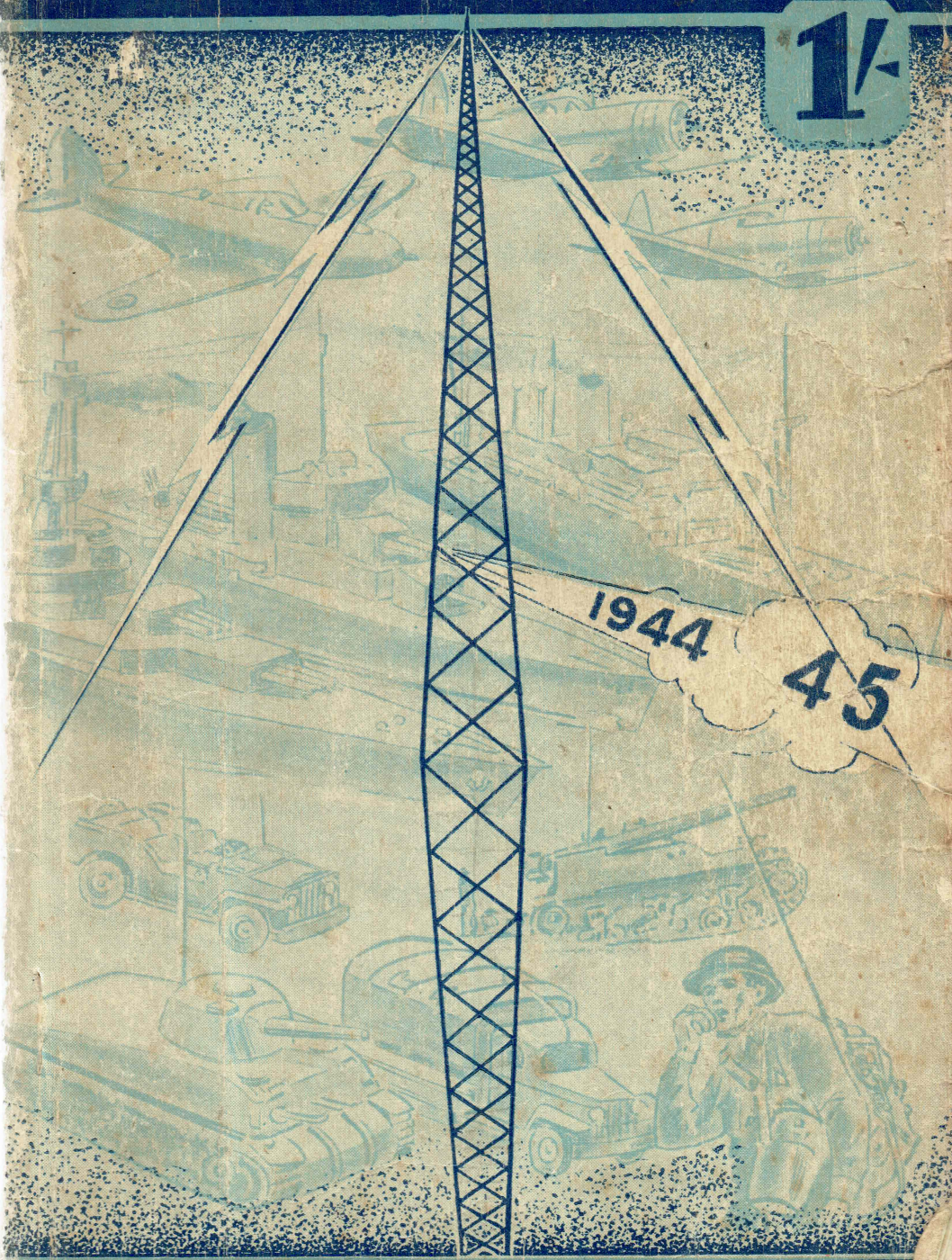
LAMPHOUSE ANNUAL

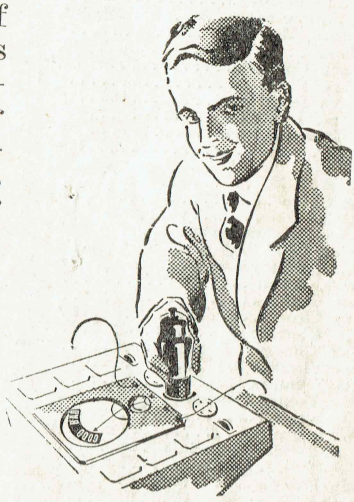
1/-



NEW ZEALAND'S RADIO AND ELECTRICAL GUIDE

1944

Lamphouse Annual



This, the 1944 edition of the Lamphouse Annual, is the 12th Annual to be published, and the 5th under war conditions. Circumstances do not allow us to continue our policy of "every issue must be bigger and better," but we know that you will find much of interest and educational value in the following pages.

The Catalogue portion contains details of goods which we can reasonably expect to supply at some time during the currency of the Catalogue, and we want to make it clear that we will not be able to supply all the goods listed, all the time. We will always do our best to fulfil all orders, and if we can assist you to procure hard-to-obtain goods, do not fail to call upon our services.

Through Peace or War, the Lamphouse Guarantee remains the same: *Any Goods that prove in any way unsuitable may be returned undamaged within seven days from receipt and your money will be refunded.*

May we thank you for any orders you may have placed with us during the past twelve months, and join with you in a wish for the early and safe return of your loved ones, and a return to Peace and Prosperity to all.

THE ELECTRIC LAMP HOUSE, LTD.,
WELLINGTON.

INDEX.

INDEX—Continued.

INDEX—Continued.

INDEX—Continued.

THE LAMPHOUSE ANNUAL
1944-1945

CONTENTS

GENERAL INFORMATION

PRICES:—The prices in this Catalogue should be taken as an indication only. Prices are fluctuating rapidly and all orders will be executed at the prices ruling at the date of supply.

TERMS OF BUSINESS.—Our terms are cash with order. We buy for cash and sell for cash, that's why our prices are lower. If it is desired we will hold any moneys of regular customers in a deposit account for future purchases, otherwise any balance due will be returned with the goods.

HOW TO ORDER.—Order forms are always available for your convenience. It is only necessary to quote the catalogue number and short description when ordering, such as SE506—Iron Element.

CATALOGUE NUMBERS.—The first letter S) of the number is for our reference, and alters with each price list or advertisement published. The balance of the catalogue number will always remain the same for the same article.

FREIGHT.—We pay freight on all retail orders over £1 value. Please include sufficient cash for postage on small orders.

GUARANTEE.—Any goods that prove **in any way unsuitable may be returned undamaged within seven days from receipt and your money will be refunded in full.**

REFERENCE.—Our Bankers are the National Bank of New Zealand, Ltd., Courtenay Place, Wellington.

COMPLAINTS—Please specially address all letters containing complaints, etc., to "The Director."

RETURNS.—Should it be necessary to return goods, always put in a slip of paper with your name and address. When returning goods for credit or exchange, state invoice number in covering letter to ensure prompt attention.

TELEGRAMS.—Address telegrams to "Lamphouse," Wellington.

REMITTANCES. — Enclose cheque, pound notes, postal note, or money order to the full amount of your order. If you send coin or bank notes, be sure to register the letter. Make cheques and postal notes payable to the Electric Lamp House, Ltd., and keep numbers for reference.

DELIVERY—We endeavour to maintain a same day dispatch service. This is not always possible as at times goods have to be specially procured, and at times exceptional rushes take place. It is very seldom, however, that an order is held for more than one day after receipt.

SUBSTITUTES.—Owing to the present difficulty of obtaining supplies we suggest that you indicate on your order whether or not you wish us to substitute with similar articles in the event of the goods ordered being out of stock.

LAY-BY.—See page 5.

POSTAL ADDRESS.—All orders and general correspondence should be addressed to—

THE ELECTRIC LAMPHOUSE LTD.

11 MANNERS STREET - - - WELLINGTON, C.1.

Telephones 43-015 and 43-016

A SUGGESTION.—As it is much easier for us to make a refund along with your receipt than for you to get stamps or postal notes to remit a small balance that may be left owing when your receipt is sent, would it not save you inconvenience if you were always to send ample cash to allow for freight, etc? We will refund the difference, or place it to your credit, according to your instructions. Do as hundreds of our customers do, send a blank cheque, which we will fill in when we have totalled your order. You can write across the top of the cheque "Not to exceed £5"—or £10, or £20, as the case may be.

IMPORTANT

The prices in this book must be regarded as an indication only, and are subject to alteration without notice. Even while the Catalogue is being printed some prices have advanced, and others have been reduced. All orders will be executed at approved prices ruling on the date of supply.

VALVES

The prices of American type Valves (see pages 65—66) are cancelled. A complete new price schedule for Valves will be published in the July "Radiogram." A copy of this "Radiogram" will be sent **FREE** on request.

