on each stand. The set employed consisted of the Schools Demonstration Receiver, followed by six independent output stages each fitted with choke condensers and two P 625 valves.

An admirable feature of the competitions was the introduction of a new method of classification enabling entrants every chance to succeed having regard to their opportunities and qualifications. Three classes of competition were instituted—A, B, and C—the first for *bona fide* amateur members of the Society, the second for other members, and the third for *bona fide* amateurs who were non-members. The scheme worked well.

Through the generosity of the trade, prizes were offered for a variety of home-made apparatus, and this formed the basis of the amateur side of the Exhibition. The apparatus submitted included portables, short-wave receivers, one- to three-valve and multi-valve receivers, loud speakers, battery eliminators, wavemeters and wavetraps, receiving set cabinets, and various mechanical and non-mechanical units. Much careful and painstaking work was indicated, and the standard of craftsmanship increased the difficulties of the judges, Mr. F. H. Haynes, Mr. H. B. Dent, and Mr. H. L. Lobb.

The list of prize-winners is as follows:

<table>
<thead>
<tr>
<th>Class</th>
<th>Prize</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Complete Set by High School Boy — 1st Mr. C. Stockell. 2nd Mr. R. Kramer.</td>
</tr>
<tr>
<td>B</td>
<td>Portable Sets — No Entries.</td>
</tr>
<tr>
<td>C</td>
<td>No Entries.</td>
</tr>
<tr>
<td>A</td>
<td>Short Wave Receivers — No Entries.</td>
</tr>
<tr>
<td>B</td>
<td>No Entries.</td>
</tr>
<tr>
<td>C</td>
<td>No Entries.</td>
</tr>
<tr>
<td>A</td>
<td>1 to 3 Valve Receivers — 1st Mr. E. W. Lockhart. 2nd Mr. E. T. Wiseman.</td>
</tr>
<tr>
<td>B</td>
<td>No Award.</td>
</tr>
<tr>
<td>C</td>
<td>No Entries.</td>
</tr>
<tr>
<td>A</td>
<td>4 or more Valve Receivers — 1st Mr. W. J. Fletcher. 2nd Mr. H. R. Ireland.</td>
</tr>
<tr>
<td>B</td>
<td>No Award.</td>
</tr>
<tr>
<td>C</td>
<td>No Entries.</td>
</tr>
<tr>
<td>A</td>
<td>Loud Speakers — Special Mr. H. R. Ireland. Special Mr. W. J. Fletcher.</td>
</tr>
<tr>
<td>B</td>
<td>No Entries.</td>
</tr>
<tr>
<td>C</td>
<td>No Entries.</td>
</tr>
<tr>
<td>A</td>
<td>Battery Eliminators — 1st Mr. P. Green.</td>
</tr>
<tr>
<td>B</td>
<td>No Award.</td>
</tr>
<tr>
<td>C</td>
<td>No Entries.</td>
</tr>
<tr>
<td>A</td>
<td>Wavemeters and Wavetraps — 1st Mr. E. W. Lockhart.</td>
</tr>
<tr>
<td>B</td>
<td>— No Entries.</td>
</tr>
<tr>
<td>C</td>
<td>— No Entries.</td>
</tr>
<tr>
<td>A</td>
<td>Receiving-set Cabinets — 1st Mr. H. R. Ireland. 2nd Mr. A. E. Atwood.</td>
</tr>
<tr>
<td>B</td>
<td>— No Entries.</td>
</tr>
<tr>
<td>C</td>
<td>— No Entries.</td>
</tr>
<tr>
<td>A</td>
<td>Various Mechanical Units — Special Mr. A. R. Knipe.</td>
</tr>
<tr>
<td>B</td>
<td>Special Mr. A. C. Horsnell.</td>
</tr>
<tr>
<td>C</td>
<td>Special Mr. T. Holbeche.</td>
</tr>
<tr>
<td>A</td>
<td>Various Non-mechanical Units — 1st Mr. W. B. Briggs.</td>
</tr>
<tr>
<td>B</td>
<td>2nd Mr. A. R. Knipe.</td>
</tr>
<tr>
<td>C</td>
<td>2nd Mr. A. C. Horsnell.</td>
</tr>
</tbody>
</table>
Southend Wireless Show.

Three sets, not for competition, were exhibited by the chairman, Mr. H. H. Burrows. One of these was an imposing six-valve instrument having two screen-grid H.F. stages, detector, and two stages of L.F., the last consisting of two power valves in parallel. The total value of the components alone was estimated at £25. The set was given in connection with a shilling competition in aid of the Hospital Wireless Fund.

Interest in amateur television was demonstrated by the curiosity aroused in Mr. A. Knipe's experimental television receivers, in which considerable ingenuity was displayed both in the synchronising gear and the method of marking out and constructing the disc. For his collective exhibit of television gear and a carbon microphone with control units, Mr. Knipe was awarded the Pocock Silver Championship Cup, presented by the Editor of The Wireless World for annual award for the entry of most outstanding constructive merit.

The total number of entries in the amateur section was fifty-four, and the value of the prizes distributed was £45.

The trade exhibitors included Messrs. S. H. Davis and Son (organisers of the outdoor loud speaker demonstrator), J. Bridge and Son, T. Davis, F. Jeffery, E. K. Cole, Ltd., and H. C. Revell.

The Exhibition was open for eleven hours—from 11 a.m. to 10 p.m.—and during this time there were no fewer than 4,684 visitors. Is this a record for a wireless society show?

CORRESPONDENCE.

The Editor does not hold himself responsible for the opinions of his correspondents.

B.B.C. TRANSMISSIONS.

Sir,—Much has been written recently about the effect of land lines on the quality of B.B.C. transmissions, and the following figures relative to the London-Bournemouth land line may be of interest.

The attenuation factor per 50 miles of land line is approximately 1 ounce of suet pudding in the mouth of the silvery-voiced announcer. It is regretted that no figures relative to orchestral transmissions can be given as none have been definitely identified as such.

Parkstone, Dorset.

Sir,—Whatever the faults of land-line transmissions may be, surely Mr. Jas. Hudson, of Manchester, does not mean that the output from 2ZY's aerial is a good sample of perfection, even from the fine new studio, or otherwise. A more "tin-canny" output is not to be heard from any station in Europe.