OUR COVER DESIGN

RAHOB COMPETITION No. 5

This Competition is open to members of the N.Z. Radio Hobbies Club only. Look at the front cover. Write a sentence about it in not more than 10 words. Post your entry to Competition No. 5 on or before 1st August, 1944. The Rahob who we consider sent in the best entry will receive a prize of £3 Cash. Consolation prizes of 5/- each for good entries.

Address entries: COMPETITION No. 5, C/o Radio Hobbies Club, 11 Manners Street, Wellington.

All entries must be written on a separate sheet of paper from all other correspondence. **Results in September "Radiogram."**

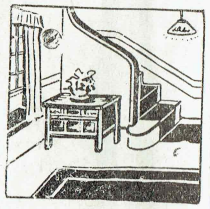
THE LAMPHOUSE, 11 Manners Street, Wellington, C.1.

The LAMPHOUSE CATALOGUE 1944 1945

OSRAM ELECTRIC LAMPS

OSRAM STANDARD VACUUM CLEAR BULB.

This is the ideal lamp for halls, landings, passages, etc., where a low intensity light is required.

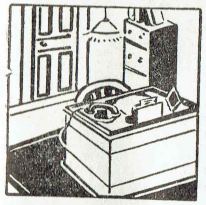


Cat. No. SL201—
15-watt **2/2** each

Cat. No. SL202—
25 watt **2/2** each

OSRAM GAS-FILLED PEARL.

PEARL AND CLEAR.



The Pearl type is frosted just sufficiently to keep sharp light beams from the eyes without impairing the efficiency of the light. Ideal for "close work" in offices or where work under artificial light is constant, and for all general lighting.

Cat. No. SL215—40w.	2/2 each
Cat. No. SL216—60w.	2/3 each
Cat. No. SL217—75w.	3/3 each
Cat. No. SL218—100w.	4/- each
Cat. No. SL219—150w.	7/- each
Cat. No. SL220—200w.	10/3 each

OSRAM GAS-FILLED CLEAR BULBS

Cat. No. SL211—300w.	14/6
Cat. No. SL212—500w.	20/9
Cat. No. SL180—1000w.	33/3

THE LAMPHOUSE
11 MANNERS STREET, WELLINGTON

LAMPS FOR HOUSE-LIGHTING PLANTS, ETC.

6 and 12 volt lamps with standard bayonet caps for house lighting plants, etc. Can be used from car battery for house or tent lighting, etc.

6 Volts, Pearl Finish.

Cat. No. SL500	10 watt	All
Cat. No. SL501	15 watt	
Cat. No. SL502	25 watt	
Cat. No. SL503	40 watt	each

12 Volts, Pearl Finish.

Cat. No. SL504	10 watt	All
Cat. No. SL505	15 watt	
Cat. No. SL506	25 watt	
Cat. No. SL507	40 watt	each

PANEL LAMPS

Genuine Westinghouse Radio Panel Lamps.
Tubular Type.

Cat. No. SL119—2 volt, .05 amp. (special low consumption for battery sets)
Cat. No. SL120—2.5 volt.
Cat. No. SL121—3.8 volt.
Cat. No. SL122—6 volt.
Cat. No. SL123—6 volt, with small bayonet base. **1/4** each

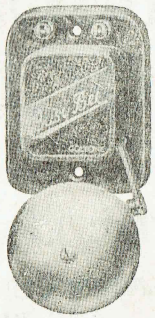
TORCH LAMPS

STANDARD TYPES.
BEST QUALITY

Cat. No. SL100—1.4 volts	7d. each
Cat. No. SL103—4 volts	11d. each
Cat. No. SL112—Focus 2.5 volts	10d. each
Cat. No. SL113—Focus 3.5 volts	10d. each
Cat. No. SL109—Focus 6 volts	1/3 each
Cat. No. SL99—2.5 volt, pre-Focus type (American Fixed Focus)	1/9 each
Cat. No. SL1—6 volt 3 watt Cycle Dynamo Lamps	1/9 each
Cat. No. SL2—6 volt 1.8 watt Cycle Dynamo Lamps	1/9 each

BELLS AND BELL MATERIAL

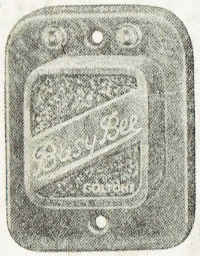
Best British BELL



British. Pressed iron frame. Silver contact points. Terminals under cover. Nickel-plated steel gong, 2¾in. diameter. Bakelite case. For battery or 4-volt A.C. operation.

Cat. No. SG320 **8/6**

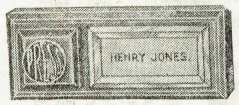
BRITISH BUZZER



British good quality Buzzer in bakelite case.

Cat. No. SG319— **6/6** each

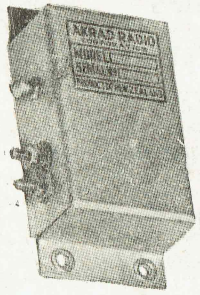
BELL PUSH



Bell Push incorporates name plate. Useful attractive bakelite push, for use in flats, with space for name card and glazed covering.

Cat. No. SG332 ..... **2/9** each

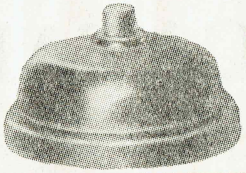
HIGH NOTE BUZZERS



Primarily designed for Morse practice. Note is adjustable by means of a screw. Operates on 4½-volt torch or C battery.

Cat. No. SG322— **7/6** each

BELL PUSH



Good quality Brown Bakelite Push; 1¾ in. diameter.

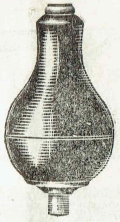
Cat. No. SG334 **2/-** each

HEAVY DUTY BELLS

Iron clad heavy duty bells for commercial users.

Cat. No. SG323 ..... **£5/10/-**

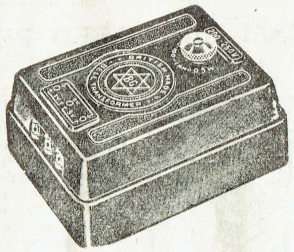
BAKELITE PEAR PUSHES



Bell Pear Push for cord suspension. Attractively finished in moulded bakelite. The plunger is of polished bone.

Cat. No. SG335 **2/-** each

BELL TRANSFORMERS



Bell Transformers for 230-volt supply. Output 3/5/8 volts. Moulded into an attractive bakelite case. British.

Cat. No. SG337 ..... **13/6** each

BELL WIRE

Out of stock at time of going to press and no word of further supplies.

VIGILANT BELLS

N.Z.-made Bells. Well constructed.

Cat. No. SG315 .. 3-inch **15/-** each

Cat. No. SG316 .. 6-inch **100/-** each

BELL STAPLES

Insulated Staples for tacking up bell wire.

Cat. No. SS118 ..... **3½D.** doz.

ELECTRICAL ACCESSORIES

ADAPTORS

For end of cords to fit into light socket for extensions, etc.

Cat. No. SG210 ..... **1/4** each

ADAPTORS, MINIATURE

To fit miniature lampholders. Standard motor-car size.

Cat. No. SG211—Single contact **1/2** each

Cat. No. SG212—Double contact **1/2** each

2-LIGHT ADAPTORS

Two-light Bakelite Adaptors.

Cat. No. SG218 **2/8** each

SWITCH TYPE

Enables an extension to be taken from a lampholder. Provided with a switch so that the centre light can be switched off and leave the extension going.

Cat. No. SG220 ..... **5/6** each

LAMPHOLDERS

CORDGRIP TYPE. BAKELITE—

Cat. No. Each

SG50—With skirt 1/9

SG51—Without skirt 1/6

SG52—With switch, with skirt ....

SG53—With switch, without skirt ..

BATTEN TYPE—

SG54—With skirt

SG56—Without skirt .....

Cat. No. SG57—With switch and skirt

Cat. No. SG58—With switch, without skirt .....

ANGLE TYPE BATTEN HOLDERS—

Cat. No. SG65 .....

THREADED TYPE—

Cat. No. SG59—½in. Bakelite type ..

Cat. No. SG60—½in. metal type.

Cat. No. SG61—⅜in. light metal.

Cat. No. SG62—⅜in. conduit thread type

Cat. No. SG63—⅜in. bakelite type.

Cat. No. SG64—½in. with switch.

E.S. HOLDERS—

Cat. No. SG68—Batten type .....

Cat. No. SG69—Cordgrip type .....

Cat. No. RG70—Goliath screw type ..

WALL PLUG CAPS

2-Pin "T" Type.

Cat. No. SG85 .... **7D.** each

SIDE ENTRY 3-PIN PLUGS

Moulded in two pieces. Connecting screws completely covered.

Cat. No. SG89—"Titegrip" .... **1/3** each

Cat. No. SG97—H.P.M. ..... **1/5** each

All Rubber, three new plug tops.