Bolton.

A. GREGSON.

THE PROGRAMME DIFFICULTY.

Sir,—The article concerning a Low-power Synchronised Transmission Scheme, by Major Humphry MacCallum, in your issue of December 25th, provided food for much thought. The outcome is that the views expressed are certainly worthy of more than passing attention. Eight out of ten people with whom I came into contact appeared to be dissatisfied with the general run of programmes, whilst agreeing that the whole business of programme "building" is something of a problem. The eight, including myself, have not been clever enough to formulate a really practicable scheme. The one suggested has great possibilities and appears to be quite practicable from a technical point of view as far as wireless is concerned. I am not so sure, however, as regards the land-line system involved. Judging by last night's (December 29th) transmission over the lines from Manchester, there remains much to be done in this direction. The cut-off in the lower register was very pronounced. This on a receiver which normally gives most faithful reproduction. With this difficulty overcome, the scheme presented would be welcomed by the great majority of, and probably all, listeners, whilst, in addition, one can visualise a boom in the radio industry. Given a scheme on the above lines, and the Robinson Radiocast, we shall be wondering what to do with all our spare ether channels!

A. A. HANKEY.

Sir,—I have read with considerable interest the article under the above heading in your current issue, but I cannot help thinking that the suggested scheme is "too good to be true". If not, how is it that someone has not thought of it before? There must be a snag somewhere, though the writer states his case very convincingly. If there is no "nigger in the wood pile," it would seem that the MacCallum Scheme provides a complete solution of the programme difficulties, and its adoption should bring real prosperity to the radio industry and satisfaction alike to the listener and the B.B.C.

Parkstone, Dorset.

Sir,—I have read with considerable interest the article under the above heading in your current issue, but I cannot help thinking that the suggested scheme is "too good to be true". If not, how is it that someone has not thought of it before? There must be a snag somewhere, though the writer states his case very convincingly. If there is no "nigger in the wood pile," it would seem that the MacCallum Scheme provides a complete solution of the programme difficulties, and its adoption should bring real prosperity to the radio industry and satisfaction alike to the listener and the B.B.C.

Parkstone, Dorset.

W. E. WARRILOW.
SIR,—I venture to put forward the following four propositions as raising the question of some interest and importance to provincial listeners:—

(1) It is not possible in practice for a number of transmitters, even though operating on low power and radiating one programme, to operate within a restricted area on the same wavelength without mutual interference.

(2) There is mutual interference between B.B.C. common wave transmitters.

(3) All B.B.C. transmissions on the common wavelength are therefore of bad quality.

(4) In the matter of oscillation interference, the B.B.C. are themselves the chief offenders.

It will be borne in mind that as many as eleven transmitters in Great Britain, from Dundee in the north to Plymouth in the south, share at present the common wavelength of 288.5 metres. If the oscillation scheme in its present stage be brought to completion, subsidiary stations, for which there will be no independent wavelength available, will be needed at Aberdeen and Newcastle.

There are two essential elements in a good wireless programme—good quality transmission and good quality programme matter. The two are complementary, one being as necessary as the other. In the case of the indifferent programme, good quality transmission may make the programme matter tolerable, bad quality transmission can reduce the best programme matter to the level of the worst. It may be said, therefore, that a symphony concert relayed from the London Queen's Hall is a good programme only for those within the service area of the London transmitter. For listeners elsewhere, the quality of transmission is impaired or destroyed by the use of land-lines and the inherent defects of common wave transmission.

These clear and simple considerations indicate the terms in which the provinces should formulate any demand for a better service. The demand should be for—

(a) Direct transmissions of (b) good programme matter on (c) an independent wavelength.

It is certain, however, that any such demand would have a chance of success only if it were pressed with energy and determination. Present signs amongst the salivary of the London Promenade Concerts, the formation of the National Orchestra in London, the scheduled expenditure of some half a million pounds on the erection in London of Broadcasting House—all clearly foreshadow the permanent centralisation of the service in London and a continuation of the evil system of land-line transmission to the provinces.

K. MCCORMACK.

Oscillation.

SIR,—It seems to me that the only way out of the trouble (oscillation) is for the Post Office or British Broadcasting Corporation authorities to make a standard test of the impending listener's set before same is licensed, and, unless such a radio installation came up to a proper standard, the licence should be refused.

This law would quickly rid the radio business of the "absolute detriment of the service and public alike." HERBERT W. HAYDON, G.Z.Z.L.

Glocester.

Overseas Buyers.

SIR,—As an interested subscriber to your valuable paper, may I suggest that you render extremely valuable assistance to overseas experimenters and assist the popularity and prosperity of wireless in parts of the world where business is not sufficiently great for the establishment of local enterprise by maintaining an overseas buying department.
Elements of Radio Communication, by J. H. Morecroft (Chapman and Hall, 1929, 15s. net, Pp. 259). Professor Morecroft's well-known standard work, "Principles of Radio Communication," has now passed through several editions and is an indispensable work of reference to the professional wireless designer, but is somewhat heavy reading for the student and the amateur. The present work is of a simpler character, and may be considered as an introducing volume to the larger book.

Though the treatment is elementary in that no mathematical equipment beyond a knowledge of algebra is required, yet the subject is dealt with in a more solid fashion than in the average popular exposition. The principles are to give first an account of the theory of alternating currents, with special reference to the radio-telegraphy and telephony and to follow this with the applications involved in modern practice. The numerical information given is unusually complete. Thus, we are given figures as to the absorption of waves by steel buildings, the relative ranges and ship distances of transmissions on various wavelengths, and the comparative rectifying powers of crystals and valves using anode-bend or cumulative detection.

The chapter on receiving sets gives a most readable account of the good and bad points of modern sets. It begins with crystal circuits and treats of loud speakers, microphone units, superhet, various types of H.F. and L.F. amplifiers, and ends with mains-fed sets and filter systems.

R. T. B.
The World’s Biggest Broadcast.

If the International Disarmament Conference were being held in a studio at Savoy Hill, the powers that be could show no greater deference to the peculiar requirements of broadcasting than they will on January 21st. For the special benefit of the world’s listeners, H.M. the King and ten representatives of the Great Powers will observe a rigid time-table which will bring all their speeches within the compass of two hours.

Order of Speeches.

Immediately after the King’s speech, which begins at 11 a.m., His Majesty will leave the Chamber, the chair then being taken by the Rt. Hon. Ramsay MacDonald.

I learn from an authoritative source that the subsequent speeches will be given in this order: (1) Mr. Ramsay MacDonald, (2) Mr. Henry Stimson (U.S.A.), (3) M. André Tardieu (France), (4) Signor Dino Grandi (Italy), (5) Mr. Kanami Wakasugi (Japan), (6) Col. the Hon. J. L. Ralston (Canada), (7) Mr. J. E. Fenton (Australia), (8) Hon. T. M. Williamson (New Zealand), (9) M. T. ter Water (South Africa), and (10) Sir Atul Chandra Chatterjee (India).

B.B.C.’s Responsibility.

The delegates will be seated round a horseshoe table and each will be provided with a microphone extension. The B.B.C. control engineer will be discreetly inconspicuous just outside the door.

There can be little doubt, I think, that this broadcast will be the biggest of its kind ever staged. Ten nations have a direct interest in the proceedings of the Conference, while nearly every other country will hold a watching brief. Europe will be listening to Daventry, or via special landlines to Continental transmitters, and the rest of the world will be doing its best to hear SSW. The B.B.C. has a big responsibility.

Dreary News Bulletins.

“Brighter news?” was the question that leapt to everyone’s lips at the announcement of a staff change in the Savoy Hill news department. I doubt whether the change will have any effect whatever, but some means should be found, however, to brighten up one of the dullest features of the broadcast service.

Special Radio Week Feature.

I see that one of the organs of the B.B.C. prints a sonnet “to be broadcast, with other poems, by Elizabeth Barrett Browning, on January 14th.” Seeing that this is National Radio Week, the B.B.C. might have gone a step further by giving us a sonnet from the lips of Will Shakespeare himself.

New Tests from Brookmans Park.

Only seven thousand letters have been received at Savoy Hill regarding the Brookmans Park tests. This is a negligible figure compared with the vast numbers who are known to be within the service area, and the inference might be that the twins are giving satisfaction. The real truth, of course, is that the really serious tests have yet to come. So far few people have been inconvenienced by the simultaneous transmissions, but I hear the tests will be much more drastic in a week or two, with music from both transmitters. Up to the present this has been attempted only at unimportant times; in the afternoon, for instance.

Not until the final test period begins will it be possible to say when the twin transmitters will begin their permanent service of simultaneous transmissions. The final tests will probably last three or four weeks.

Present Schedule.

Until further notice, the arrangement of the alternative programme test transmissions from Brookmans Park is as follows:

The published programme is transmitted by the National programme transmitter working on a wavelength of 261 metres and by Daventry 5XX, from 12 noon to 1 p.m. on Monday to Fridays, and from 1 p.m. to 2 p.m. on Saturdays. The whole of the late dance music which follows the studio programme each evening is transmitted also by the National programme transmitter on a wavelength of 261 metres and by Daventry 5XX. During the whole of these periods the 356 metre Regional programme transmitter radiates a contrasted programme. On Sundays there will be no test transmissions in the evenings, but the alternative programme test transmissions will take place as usual between 2 and 2.50 p.m.

THE NORWEGIAN GIANT. The new 60-kilowatt broadcasting station at Oslo, just completed by the German Telefunken Company. Operating on 493 metres, Oslo can be heard at most times of the day in Great Britain.
Juggling with Grid Bias Cells.
I am using, as an anode bend detector, a high-impedance valve which apparently requires a bias of some-thing like 11 or 15 volts (the voltages of one or two dry cells). To avoid the need for fitting a potentiometer, I recently obtained one of the new nickel-oxide bina cells, and have con-nected it in series with an ordinary dry cell; although signals are louder, I think that the valve would work better with slightly less negative on its grid. Is it safe to try the expedient of reversing the polarity of the low-voltage cell con-nexions?  D. D. L.
No harm can be done by trying this experiment, and we suggest that you should connect two ordinary dry cells in series and then join up the 0.8-volt cell in opposition. This would give an effective voltage of 2.1, which should be about right.  

An Extra Tuned Circuit.
I understand that the addition of a separately turned and loosely coupled aerial circuit will increase the selectivity of my Kolo Mc receiver. Is it reasonable to assume that this addition will also bring about an appreciable increase in its range?  H. T. L.
Under average working conditions, it is safe to assume that a separate tuned aerial circuit will add to the range of a receiver fitted with the "periodic" arrangement which it usually dis-places. At any rate, it is quite safe to make this assumption if the comparison is to be made on a basis of equal selectivity; a two-circuit aerial tuner with coupling adjusted for loudest signals gives better results than an "aperiodic" arrangement similarly adjusted.  

When Valves Fail.
My present valves have been in use for well over two years, and as the signals given by my receiver are not as good as formerly, I have come to the conclusion that this falling off is due to a partial failure of valve emission; a careful point-to-point and stage-by-stage test with the apparatus at my disposal finds no fault. Will you tell me if there is any simple and easy way of checking the emission of the valves without the need for any elaborate equipment?  M. K.
A milliammeter with a range depending on the characteristics of the valves to be tested is sufficient equipment to enable you to form an idea as to whether your valves are in order in the matter of their emission. First connect the milliammeter in the anode circuit of the valve under test, taking care to short circuit any transformer primary or other resistance of appreciable value that may be in series. Next, having set grid bias and anode voltages at convenient values, observe if the anode current indicated is reasonably near (say within 25 per cent.) to that indicated by the manufacturer's published curve. Even without any apparatus at all it is possible in some cases to form a very fair opinion as to the state of the valves, provided one can assume that the various batteries are in order. When it is found that an L.F. amplifying valve cannot be used with the full value of negative grid bias recommended by its makers without introducing obvious distortion, it can generally be assumed that emission has fallen off considerably.  