Cat. No. SG99 ..... **3/6** each

WALL PLUGS AND BASES

"Titegrip"—

Cat. No. SG92 **2/11** each

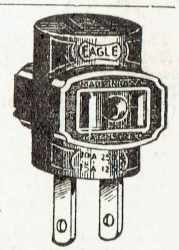
Cat. No. SG97/98, H.P.M. **3/11** each

PLUG BASE ONLY

Cat. No. SG95—3-pin "Titegrip" Wall Base ..... **1/8** each

Cat. No. SG98—H.P.M. ..... **2/6** each

PLUG CUBE



Triple Plug Cube with parallel pins. Enables 3 separate leads to be taken from one point.

Cat. No. SG102— **10D.** each

APPLIANCE PLUGS

Fit practically all types irons, toasters and other electrical appliances.

Cat No. SG112 **10D.** each

Cat. No. SG114— Neeco ditto **3/6** each

Type with earth strip (for 3-wire flex).

Cat. No. SG113 **1/3** each

Cat. No. SG115— Neeco ditto **4/6** each

ELECTRICAL ACCESSORIES

CONNECTORS—2-WIRE BLOCK

Porcelain Insulated Connector for joining wires, etc.

Cat. No. SG29—Single Wire .. 6D. each

Cat. No. SG28—Two Wire .. 10D. each

Cat. No. SG27—Three-wire .. 1/3 each

CONNECTORS FOR A.C. LEADS

Two-piece Cord Connectors (parallel pin) for joining mains. flex. Polarised type.

Cat. No. SG20—

CONVERSION ADAPTORS

These Conversion Adaptors will be found useful to the general public, besides appliance salesman, etc. They enable a radio set with a three-pin plug to be used from a two-pin socket, etc.

Cat. No.	Fits into.	Takes.	Price.
SG500	3-pin	2-pin Tee ..	—
SG501	3-pin	2-pin Prll. .	—
SG502	3-pin	Lamp Socket	3/6
SG503	2-pin Tee ..	2-pin Prll. .	—
SG504	2-pin Tee ..	3-pin ..	4/6
SG505	2-pin Tee ..	Lamp Socket	3/6
SG506	2-pin Parallel ..	3-pin ..	4/6
SG507	2-pin Parallel ..	2-pin Tee ..	—
SG508	2-pin Parallel ..	Lamp Socket	3/6
SG509	Lamp Socket Adaptor	2-pin Tee ..	—
SG510	Lamp Socket Adaptor	2-pin Prll. .	—
SG511	Lamp Socket Adaptor	3-pin ..	4/6

Motor Car LAMP SOCKETS

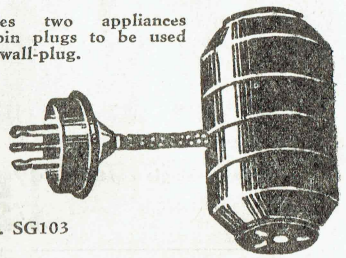
American type Lamp Sockets for Motor Car Lamp Extensions, etc., etc.

Cat. No. SG72—Single contact 1/8 each

Cat. No. SG73—Double Contact 1/8 each

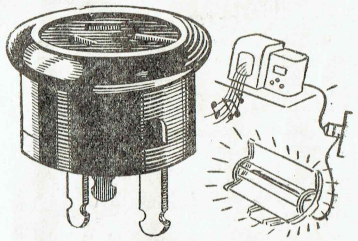
LAMPHOUSE 2-WAY ADAPTORS

Enables two appliances with 3-pin plugs to be used from a wall-plug.



Cat. No. SG103

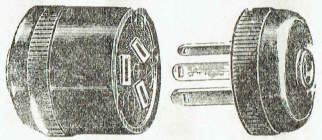
PLUGS, DOUBLE THREE-PIN



A useful plug where it is desired to take two leads from one three-pin socket. The plug illustrated is fitted to the appliance or radio cord. A standard 3-pin plug cap can then be inserted into the top of it.

Cat. No. SG100 .. .. .. 3/-

CORD CONNECTORS (3-Wire)



Two-piece Cord Connectors for joining three-wire cord. Moulded in bakelite. Titegrip. N.Z.-made. Cat. No. SG26 .. 3/8 each

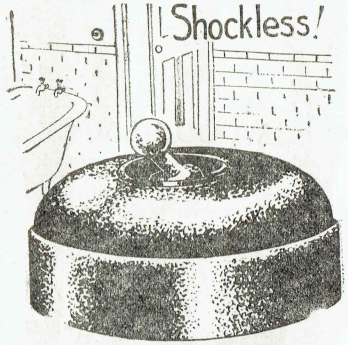
ADAPTORS, MINIATURE

These are similar to SG210, but fit miniature lamp holders. They are standard size for use on motor cars.

Cat. No.	Each.
SG211—Single contact	1/2
SG212—Double contact	1/2

ELECTRICAL SWITCHES

SWITCHES—INSULATED ELECTRIC



All-insulated Switch for use in bathrooms, kitchens, and near telephones, etc. British-made.

Cat. No. SG119— 5-amp .. .. 1/11 each

Cat. No. SG120—10-amp .. 5/6 each

Cat. No. SG121— 5-amp., 2-way . 2/6 each

Cat. No. SG122—10-amp., 2-way . 5/6 each

Cat. No. SG125—15-amp., 1-way . 7/6 each

CRABTREE CEILING SWITCHES Best Quality.

Cat. No. SG127—1-way ..... 6/6 each

Cat. No. SG128—2-way ..... 7/6 each

CORDS FOR CEILING SWITCHES

Spare Cords for Ceiling Switches.

Cat. No. SG116 8D. each

SUPER QUALITY SWITCHES

Genuine Crabtree Insulated Switches.

Cat. No. SG123—5-amp., 1-way 2/8 each

Cat. No. SG124—10/15 amp. .. 5/6 each

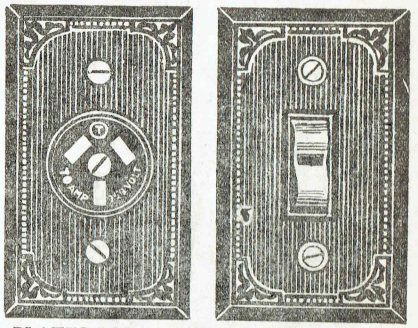
FLUSH SWITCHES AND PLUGS

SWITCHES ONLY.

Cat. No. SG170— 5-amp. Brown ..	2/3
Cat. No. SG171— 5-amp. Ivory ..	3/-
Cat. No. SG172—10-amp. Brown ..	3/-
Cat. No. SG173—10-amp. Ivory ..	3/6
Cat. No. SG174— 5-amp. Brown 2-way	3/3
Cat. No. SG175— 5-amp. Ivory 2-way .	3/6

PLUG BASES ONLY.

Cat. No. SG176—2-pin Parallel Bases .	3/-
Cat. No. SG177—3-pin Brown Bases ..	2/4
Cat. No. SG178—3-pin Ivory Bases ..	2/9



PLATES FOR SWITCHES AND PLUGS.

Cat. No.	
SG179—Chrome, for 1 switch	2/6
SG180—Chrome, for 2 switches ..	5/-
SG181—Chrome, for 1 switch and 1 plug	5/-
SG182—Brown Bakelite, for 1 switch ..	11d.
SG193—Brown Bakelite, for 1 plug ..	11d.
SG183—Brown Bakelite, for 2 switches	1/10
SG184—Brown Bakelite, for 3 switches .	4/6
SG185—Brown Bakelite, for 1 switch and 1 plug	1/10
SG186—Ivory Bakelite, Classic type, for 1 switch	2/3
SG187—Ivory Bakelite, Classic type, for 2 switches	4/6
SG188—Ivory Bakelite, Classic type, for 3 switches	5/6
SG189—Ivory Bakelite, Classic type, for 1 switch and 1 plug	4/6
SG194—Ivory Bakelite, Classic type, for 1 plug	2/3
SG195—Brown Bakelite, for 1 switch, Classic type	1/4
SG196—Brown Bakelite, for 2 switches, Classic type	2/8

METAL MOUNTING BOXES

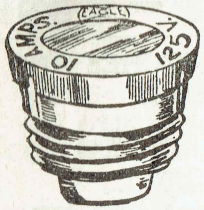
SG190—Single Gang Boxes ..	1/6
SG191—Double Gang Boxes	2/4
SG192—Triple Gang Boxes	3/2

THE LAMPHOUSE, 11 Manners Street, Wellington, C.1.

H.P.M. SWITCHES

All Bakelite Wall Switches, brown
Cat. No. SG140—5 amp. .... 1/11 each
Cat. No. SG126—10 amp. .... 2/3 each

FUSES, ELECTRIC RANGE

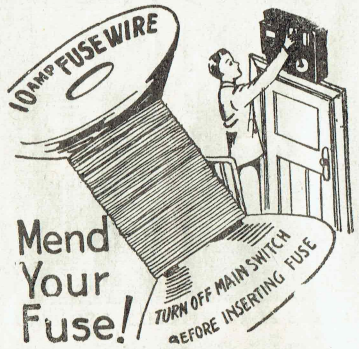


Screw Type Fuses are used on nearly all makes of electric ranges and other electrical appliances.

Cat. No. SG40—5 amp. 9D. ea.