A Double-purpose Resistance.
Will you please criticize the circuit diagram of my proposed four-valve receiver? Valve types and resistance and capacity values are marked. Please say if these are suitable.  S. P. S.
Your diagram shows a fairly conventional H.F.-det-2 L.F. receiver; in general, it should give satisfactory results, but we expect you will find it necessary to alter the ratio of the H.F. transformer (shown as 1:1), or to add another tuned circuit. The set as it stands will lack selectivity for use in your locality.

The decoupling resistance in the detector anode circuit should be increased from 600 ohms (as shown) to about 20,000 ohms. It must not be forgotten that in this circuit we are dealing both with H.F. and L.F. currents; it is probably true to say that the latter are most likely to give rise to trouble, and they must be taken into account when determining the values of decoupling components. The asso-ciated by-pass condenser should be increased in capacityfrom 0.1 mfd. to 2 mfd.

Fig. 1.—Gramophone pick-up connections for "The Wireless World" Kit Set.
Detector Anode Milliammeter.

My receiver is a 1-2 combination, with anode bend detector coupled by a high-inductance choke to the first L.F. amplifier, which is coupled to the output valve by a transformer. A post-detection volume control is fitted, in the form of a quarter-megohm variable resistance shunted across the L.F. choke.

The set works well, but I have been puzzled, since fitting a detector anode milliammeter as an indicator, by the fact that quite good and very loud signals are obtained from many stations without any observable change taking place in anode current reading. So far as several nearer and more powerful transmissions are concerned, it is quite easy to get a maximum deflection of between one and two milliamperes; of course, in these conditions it becomes necessary to use the volume control to prevent overloading.

Even after dark, it is unusual to find any great number of stations whose signals bring about an increase of more than a small fraction of a milliamper.

Does the above suggest that anything is wrong? Grid bias has been carefully adjusted by ear, the standing current when no signal is coming in is as near as I can read it, a quarter of a milliamper. E. F. R.

Without full particulars of your set, and, more important still, practical experience of your local receiving conditions, it is impossible to say definitely that the performance you describe is everything that can be expected. On the whole, we think that you can have little cause for concern, as the receiver seems to be working quite well.

It must be remembered that your two-stage L.F. amplifier probably provides a very large overall amplification, and, if so, very small signal voltage variations on the detector grid, with almost imperceptible changes in anode current, may well provide a sufficient input for considerable output volume. No doubt the post-detection volume control must be brought into use long before the detector becomes fully loaded (as indicated by a current reading of about one milliamper, assuming normal working conditions).

Although you give no particulars of your milliammeter, we are inclined to think that your apparent difficulty in taking fractional readings is a proof that the instrument is less sensitive than is desirable for this sort of work. Generally speaking, a scale reading of 0-1.5 or 0-2 milliamperes is to be recommended.

A "Tune-stand-by" Switch.

I am planning a new receiver, which is to include a separately tuned aerial coupled to the grid circuit through a small variable condenser connected between the centre points of the two coils. Is it possible, without introducing any serious losses, to fit a switch for cutting out the tuned aerial circuit at will? My object is to simplify operation of the set when searching for transmissions of which the corresponding condenser adjustments are not known.

J. G. P.

In the design of commercial and "Service" apparatus it has always been quite usual to include a so-called 'Tune-stand-by' switch for this purpose, and, now that two-circuit aerial tuners are coming into more general use for broadcast reception, this is a practice that might well be imitated. It is very likely to be helpful in your own particular case, as we see that you live at a considerable distance from a transmitting station, and consequently you will not always need the higher sensitivity conferred by the separately tuned aerial circuit.

For the arrangement you describe the form of connection shown in Fig. 2 (a) is suitable, an "aperiodic" coupling being provided when the switch is "down".

It may be pointed out that matters may be simplified if you change your circuit slightly, and adopt the arrangement suggested in Fig. 2 (b). Provided the coupling condenser (C.C.) has a suitably low minimum value, this is practically as effective as the form. .of a quarter-megohm variable resistor shunted across the L.F. transformer with a built-in condenser in shunt with the primary winding would not be used, in view of this sort? If not, would it be satisfactory to remove the condenser?

W. L. S.

The effect of this condenser--for the "L.F." point of view--is allowed for by the manufacturers, and these transformers can most certainly be used with entirely satisfactory results. The condenser should not be removed.

Porcelain Connectors.

I recently saw some small porcelain blocks fitted with brass insets carrying nipping screws; these were used for securing some of the connections of an experimental receiver. Having had some experience of burning out valves curing some of the connections of an experimental receiver. Having had some experience of burning out valves through short-circuits between temporary leads, these little "gadgets" attracted my attention. Can you tell me what they are called and where they may be obtained?

These are known as porcelain connectors, and we are rather surprised that you should have any difficulty in obtaining them. They are usually stocked by dealers in small electrical fittings, and are made with one, two or three insets for similar numbers of conductors. We agree that they are very useful for making safe semi-permanent connections.

FOREIGN BROADCAST GUIDE.

KHARKOV (Russia).

Geographical Position : 50° N. 36° 14' E.

Approximate air line from London : 1,580 miles.

Wavelength : 1,204 m.

Kilocycles : 1250. Power : 12 kW.

Time : Eastern European (two hours in advance of G.M.T.).

Standard Daily Transmissions.

Time signal at 17.00 G.M.T. a long buzz followed by chimes on a gong to indicate 19.00 Eastern European Time.

06.00 and 09.00 morning concert; 18.00 and 20.00 main evening programme; 21.00 dance music (Saturdays only).

Frequently relays programmes from Moscow Komintern and Leningrad.


Interval signal : gong.

These transmissions are also broadcast by a 1-kilowatt station on 426 m. (7042 kc.).
SOUTH POLE speaks to LONDON!

In far Antarctic wastes...Sir Douglas Mawson charts unknown continent. Sights new island. Wirelesses to London—through Marconi Valves. "Discovery" uses them—to keep touch with civilization, with supply ship, with accompanying airplane. Cable Service to Australia...Empiradio Beam Wireless...all British Broadcasting Stations...use Marconi Valves. For their wide range. For their long life. For their reliability.

In cases like these, when unfailing efficiency is essential—a matter of life and death even—men insist on Marconi Valves

FIT MARCONI VALVES TO YOUR RADIO SET

Give you clearer tone, greater volume, longer range. Cost not a penny more. Fit any set.

The first and greatest name in wireless

Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.
NOTICES.

For the convenience of private advertisers, letters may be addressed to numbers at "The Wireless World" Office. The names and addresses of advertisers are not given, unless accompanied by instructions to the contrary. All advertisers in this section are strictly prepaid.

We reserve the right to refuse or withdraw advertisements at our discretion.

The proprietors are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

Numerous Addresses.

For the convenience of private advertisers, letters may be addressed to numbers at "The Wireless World" Office. The names and addresses of advertisers are not given, unless accompanied by instructions to the contrary. All advertisers in this section are strictly prepaid.

Deposit System.

Readers who hesitate to send money to unknown persons may deal in perfect safety by availing themselves of our Deposit System. The instructions are as follows on orders for consecutive insertions, provided a contract is placed in advance, and in the absence of fresh instructions, provided a contract is placed in advance, and in the absence of fresh instructions.

Advertisements for these columns are accepted up to the preceding day of publication, and in the absence of fresh instructions, provided a contract is placed in advance.

Seriously Discounts are allowed to Trade Advertisers as follows: 25% on orders for consecutive insertions, provided a contract is placed in advance. In the absence of instructions, a contract is placed in advance. The same contract must be in force for all insertions.

Series Discounts are allowed to Trade Advertisers as follows: 25% on orders for consecutive insertions, provided a contract is placed in advance. The same contract must be in force for all insertions.

NUMERICAL ADDRESSES.

For the convenience of private advertisers, letters may be addressed to numbers at "The Wireless World" Office. The names and addresses of advertisers are not given, unless accompanied by instructions to the contrary. All advertisers in this section are strictly prepaid.

BARGAINS.

For Modern High-grade Material Only.

CHAPL ST., LONDON, N.W.1

OPEN TILL 7 P.M. SAT. & SUN.

BELLING FOR ALL WIRELESS COMMUNICATION.

All WIRELESS WORLD COILS

1890 EVERYMAN FOUR 47t/6 each
KIT SET, Cots with Switches 45/-
NEW KNOB G 45/-
RECORD III 45/-
RECORD LISTENERS 4 66/-
METAL CABINET 1/2/5/- each
5/- DRUM DIALS with Escutcheons 6/6
WAVE TRAP, Lite Wire... 16/- each

B & J WIRELESS CO.

2, 3 & 4, Athelstan Mews,
St Sraan Great Narn, N.S.

"END OF YEAR CLEARING."

APPLEBY'S

FOR BARGAINS WATCH
THE MIDDLESEX COLUMN THE MONTH.

For Modern High-grade Material Only.

CHAPL ST., LONDON, N.W.1

OPEN TILL 7 P.M. SAT. & SUN.

BELLING FOR ALL WIRELESS COMMUNICATION.

All WIRELESS WORLD COILS

1890 EVERYMAN FOUR 47t/6 each
KIT SET, Cots with Switches 45/-
NEW KNOB G 45/-
RECORD III 45/-
RECORD LISTENERS 4 66/-
METAL CABINET 1/2/5/- each
5/- DRUM DIALS with Escutcheons 6/6
WAVE TRAP, Lite Wire... 16/- each

B & J WIRELESS CO.

2, 3 & 4, Athelstan Mews,
St Sraan Great Narn, N.S.

"END OF YEAR CLEARING."

APPLEBY'S

FOR BARGAINS WATCH
THE MIDDLESEX COLUMN THE MONTH.

For Modern High-grade Material Only.

CHAPL ST., LONDON, N.W.1

OPEN TILL 7 P.M. SAT. & SUN.

BELLING FOR ALL WIRELESS COMMUNICATION.

All WIRELESS WORLD COILS

1890 EVERYMAN FOUR 47t/6 each
KIT SET, Cots with Switches 45/-
NEW KNOB G 45/-
RECORD III 45/-
RECORD LISTENERS 4 66/-
METAL CABINET 1/2/5/- each
5/- DRUM DIALS with Escutcheons 6/6
WAVE TRAP, Lite Wire... 16/- each

B & J WIRELESS CO.

2, 3 & 4, Athelstan Mews,
St Sraan Great Narn, N.S.

"END OF YEAR CLEARING."

APPLEBY'S

FOR BARGAINS WATCH
THE MIDDLESEX COLUMN THE MONTH.

For Modern High-grade Material Only.

CHAPL ST., LONDON, N.W.1

OPEN TILL 7 P.M. SAT. & SUN.

BELLING FOR ALL WIRELESS COMMUNICATION.

All WIRELESS WORLD COILS

1890 EVERYMAN FOUR 47t/6 each
KIT SET, Cots with Switches 45/-
NEW KNOB G 45/-
RECORD III 45/-
RECORD LISTENERS 4 66/-
METAL CABINET 1/2/5/- each
5/- DRUM DIALS with Escutcheons 6/6
WAVE TRAP, Lite Wire... 16/- each

B & J WIRELESS CO.

2, 3 & 4, Athelstan Mews,
St Sraan Great Narn, N.S.
The finest Loudspeakers in the world in their class

EPOCH
Moving Coil Model

Models 99 and 66 are the standard of comparison in many of the famous laboratories of the world. The speakers that have made EPOCH so enjoyable are the best of all. 14 different models for all requirements. £2 to £6 upwards.

Write for booklet W.S. giving full particulars and the 7 days free trial offer.

Our Latest Triumph!

EPOCH
Super-Cinema Model

The most powerful speaker ever put on the market, and the most sensitive too! Many times as sensitive as an ordinary moving-coil speaker. Such super quality has never been heard before. Delivers enormous volume and wonderful quality from the most modest of sets. The speaker for the home, public entertainments or Taikes!

 niece to be thoroughly reliable.

Advertiser for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.

BATTERIES.

W.E.T. Replacements.—Sacs (closed or unclosed), highest grade—Nos. A 2, 1/2p per doz. See below.

Z.M. C.R. ( perishable quality, wet and dry), Nos. 1, 8d. per doz. in packets of 50.