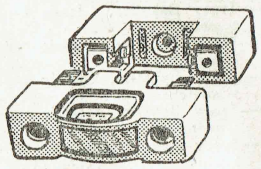
Cat. No. SG41—10-amp.
Cat. No. SG42—15-amp.
Cat. No. SG43—20-amp.
ALL 9D. each

MEND YOUR FUSE



Have a packet of this Wire handy. You never know when you will have to renew your fuse.
Cat. No. SG47—10-amp. size .. 2D. each

FUSES FOR SWITCHBOARDS, ETC.



2-piece Fuse Blocks.
Cat. No. SG160— 5-amp .. 2/- each
Cat. No. SG161—10-amp .. 2/- each

FLANGES

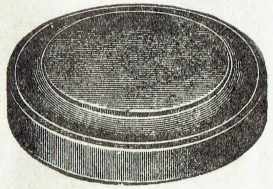
Metal Conduit Flanges to fit ⅝in. Conduit.
Cat. No. SN1 w/male thread .. 4D. each
Cat. No. SN2 w/female thread .. 4D. each

CEILING ROSES

Bakelite Ceiling Roses for electric light pendants.
Cat. No. SG32 .. .. .. 1/6 each

WOOD BLOCKS

Round and rectangular Wood Blocks for mounting switches, ceiling plates, etc. Carefully made and well finished. Recessed.
(Made in N.Z.)



Cat. No. SG79—3½in. round 4D. each
Cat. No. SG83—3½ x 3½ square 6D. each
Cat. No. SG80—6 x 3 rectangular 10D. each
Cat. No. SG81—9 x 3 rectangular 1/- each
Cat. No. SG82—6 x 6 square .. 1/9 each

ERA BLOCKS

Cat. No. SG78—Era Blocks, with connectors 2/6

CONDUIT FITTINGS

	Each
Cat. No. SN20—⅜in. Plain Black Elbows	4d.
Cat. No. SN21—⅜in. Galv. Elbows ..	5d.
Cat. No. SN22—⅜in. Insp. Black Elbows	5d.
Cat. No. SN23—⅜in. Galv. Insp. Elbows	6d.
Cat. No. SN24—⅜in. Black Insp. Tees ..	6d.
Cat. No. SN25—⅜in. Galv. Insp. Tees ..	7d.

BLACK INSULATING TAPE

Has many uses, such as binding hockey sticks, axes, etc., besides being an excellent means of insulating. 2oz. rolls.
Cat. No. SS237 .. .. — roll
Cat. No. SS236—4 oz. rolls .. — roll
Cat. No. SS238—8 oz. rolls .. 2/11 roll

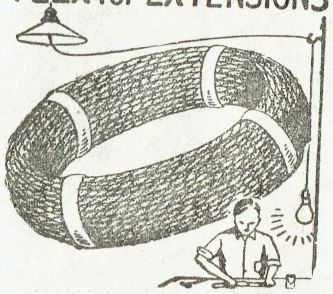
WHITE ADHESIVE TAPE

(STICKING PLASTER)

Handy for binding Hockey Sticks, Tennis Racket Handles, etc., as well as ordinary medical uses.
Cat. No. SS250—1in. wide x 2½yds. .. 1/6
Cat. No. SS251—½in. wide x 5yds. .. 1/6
Cat. No. SS252—½in. wide x 1yd. .. 6d.
Cat. No. SS253—1in. wide x 1yd. .. 8d.

WIRES — CABLES

FLEX for EXTENSIONS



For 230-volt supply. Handy for extending lights, etc. 23/.0076.
Cat. No. SW70 .. .. .. —

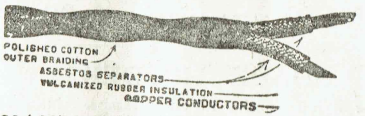
WIRES, V.I.R. CABLE

Cat. No.	Yard.	100 yard coil.
SW77—1/.044 (1/18)	4d.	20/9
SW78—7/.029 (7/21)	8d.	52/-
SW79—3/.036 (3/20)	6d.	39/-
SW80—7/.036 (7/20)	9d.	67/6
SW81—7/.044 (7/18)	1/1	98/-

SILK-COVERED FLEX

Thin Silk-covered Flex, 14/0076, laid flat and braided all over. Handy for wiring table lamps, etc., which have too small a hole for ordinary flex.
Cat. No. SW118 .. .. ..

WIRES, HEATING



23/.0076 Rubber-insulated Asbestos-covered, heating flexible. Covered over all with a glazed cotton braid. Used for toaster and other appliance cords.
Cat. No. SW66—2-wire .. ..
Cat. No. SW67—3-wire .. ..
Cat. No. SW71—40/0076, 2-wire ..
Cat. No. SW72—40/0076, 3-wire ..
Cat. No. SW73—70/0076, 3-wire ..

WORKSHOP FLEX

23/0076 Flex. Heavily insulated and protected overall with stout braid, waterproofed.
Cat. No. SW96—2-wire ..... yard
Cat. No. SW95—3-wire ..... yard

RANGE WIRING WIRE

Asbestos-covered Wire for internal wiring of electric ranges, backs of fires and in other places subject to heat. 3/.036.
Cat. No. SW85 .. .. .. 1/6 yard

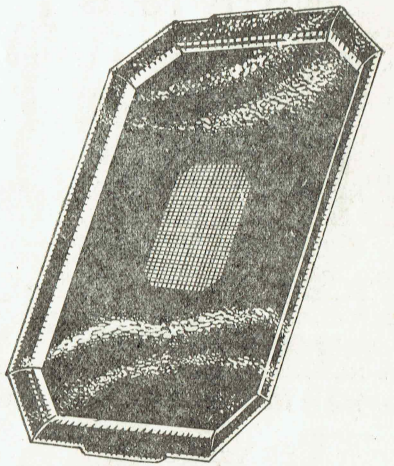
WIRE, FLEXIBLE.

Two and three-wire. British. Flexible, for extensions, appliances, etc. Each core is rubber covered and braided overall.
Cat. No. SW90—2-wire ..
Cat. No. SW91—3-wire ..

RADIO WIRES

See Page 63

TOASTER TRAYS



Made of Moulded Bakelite in following colours: Red, Cream, Black, Green. For standing under toasters to catch crumbs, etc. —as well as many other home uses. Size (overall) 10⅜in. x 7in.
Cat. No. SE761 .. .. .. 3/9

Special Trays (drilled) for Speedee Hostess Toasters.
Cat. No. SE760 .. .. .. 3/9

Ditto for Speedee Tiffen Toasters.
Cat. No. SE759 .. .. .. 7/6

LINEN TAPE

¾in. Linen Tape, for Armature Winders, etc.
Cat. No. SS240 ..... 14/6 gross yard

CHAIN SETS — FITTING ACCESSORIES

CHAIN SETS

Complete Chain Set for hanging bowl fittings. Consists of deep canopy with three hooks, three lengths of chain, each 36in. long, three oxidised gravity hooks.
Cat. No. SF306 .....

DEEP CANOPY

Has three hooks for hanging bowl fittings, etc. Deep enough to fit right over the ceiling rose, thus saving the expense and trouble of removing the ceiling rose and block to fit a special connecting block. Oxidised copper finished. Each
Cat. No. SF310 .....

Cat. No. SF311—Ditto, chrome finish

CHAIN

For hanging bowl fittings, etc. 1in. link, oxidised copper finish. per yd.
Cat. No. SF315 .....

Cat. No. SF316—Ditto, chrome finish

GRAVITY HOOKS

For hanging on the lip of bowl fittings. Oxidised copper finish. Each
Cat. No. SF320 .. .. .. 5D.

Cat. No. SF321—Ditto, chrome finish 9D.

HOOKS

O.C. Hooks with ⅜in. thread.
Cat. No. SF322 .. .. .. 1/3

CEILING PLATES

O.C. Ceiling Plates, single hooks.
Cat. No. SF312 ..... 3/-

BOWL BUTTONS

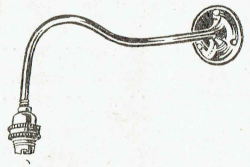
Cat. No. SF325—Oxidised .. .. 5D.

Cat. No. SF326—Chrome .. .. 9D.

ERA BLOCKS

Round Era Connecting Blocks, with centres.
Cat. No. SG78 .. .. .. 2/6

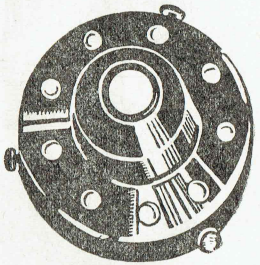
WALL BRACKETS



Plain plated 9in. Wall Brackets, complete with Lamp-holder.
Cat. No. SF800 .. .. .. 8/- each

GALLERIES FOR LAMP SHADES

All the following have a standard 1⅝in. hole for fitting on to standard size lampholder.
Brown Bakelite Moulded Gallery, 2¼in.



Cat. No. SF350—
1/- each

Cat. No. SF351—Ditto, 3¼in. .....

Cat. No. SF352—Ditto, 4¼in. .....