WE T. Batteries—Partly dosed, 10d. per box, or boxes, 1/6 per box.

M.E.T. Batteries.—Partly dosed, 10d. per box, or boxes, 1/6 per box.

DENTON.—Uses for small sizes, 20p. each.—Apply 217, Gunnersbury Lane, W.3.

M.E.T. Batteries.—Partly dosed, 10d. per box, or boxes, 1/6 per box.

Carefully and individually wound. 20,000 milliamps, 1/3; No. 2, 200, 2/-; No. 3, 25/-; No. 5, 30/-; A-0.7, £3/17/6, complete with charging apparatus.

For Our Radio, "Radio Power" to this address and Cheque Bridge, Bolton. (Phone: 2538.) Grams: Safety, Bolton, 10/9. Over 50 years' experience.

Our Latest Triumph !

W. H. SADLER, Ottery St. Mary.

REV 1 Beginners.—2-valve Brownie, complete with (R.C.C. SXX), valves and good accumulator; £10. 6/-, 2, Birch Grove, London, S.E.12.

REV 2 VALVE Burndeagle, complete with L.S. and B.T.I. headphones, good working order; £15/10/-.

MARCONI Straight Eight, complete with A.C. Transformers, and Fanger charger in perfect condition; £9, Southgate, 74, Rochester Row, Victoria, S.W.1. Tel.: Victoria 4158.

SUNDRED.—Floyd—Eskimann S.XS. Valve Neutrino, model N.K., newigram valves, 200 valves reproducing, £105, 52, Great Portland Street, W.1. Direct from our Works, Newmarket.

F. S. O. Michael.—7-valve Superhet, complete with (r.f. aerial, Amigons malagasy Radiolux (large), Valvematic, and 10,500 watts; £20, cash over £70; seen after 7—22, Edgware Rd., Clapham Common, S.W.12.

ALL MAINS (A.C.) Valve Set, new; £15/-, 6, Rotherhithe Rd., S.W.12.

A. P. HEADLEY.—A. P. HEADLEY'S Bureaus.


TAYLOR and LUMICK and A.O. Rectifiers; make your own, 100% efficient. Send post card and name, and a 5d. stamp for H.T. and L.T. (1) each, Lumicked: Rectifiers fitted with new, 35,000 milliamps; "Blagwells" Metallurgical Works, Ltd., Gospel Rd., Westbury, London, S.W.11. (Phone: 1029.)

PHILLIPS' Safety High Tension Battery Eliminators.

10-505.-Down and the Balance in Easy Monthly payments secures these finest high tension supply available.

PHILLIPS' Safety Eliminators are Guaranteed for life.

PHILLIPS' Safety Eliminators are the Cheapest on the Market, and the Cheapest to Run. Model A.0.S. £4/17/6, A.0.T. £3/17/6, complete with full written directions; £4/15/6. A.0.H. £3/5/6. ALL Models obtained for 16/- Deposit; take advantage of this and get constant high tension immediately.


CHEBROS.—Chokes for all types of transformers and chokes, high grade instruments at a very moderate price; enquiries invited.—Chester Bros., 246, Bolton Lane, London, E.

TRANSFORMERS and Chokes for Battery Eliminators and for all wireless purposes, receiving or transmitting; inquiries invited.—Chester Bros., 246, Bolton Lane, London, E.

SAVAGE'S Mains Transformer.—B.T.3 500, 0-500 volts; £5. S.A.V. 200,000; £4. 6, C. Grange Rd., Clapham, S.W.11.

SAVAGE'S Mains Transformers and Power Chokes for all purposes, receiving or transmitting; inquiries invited.—Chester Bros., 246, Bolton Lane, London, E.

SAVAGE'S Mains Transformers and Power Chokes are carefully and individually wound. 20,000 milliamps, 1/3; No. 2, 200, 2/-; No. 3, 25/-; A-0.7, £3/17/6, complete with charging apparatus.

SAVAGE'S Eliminator Kit is Post Free; price 10/-.

F. A. M. MAINS Transformers and Power Chokes are carefully and individually wound. Electric kilowatt hours. Our special charges for A.O. Rectifiers; make your own, 100% efficient. Send post card and name, and a 5d. stamp for H.T. and L.T. (1) each, Lumicked: Rectifiers fitted with new, 35,000 milliamps; "Blagwells" Metallurgical Works, Ltd., Gospel Rd., Westbury, London, S.W.11. (Phone: 1029.)

PHILLIPS' Safety High Tension Battery Eliminators.

10-505.—Down and the Balance in Easy Monthly payments secures these finest high tension supply available.

PHILLIPS' Safety Eliminators are Guaranteed for life.

PHILLIPS' Safety Eliminators are the Cheapest on the Market, and the Cheapest to Run. Model A.0.S. £4/17/6, A.0.T. £3/17/6, complete with full written directions; £4/15/6. A.0.H. £3/5/6. ALL Models obtained for 16/-Deposit; take advantage of this and get constant high tension immediately.


CHEBROS.—Chokes for all types of transformers and chokes, high grade instruments at a very moderate price; enquiries invited.—Chester Bros., 246, Bolton Lane, London, E.

SAVAGE'S Mains Transformer.—B.T.3 500, 0-500 volts; £5. S.A.V. 200,000; £4. 6, C. Grange Rd., Clapham, S.W.11.

SAVAGE'S Mains Transformers and Power Chokes for all purposes, receiving or transmitting; inquiries invited.—Chester Bros., 246, Bolton Lane, London, E.

SAVAGE'S Mains Transformers and Power Chokes are carefully and individually wound. Electric kilowatt hours. Our special charges for A.O. Rectifiers; make your own, 100% efficient. Send post card and name, and a 5d. stamp for H.T. and L.T. (1) each, Lumicked: Rectifiers fitted with new, 35,000 milliamps; "Blagwells" Metallurgical Works, Ltd., Gospel Rd., Westbury, London, S.W.11. (Phone: 1029.)
**KUSHETTE PICK-UP ARM**

A new Arma for Radio Gramophones; fascinating, and is more efficient than a cheap four arm. Suitable for use with existing Tone Arms to avoid removal of Sound Box.

**Price**

5/9

Weight-reducing adjustable. Lifts out from base; correctly angled for best alignment; bushed bearing; no vibration; well finished in aluminium.


**THE WANDER PLUG WITH THE POWERFUL GRIP**

Look at its progress of special special metal that gives the plug the finishing touch. The finish is as good as gold itself. The finish is as good as gold itself. The finish is as good as gold itself.

Ask your dealer, or send to us for BELLING & LEE, London, E.C.2.

**THE MODERN CONDENSER FOR MODERN CONDITIO**

**Polar**

**SEND TO-DAY FOR OUR FREE 35-PAGE BOOK, BAKER'S LEE ADVICE.**

**Bakers & Lee**

**BAKERS & LEE FOR EVERY RADIO CONNECTION.**

**Our 103 Radio Price Model.**

**GO HOME AND LISTEN.**

Definitely proved by independent laboratory tests to be the most efficient moving coil loudspeaker manufactured.

The Music Lover's choice.

**YOUR LOCAL LANDLORD.**

**Call Us To-Day For Your Free 35-PAGE BOOK, BAKERS & LEE ADVICE.**

**Offices: 28 BELLBURY ROAD, ROUTE RUSSELL, S.W.15.**

**GET MOVING COIL SPEAKERS.**

**Polar**

**THE MOST MODERN TO-CODNER FOR MODERN CONDITIONS.**

**THE WIRELESS WORLD**

**January 15th, 1930.**

**CHARGERS AND ELIMINATORS—Cont.**

**TANALUM** Strip for Rectifiers; 4/- per square inch—C. J. James, 17, Brunwick St., Soho, W.1. [7066]

**CRYPTO A.C. to D.C. Converter, A.C. Input 200-250 volts, D.C. Output 2-75, 200 to 500 volts, 1500 or 3000 volts, 3/30. Price: £20 complete, with switchboard fitted with tumbler, 30 sets, 30 circuits—Simmonds Bros., 11, Moons Lane, Wandsworth, London, S.W.2. [7722]

**MARCHING ELIMINATOR** 500 volts 5 m.s., 110 volts, £1 £2. [7067]

**AMERICAN** All Power Unit, D.C. 240-300 volts—Cordingley, Hobbiden Rd., Grunssington, Skipton. [7069]
THE WIRELESS WORLD

Advertisements.

To

Only Brownie's huge production enables them to offer this really splendid dial for 2/6. The special non-backlash design makes hair-breadth tuning a matter of delightful ease, while its handsome appearance (black or beautifully grained mahogany bakelite) will add to the good looks of that new set you are building.

BROWNIE WIRELESS COMPANY (G.B.) LIMITED,
NELSON STREET WORKS, LONDON, N.W.1.

BROWNIE
W I
R
E
E S

— a tone-perfect production
— a friend of good Records!

Scientifically designed, beautifully made, The MELTROPE Sound Box gives perfect tone and wonderful service, and will bring the oldest gramophone up to date!

Price 12/6.

Made by
AMPLIFIERS LTD.,
BILLET ROAD, LONDON, E.17.

Suitable for all types of tone arm.

NEW LIFE TO
SETS...OLD OR NEW

from

£3 19/6

Sold in all radio shops. If out of stock send dealer’s name and address to us.

Ideal acoustic conditions for the natural reproduction of broadcast music, speech and song exclusive to factory-made Double Linen Diaphragm Speakers. Small diaphragm for high, large diaphragm for low audible frequencies. Accurately balanced for area, juxtaposition and mutual tension. Hear it at your dealer’s. Available in five models from £3-19-6.

ULTRA ELECTRIC LIMITED
661-663, Harrow Road, London, N.W.10

ULTRA AIR CHROME SPEAKER

for SMOOTH RECEPTION

“Layerbilt” is unbeatable for smooth reception. It is crammed full of electricity and lasts half as long again as any other battery of the same size and weight in the world.

This is assured by the Columbia patented process of building layer upon layer of tin cells. The “Layerbilt” Heavy Duty Battery is the best and most economical battery in the world. Use it always.

25/-.

Columbia
RADIO BATTERIES
J. R. MORRIS, Imperial House,
Scotland: J. T. Cartwright, 3, Cadogan St., Glasgow.

Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.
So Many Replies!

A recent advertiser in "THE WIRELESS WORLD" writes as follows:

"I have received so many replies to my advertisement in 'The Wireless World,' which appeared under a Box Number that I am sending herewith an amount equal to the value of 6d. as further payment towards your postage expenses. Thanking you for the quick despatch of all replies."

R. W. CAPEWELL,
52, Chapel Terrace,
Trent Vale,
Stoke-on-Trent.

STUPENDOUS!

A recent advertiser in "THE WIRELESS WORLD" writes as follows:

"As the results from my advertisement in 'The Wireless World' were stupendous, I shall be glad if you will cancel my advertisement in your next issue as I am cleared out."

W. F. Macbeth,
"Brumari", Ballymena, Ulster.

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.

ALEXANDER BLACK.
Pleae Note New Address.

THE Original Wireless Doctor, will call (London and Home Counties) and cure your set.

CONSULTATIONS by Appointment Without Obligation, sets installed, maintained, and brought up to date, gramophone pick-ups, eliminators, and Watson moving coil speakers demonstrated; purity reproduction specialist.

55 Barry St., Victoria, S.W.1. Telene 1665.

EASY Payments.—We supply by easy payments, for components, accessories, and sets, any make; 12" down, balance payable over 3 months. —Send list of requirements to London Radio Supply Co., 51, Ladbroke, London, E.G.2.

WIRELESS Notes.—Monthly service of information for all those who want the very best in wireless or gramophone reproduction; frank criticism of receivers and components; immediate postal help and advice in all difficulties; something new and unique; you must have it if you want to know the truth.—Full particulars free from Ernest H. Robinson, Langmore, Firbank, Woking, Surrey.

SCOTT SESSIONS and Co., Great Britain's radio doctors, officially approved by wireless repairers or Radio Society of Great Britain and Wireless League; sets of every type repaired, rebuilt, modernised; send set for immediate quotation.

PATENT AGENTS.

Patents and Trade Marks, British and foreign.