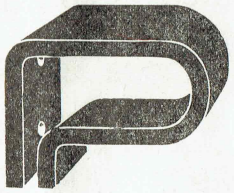
METAL GALLERIES AS ABOVE.
Oxidised Copper.

Cat. No. SF353—2¼in. 1/-
Cat. No. SF354—3¼in. 3/6
Cat. No. SF355—4¼in. 4/9

CHROME FINISH.

Cat. No. SF357—2¼in. 1/9
Cat. No. SF358—3¼in. 4/9
Cat. No. SF359—4¼in. 5/3

MAGNETS



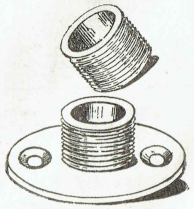
Strong Magnets removed from old meters. Useful in every workshop, office, etc., for picking up nails, screws, pins, etc., Every youngster will find dozens of other uses.
Cat. No. SU4 ..... 6D. each

SHADE HOLDERS

For fixing Shades to table lamps. Non adjustable type.
Cat. No. SG38 ..... 2/3 each

NIPPLES

Threaded Brass Tube for making table lamps, etc Fit standard ⅜in. lampholders.
Cat. No. SG200—
6D. each

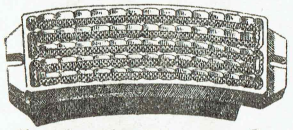


FLANGES

Cat. No. SG206 .. .. .. 8D. each

ELEMENTS AND SPARES

SPARE ELEMENTS FOR RADIATORS



Large tile, 9½ x 3⅛, 1000 watts. Complete.
Cat. No. SE519 .. .. .. 9/1

Small tile, 7⅝ x 3, 1000 watts.
Cat. No. SE518 .. .. .. 8/1

Round porcelain bar with spiral element, 1000 watts.
Cat. No. SE533 .. .. .. 9/9

Pencil Rod Elements, 1000 watts, 10 in. Komfee Brand.
Cat. No. SE520 .. .. 12/6

Ditto, 12 in., 1000 watts.
Cat. No. SE521 .. .. 12/6

Ultimate 850 watt Radiator Elements.
Cat. No. SE522 .. .. .. 8/9

Ditto, 1000 watts.
Cat. No. SE523 .. .. .. 8/9

ELECTROWAY RADIATOR ELEMENTS

Cat. No. SE534—Short Tubular .. Each 10/6

Cat. No. SE535—Long Tubular .. 12/-

Cat. No. SE536—Small Tile .. 12/-

Cat. No. SE537—Large Tile .. 12/6

RADIATOR ELEMENTS

SPIRAL WINDINGS.

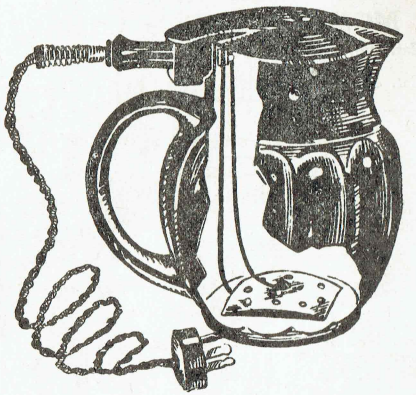
Spiral Element Windings for re-winding Radiator Elements, etc. Made of best British resistance wire.

Cat. No. Each
SE509—230 volt, 600 watt 2/-
SE510—230 volt, 750 watt 2/3
SE511—230 volt, 1000 watt 2/6

NEECO JUG SPARES

Cat. No. Each
SE560—Complete Elements 5/6
SE515—Bobbins for Elements 1/3
SE562—Jug Lids 6/6
SE563—Terminal Pins 1/1
SE564—Element Supports .. .. 9d.
SE565—Lid Hinge Blocks .. pair 2/3
SE514—Wire Element Spirals 1/4

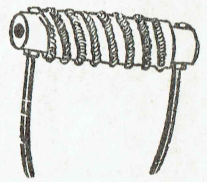
THE "WIRELESS" JUG ELEMENT.



Cannot burn out! This Element is made on an entirely new and patented principle. Having no element wire, cannot burn out. Easy to fit.
Cat. No. SE517 .. .. .. 8/6 each

ELECTRIC JUG ELEMENTS

Spiral Windings for Electric Jugs. 230 volt.
Cat. No. SE514—
1/4



Cat. No. SE503—
Light type 1/-

Porcelain Bobbins for Jug Elements.
Cat. No.. SE515 .. .. 1/3 each

Complete Jug Elements, consisting of winding on bobbin and connecting rods.
Cat. No. SE560 .. .. 4/3 each

SPEEDEE JUG ELEMENTS

For Speedee Enamelled Jugs.
Cat. No. SE516 .. .. .. 9/6 each

ULTIMATE SPARES

Ultimate Kettle Elements.
Cat. No. SE526 .. .. .. 15/6
Ultimate Oven Elements for Rangettes,
Cat. No. SE527 .. .. .. 23/4
Hotplates for Rangettes.
Cat. No. SE570—Ultimate 6in. .. £1/6/9
Cat. No. SE571—Ultimate 8in. .. £1/11/3

RANGE ELEMENTS

Electric Range Hot Plates. Elements that will fit all makes of ranges. Speedee to fit any make of range, 8in. to 11½in. diameter. 1750 watts.
Cat. No. SE550 .. .. .. 35/-

Ditto, 6in. to 8in. diameter, 900 watts.
Cat. No. SE551 .. .. .. 29/-

ELEMENTS — SPARES — FUSES

SPARES FOR VIOLET RAYS

Cat. No. SE251—H.F. Coils .. **12/6**

MONARCH PIFCO LAMPS

Cat. No. SE77—Infra Red Elements

Cat. No. SE78—Radiant Heat Bulbs **15/-**

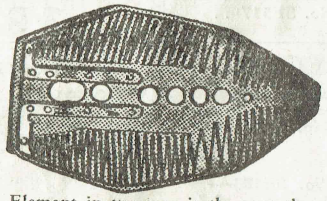
CARBONS FOR HEALTH LAMPS

Spare Carbons for Pifco and other Arc type Health and Sun-tan Lamps.
Cat. No. SE599 .. .. .. **4/-** pair

Spares for Electric Shavers

Pairs Cutters, Remington or Rand.
Cat. No. SE580 .. .. .. —
Cat. No. SE581—Pairs Cutters, Shick . —
Cat. No. SE582—Spare Cleaning Brushes 1/3
Cat No. SE583 — Shavemaster Cutting Heads 13/6

ELECTRIC IRON ELEMENTS

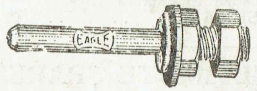


The Element in the iron is the part that does all the work and practically the only part that goes wrong. These Elements are specially constructed for long service, and will fit all standard makes of irons.

Fitall Type Iron Elements.
Cat. No. SE508 .. .. **3/9** each

Iron Elements, 110 volts.
Cat. No. SE504 .. .. **7/6** each

APPLIANCE TERMINALS



Appliance Terminals, for fitting in the back of electric irons, etc. Supplied complete with nuts. Cat. No. SE400 .. .. **8**D. each

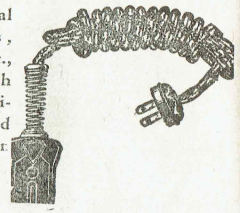
KICK SWITCHES

For replacements in Speedee Wall Fires, etc.
Cat. No. SG138 .. .. **6/9** each

PORCELAIN ELEMENT BARS

Round Porcelain Bars for Radiator Elements, etc. Unwound. Size 9½in. x ¼in. diam. 5/32in. hole.
Cat. No. SE502 .. .. **4/3** each

APPLIANCE CORDS



Cords for electrical appliances, irons, toasters, jugs, etc., etc. Fitted with "Fitall" type appliance plug on one end and a wall plug on the other end.

Cat. No.
SE800—Cord with 2-pin parallel Cap **4/6**
SE801—With two-pin tee cap .. **4/6**
SE803—With three-pin cap **5/-**
SE802—With lamp socket adaptor .. **4/3**

(Note.—The above are fitted with 6 feet best cord. Extra long cords can be supplied. Add 1/6 for each extra yard required.)

KNIGHT VACUUM CLEANER SPARES

Cat. No. SE237—Field Coils 10/6
Cat. No. SE238—Carbon Brushes .. 1/9
Cat. No. SE242—Spare Brush Caps .. 1/3
Cat. No. SE244—Spare Ball Races .. 9/-

ELECTRIC IRON HANDLES

Wooden handles for electric irons—will fit practically all makes.
Cat. No. SE405 ..... **1/9** each

RUBBER RINGS

For fixing Elements in metal jugs, such as Speedee, Ultimate, etc.
Cat. No. SE500 .. .. .. **6**D. each

NEECO TABLE COOKER SPARES

Cat. No. SE530—Elements, complete **27/-**
Cat. No. 531—Elements, spiral only **2/9**
Cat. No. SE532—Cast Top Plate .. **9/9**

NEECO RADIATOR SPARES

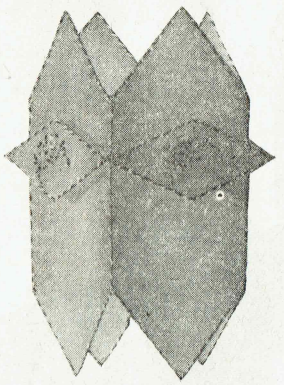
Cat. No. SE528—Hi Speed Reflector Elements **13/6**
Cat. No. SE529—Neeco 1000-W. Fire Elements **13/6**

POKER WORK MACHINES SPARES

Cat. No. SE91—Spare Tips .... **4**D. each

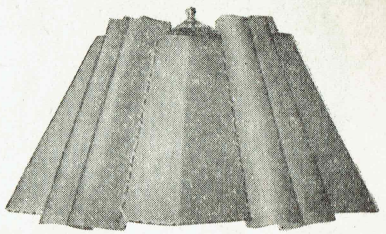
MODERN LAMPSHADES

Here we list modern Lamp Shades manufactured from the latest translucent parchments. All Shades listed are washable and can be supplied in the following colours: Rose, Tango (Orange), Rust (Orange-Brown), Gold, Green, Blue, Clover (Mauve).

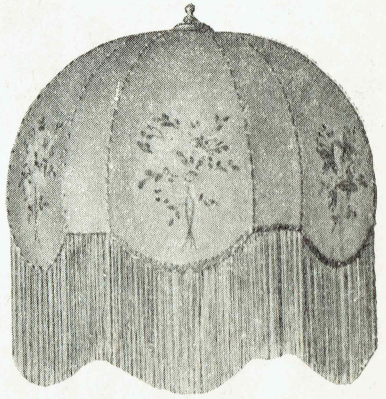


Bright Hall Lamp Shade. For halls, passages, etc. Size 10in. x 14in.
Cat. No. SF605 .. .. **12/6** each

A dignified Shade in the lower-priced class. Diam. 12in., height 7½in.
Cat. No. SF604 .. .. **6/-** each

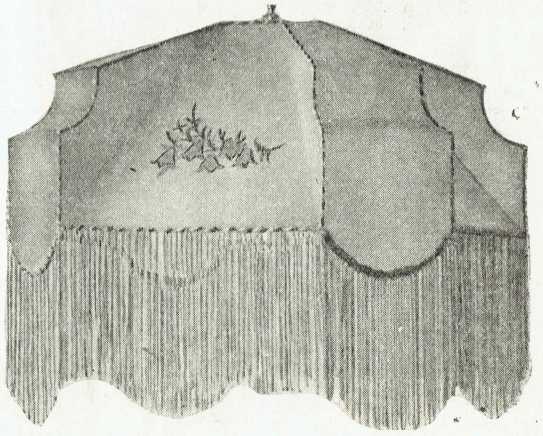


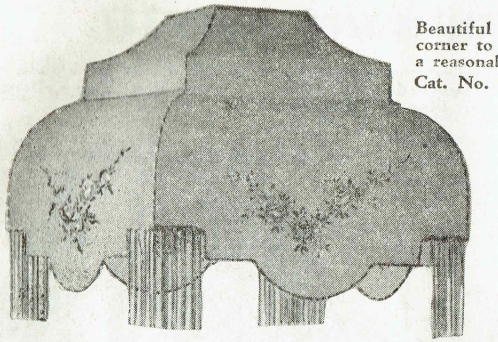
One of our most popular models. Diam. 14in., height 7in.
Cat. No. SF603 .. .. **11/-** each



Attractive Decorated Shade, with fringe. Diam. 14in., overall depth 14½in., fringe 5in.
Cat. No. SF600 ..... **23/-** each

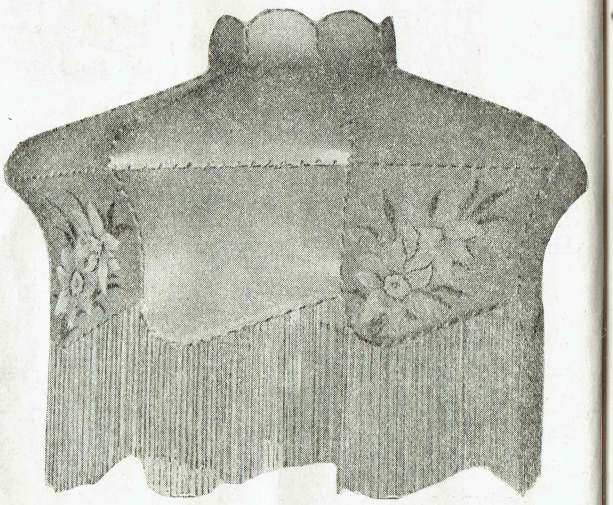
Diam. 18in. This modern Shade will enhance the appearance of any room.
Cat. No. SF626 .. **28/6**





Beautiful Shade of tasteful design. Size from corner to corner, 18in. This is a large Shade at a reasonable price.

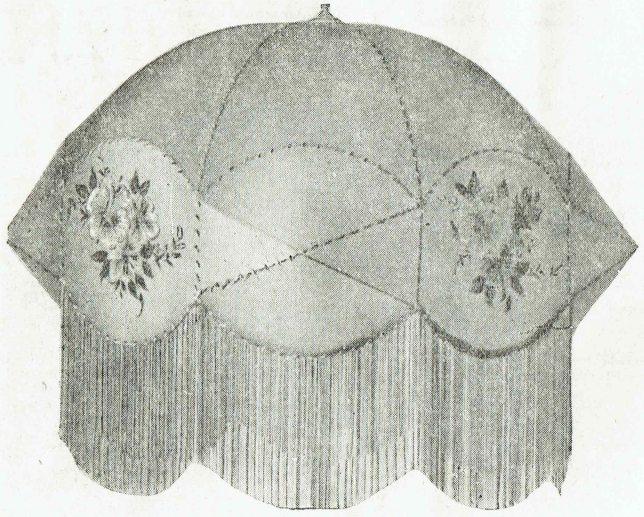
Cat. No. SF622 .. .. .. **15/6**



Another large Shade suitable either for hanging or for floor standard. Diam. 22in., depth 12½in., plus fringe 6in.

Cat. No. SF624

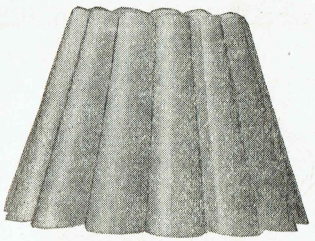
45/-



Large Shade for big room or for Floor Lamp. Made from best washable parchment. Diam. 24in., depth 12in., plus fringe 6in. Supplied in all listed colours.

Cat. No. SF623—

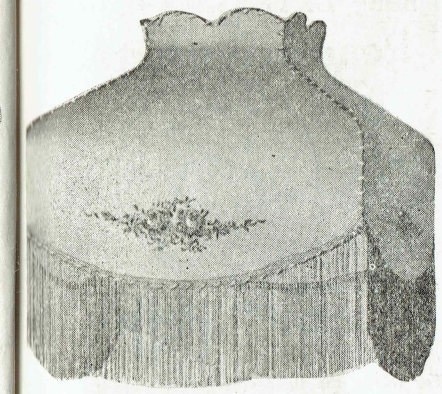
45/-



Our most popular shade for general lighting purposes. Made in different sizes.

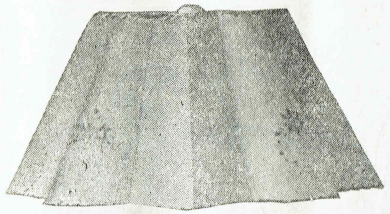
Cat. No. SF614—
8in. Diameter. Frost-Parchment **9/6**

Cat. No. SF615—
10in. Diameter. Frost-Parchment **12/6**



Modern Shade in frosted parchment. Diam. 18in., overall depth 15½in., fringe 5in.

Cat. No. SF601 .. .. .. **16/6**



A delightful shape. Diam. 14in., height 7in.

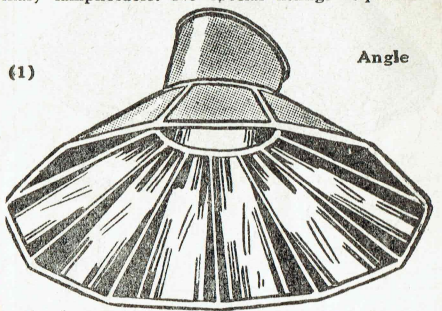
Cat. No. SF602 .. .. .. **6/9** each

Mail all orders to the Electric Lamphouse Ltd., 11 Manners Street, Wellington.

"ENSIGN" MIRALITES REFLECTORS.

For economical lighting for windows, stores and home. Special arrangement of mirrors in these reflectors enables you to obtain up to 33-1/3 per cent. more light. Miralites for ordinary lampholders. No special fittings required.