PHONE: Holborn 1525.

REPAIRS.

TWIN Catalogue, 12 months' guarantee accompanies all sets repaired; repairs any make of I.F. transformers, loud- speakers, or loudspeaker repaired and despatched within 48 hours; 4½ pence per item delivered, or collect in 1s. 6d. terms to trade.—Transformer Repair Co., 5, Boston Place, Green Rd., Leeds.

EFFICIENT Repairs, attractive maintenance service; satisfactory to Customer. —Tel.: Tudor 5326.

GUARANTEED Repairs by Experts.—Loudspeakers, telephone, cone units, pick-ups, any type, re-constructed, re-sold, repaired, inspected, and adjusted, post free 4/-.—Full Continental, 214, High St., Colliers Wood, S.W.19.

WANTED.

TWIN Mk. Commercial Inter-Matic Transformers, 6 cm. tuned 5-500 metres.—Glencoe, 11,5, London, N.1.

WANTED, "The Wireless World," issues October 24th, 1928, clean and intact; will give 2½.

Young Radio Engineer required in Sussex with former Training for Further Practice and Technical Experience of Telephonic Amplifiers and Sound Reproduction; premium if necessary.—Res. 4359, c/o The Wireless World.

WANTED, Philips 4-valve all mains set.—Polly, Piers, Kernebridge.

FERRANTI A. F.S, 20 henry filter coils, Blue Spot 66 coil, wire wound resistance, 150,000 ohms, potentiometer, 1 mpg.—Write Howes, 20, Aberdeen Park, N.5.

Telephone: East 8059.

Mention of "The Wireless World," when writing to advertisers, will ensure prompt attention.
**January 15th, 1930.**

**THE WIRELESS WORLD**

**Advertisements.**

---

**CONVERT YOUR PRESENT SET INTO A SHORT WAVE RECEIVER.**

**Magnum Short Wave Convertor.**

This Convertor is adaptable to any valve set by inserting it in the valveholder of convertor, the plug of convertor taking the place of the detector valve. In crystalline metal cabinet, with 2 Coils 20/40 and 40/80 metres. Plug and Adapter £4 10s. inclusive.

**UNIVERSAL THREE.**

15-2000 metres.

The most perfect receiver yet designed for Ultra - Short Wave, Broadcast, and Long Wave reception. Including Valves, Coils and Royalty £13 9s. 0d. Magnum Receivers are now obtainable on Easy Payment Terms. We specialise in all apparatus described in "Wireless World." Lists on application.

**Burne-Jones Co. Ltd.**

295, BOROUGH HIGH ST., LONDON, S.E.1.

---

**EXPERIMENTAL WIRELESS & THE WIRELESS ENGINEER.**

The Journal for Professional Engineers and Advanced Wireless Experimenters.

Monthly 2/6 net. Annual Subscription 32/- post free.

---

**PARFAIT THE ERCOLL ELECTRIC EBOKE.**

**SUPPLIED IN SIX FINISHES.**

Semi-Polished Black Highly Polished Black Highly Polished Mahogany Cube Surface

Obtainable from most wireless dealers.

---

Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.

---

**PORTSMOUTH MUNICIPAL COLLEGE.**

Principal: L. B. Benny, M.A.

**ELECTRICAL ENGINEERING DEPARTMENT.**

Radio Telegraphy Section.

Required. IMMEDIATELY, a Full-Time Lecturer to take charge of the Training of Wireless Operators for the Post Office-General's certificate. The work has been carried on for many years, and includes both full - time day and part - time evening courses.

Salary on the scale £186 12s. to £248, according to experience, subject to deduction of 5% under Teachers' Pension Act.

Application should be made without delay, to the undersigned, giving earliest date at which duties can be commenced. No form of application is prescribed.

H. E. CURTIS, Secretary.


---

**REPAIRS.**

Any make of L.F. Transmitter, Loudspeaker or headphones repaired and dispatched within 48 HOURS - TWELVE WEEKS GUARANTEE without charge. 4/- Post Free.

Terms to Trade.

**TRANSFORMER REPAIR Co., Ltd.**

SQUIRE Cone Speakers are a good investment from all points of view. For a very small expenditure they will bring you in reproduction that is only equalled by the most expensive speakers on the market. We make this claim with the utmost confidence, because it has been tested and proved true. There is a Squire Speaker to suit every purse and every requirement. Ask your dealer to demonstrate one and prove our claims for yourself. The 101 is illustrated above.

Fredk. Squire Ltd.,
10, Leswin Place, Stoke Newington, N.16.
BAYLISS ROTARY CONVERTER

A.C. from D.C.

Load 400 Watts.

ANY Input.
ANY Output.

PRICE
£12.10.0

Delivery from Stock.

William Bayliss Ltd.
Sheepcote Street
BIRMINGHAM

Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.
TO HEAR IT IS TO BELIEVE IT!

RADIO WEEK,
JAN. 12 to 18.
Hear the special B.B.C. Programmes reproduced with that perfect veracity obtainable only with the great Ormond combination—the Ormond Cone Unit and Chassis. Like all Ormond products this new Ormond Cone Speaker is convincing in its superiority. Tone, volume, sensitivity — every factor of perfect reproduction denotes ideal design and construction. Comprising the famous Ormond 4-Pole adjustable Loud-speaker Unit, the wonder cone and especially strengthened aluminium chassis. Wonderful value giving wonderful results. Supplied unassembled and securely packed in carton for 20/- complete.

LICENSED UNDER THE PATENTS OF THE STANDARD TELEPHONES & CABLES LTD. & LEKLOPHONE & HOPKINS CORP. FOR AMATEUR USE ONLY.

The ORMOND Cone = UNIT & CHASSIS

Also supplied separately. Chassis and Cone 7/6. Unit 12/6.
THE ORMOND ENGINEERING CO. LIMITED,
ORMOND HOUSE, Rosebery Avenue, LONDON, E.C.1.
Telephone: Clerkenwell 5344-5-6 and 9344 4-6. Telegrams: "Ormondegi, Smith."
Sorry another mistake. I turned on 2 pages together. Pages 70 and 71 are in wrong place and moving 2 places back to get in right order.

Dave