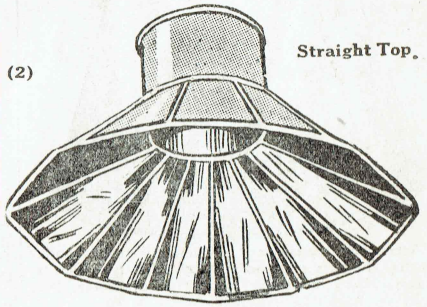
(1) **Angle**



Angle window lighting reflector. The top of this type is angled enabling the reflector to be placed in front of a window so that the light will be reflected directly on the goods displayed in the window. For lamps 75 to 150 watts. Size 11in. x 5in.

Cat. No. SF251 .. .. **20/-** each

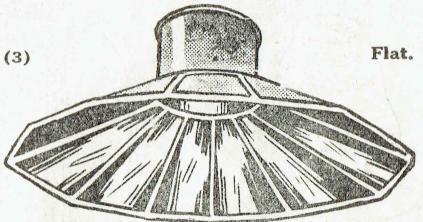
(2) **Straight Top.**



Straight top type. For use directly above special displays. Over machines, desks, etc.; anywhere where a direct intensive light is required for lamp 75-150 watts. Size 11 x 5½in.

Cat. No. SF252 .. .. **20/-** each

(3) **Flat.**



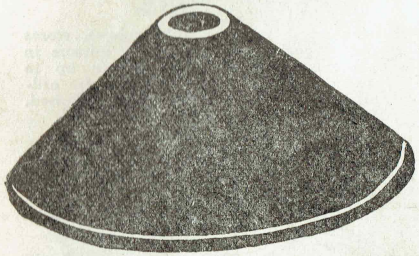
Straight top type for use where a wide, even distribution of light is required, such as in stores, shops and in the home, etc. Supplied in two sizes.

Cat. No.

SF253—11 x 3½in. (40-75 w. lamp) **15/6**

SF254—13 x 3½in. (75-100 w. lamp) **20/-**

OPAL SHADES. BAKELITE TYPE.

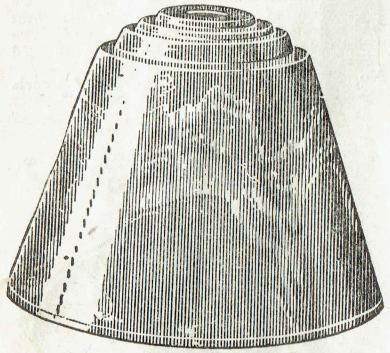


Moulded in New Zealand, these bakelite shades take the place of the old glass opal shades. Very strong and light. Supplied in plain white and pastel tints.

White—Cat. No. SF560 .. **1/3** ea.

Tinted—Cat. No. SF561 .. **1/6** ea.

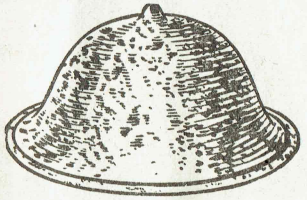
BEAUTIFUL SHADES



Attractive translucent Bakelite Lamp Shades in the following colours: Pink, Mauve, White, Green, Blue, Yellow. Size 7in. diameter, 5in. high.

Cat. No. SF562 .. .. .. **2/-** each

"CLIP ON" LAMPSHADES.

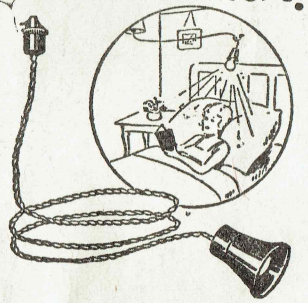


Made of translucent bakelite, these shades are fitted with a wire clip which clamps direct on to the lamp bulb, making them ideal for adjustable table lamps, etc. Available in most popular colours. Diam. 5¾in.

Cat. No. SF255 .. .. .. **2/6**

Lighting EXTENSION CORDS.

Read in Comfort!

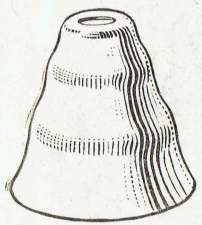


For taking the light where you want it. Ten feet long and supplied with an insulated shock-proof lampholder. Extra long lengths can be made up at 1/- yard extra.

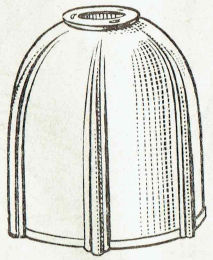
Cat. No. SE51 .. .. .. **6/9**

Cat. No. SE52 (with switch holder) **8/6**

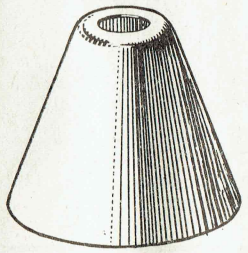
SF662



SF660



SF661



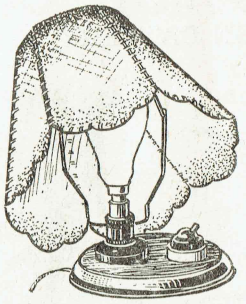
TRANSLUCENT BAKELITE SHADES

SF660 5in. high, 4¾in. diameter, available in blue, white ..... **2/6** each

SF661 4¾in. high, 5¾in. diameter, available in blue, white ..... **1/9** each

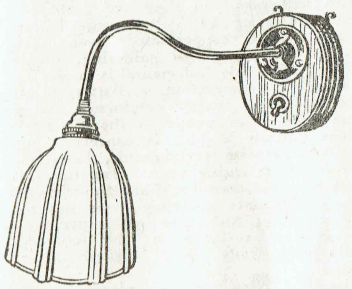
SF662 4¾in. high, 4¾in. diameter, available in pink, green, orange, blue, mauve yellow ..... **1/9** each

BETTER LIGHTS



BEDSIDE LAMP, for standing on table at bedside, or for decorative reading lamp. Mounted on polished rimu base. Diam. of base 7in. Supplied complete with 3 yards flexible cord. Switch mounted on base.

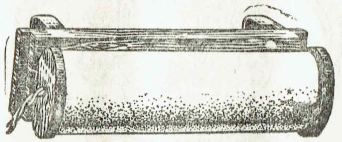
Cat. No. SF901 .. .. **29/6** each



WALL LAMP, supplied with 3 yards flexible cord. Polished wood base, 5¼in. diam. Bracket extends 9in. Bakelite shade. Switch mounted flush in base.

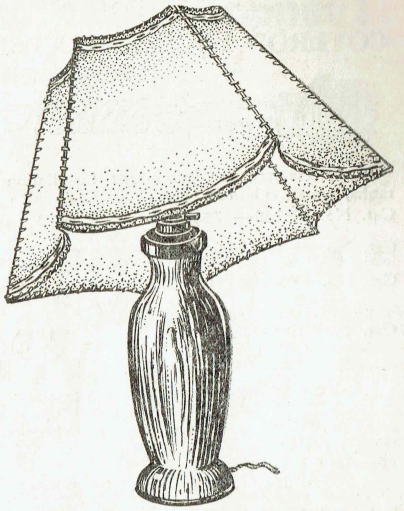
Cat. No. SF902 .. .. **30/6** each

BED LAMP.



Modern and attractive Bedroom Lamp. Can be hung on bed-rail or screwed to wall. Wood base and sides. Parchment shade. Length 11in., diameter of shade 3¼in.

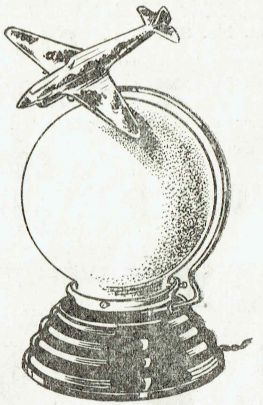
Cat. No. SF907 .. .. .. **24/6**



TURNED RIMU TABLE LAMP—Supplied with 3 yards cord, and attractive parchment shade. Height over-all 17in. Diam. of shade 14in.; diam. of stand 4in.

Cat. No. SF900 .. .. **48/6** each

AEROPLANE LAMP



Black wood base 6in. diam. Glass Ball 6in. diam. Plane mounted on chrome support. Supplied complete with 9ft. flexible cord. A novel decorative lamp.

Cat. No. SF903 .. .. .. **67/6**

THE LAMPHOUSE, 11 Manners Street, Wellington, C.1.

HEATING AND MOTORS

COYLROD WATER HEATERS

Tank Heaters for permanent installation in tanks, water cylinders, etc.

Cat. No. SE540— 750 watt **£1/5/-** each
Cat. No. SE541—1000 watt **£1/5/-** each
Cat. No. SE542—1500 watt **£1/5/-** each

Brass Flanges for fixing above.
Cat. No. SE543 .. .. .. **7/6** set

ELECTRIC MOTORS

The following Motors are available from stock. (All 230 Volt 50 cycle).

Hoover ¼ h.p. Split Phase—
Cat. No. SM660 .. **£6/6/-**

Hoover ⅓ h.p Split Phase—
Cat. No. SM661 .. **£7/10/-**

Hoover ¼ h.p. Capacitor Start—
Cat. No. SM669 .. **£10/1/6**

Hoover ⅓ h.p. Capacitor Start—
Cat. No. SM670 .. **£12**

Robbins & Meyers ¼ h.p. Split Phase—
Cat. No. SM665 .. **£6/15/-**

Robbins & Meyers ½ h.p. Capacitor Start (ball bearing)—
Cat. No. SM666 .. **£16/17/6**

B-Line ⅓ h.p. Induction Repulsion—
Cat. No. SM662 .. **£19/4/9**

Westinghouse ¼ H.P. Split Phase Motors, 1425 RPM.
Cat. No. SM671 .. .. **£6/-/-**

1/3rd H.P. Ditto
Cat. No. SM672 .. .. **£7/5/-**

SPARES FOR WELDERS

Carbon Electrodes—Cat. No. SE9 ... **2/6**
Brass Electrodes—Cat. No. SE13 ... **6D.**
Steel Electrodes—Cat. No. SE14 ... **6D.**
Packets Flux—Cat. No. SE15 ..... **6D.**

THE RADIO HOBBIES CLUB

Join up now with the great N.Z. Army of Radio enthusiasts. You will learn, you will make friends, you will have a fascinating hobby. See Page 147 for further particulars.

ENSIGN BATTERY WELDER

A Welding, Brazing and Soldering Tool, which will save you time and money. Works from any 6 or 12 Volt storage battery, providing instant, concentrated, even heat. You can do all your own soldering, brazing and welding with this indispensable tool.

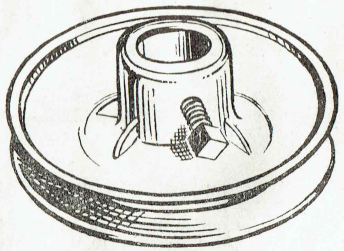
Rugged construction. Battery leads are specially heavy flexible conductors giving maximum transfer of power to the Welder.

The Ensign Welder is especially applicable for Auto repairs (mudguards, radiators, etc.), also for light inside work. For the farm it is invaluable for mending buckets, cans and light farm implements. Battery firms use them for lead burning, and they are especially useful for battery repairs on the roadside. The Radio man finds them invaluable for quick soldering.

Supplied complete with electrodes, flux and full instructions.

Cat. No. SE8 ..... **52/6**

PULLEYS FOR MOTORS, ETC.

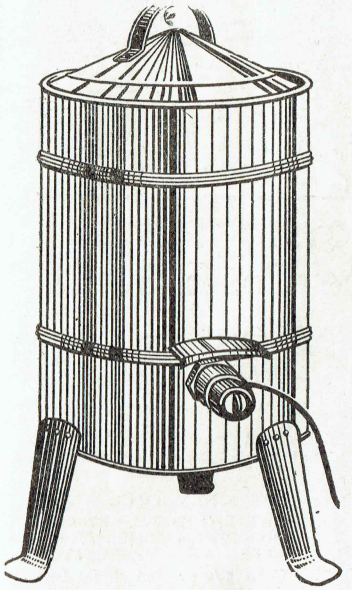


Cast Aluminium Pulleys, 4in. diam. for "V" Belts.

Cat. No. SM700 for ½in. shaft 7/9
Cat. No. SM701 for ⅝in. shaft 7/9
Cat. No. SM702 for ¾in. shaft 7/9

THE LAMPHOUSE, 11 Manners Street, Wellington, C.1.

NO STOKING with THIS Copper!



NO SMOKE!

NO WOOD CHOPPING!

NO STOKING!

NO CLEANING FIREPLACES!

Just plug into a hotpoint. Quick, clean and economical. The ideal means of electric washing. Copper is supported in a robust outer iron casing as illustrated. Filled with water and clothes takes approximately 1 hour to boil at summer temperatures, in winter a little longer. The 2500 watts. heating element is housed in special circulating chamber under the copper, which ensures maximum efficiency, quick heating and fast, continuous movement of water right through the clothes as though worked by a motor-driven pump. By this means the clothes are washed quicker and cleaner than in a washing machine. Circulating chamber well lagged for greatest efficiency. Standard finish, dark green, special colours to order. Electric coppers save the cost of a chimney; they are quicker, cleaner, and mean a lot less work. Capacity 14 gallons.

Cat. No. SE64 .. .. **£14/19/6**

NORTHERN BED WARMERS

NEW LINE WHICH WILL QUICKLY THAW FROZEN FEET.

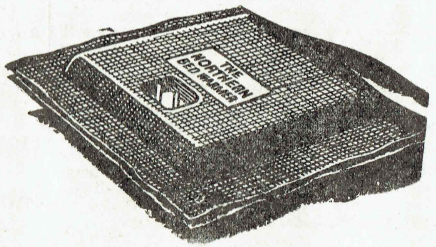
SIMPLE TO USE. LOW COST TO OPERATE.

This Northern Bed Warmer takes the place of the old type of Hot Water Bottle. To operate you simply plug in to a power point for 10 to 12 minutes, then completely disconnect it. The heat lasts from 6 to 8 hours.

It is extremely handy for people working at desks, tables, etc., who suffer from cold feet. Can also be taken in your car to the pictures.

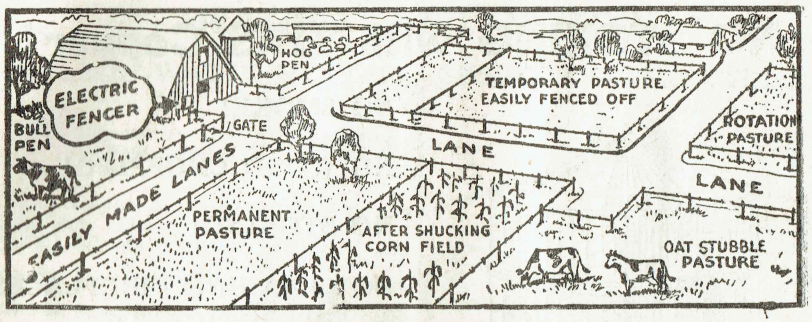
Cost about 1d. per week for current.

Can be bought without plug or cord or complete. (The household iron or toaster cord set will fit the Northern Bed Warmer).



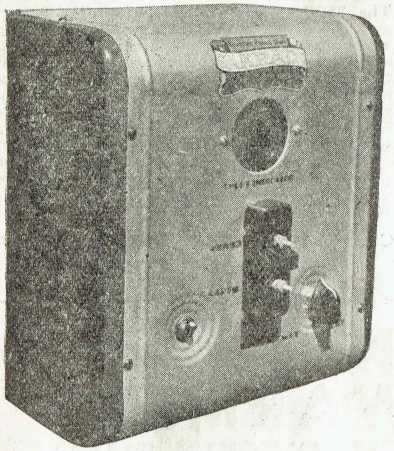
Cat. No. SE81 —Northern Bed Warmer **28/6**

Cat. No. SE81A—Northern Bed Warmer with 3-pin Plug and Cord Set **33/-**



"SAFESTOCK" ELECTRIC FENCE

Reduce Your Fence Costs 80%!



"SAFESTOCK" FENCE FEATURES:

Made in New Zealand.

Guaranteed for Twelve Months.

Sold under Lamphouse Money-back Guarantee.

USE ONLY ONE WIRE.
ONE-THIRD THE POSTS.
ONE-FIFTH THE TIME.
SAFE — EFFECTIVE.

Costs 1/- per month to run.

Has Platinum Iridium Breaker Points. Vacuum-impregnated Shock Transformer.

Case-hardened Steel Trip Cam.

High Output with Low Consumption.

BUILT TO LAST.

Will electrify 10 to 15 miles of fence. Fitted with Short Circuit Indicator. Fitted with Switch for Wet or Dry conditions.

FARMERS . . .

ELECTRIC FENCING has come to stay!

ACT NOW and start SAVING NOW!

BATTERY—Any 6-volt wet or dry battery will operate the "SAFESTOCK" Fence. We suggest Cat. No. SA43 at **£4/6/4**

You can fence with a single barb wire on posts a chain apart—FENCE 10 ACRES IN HALF A DAY.

Just think! SAFESTOCK Fencing does away with most of the work and expense of building and maintaining 100-per-cent. efficient fencing for cattle, pigs, horses and sheep.

Your livestock touches the live wire, get a harmless shock, and DON'T COME BACK FOR MORE!

Cat. No. SE62 . . . . **£9/10/-**

Cat. No. SE63—Spare Indicator Bulbs **4/6** ea.

PROTECT YOUR PRESENT FENCES

An ordinary barbed wire attached to the top of your present fences holds back the FENCE CRASHERS—no more damaged fences—and can remove for other fences some of the existing wires, too.

PIGS ARE TROUBLESOME—but not with a two-wire SAFESTOCK FENCE.

PACIFY YOUR BULL behind a one-wire SAFESTOCK FENCE.

YOUR HAYSTACK BECOMES IMMUNE FROM ATTACK with a SAFESTOCK Fence. FENCE OFF YOUR YOUNG WIND-BREAK TREES CHEAPLY AND EFFECTIVELY—you can use the wire taken from another fence when you have the—

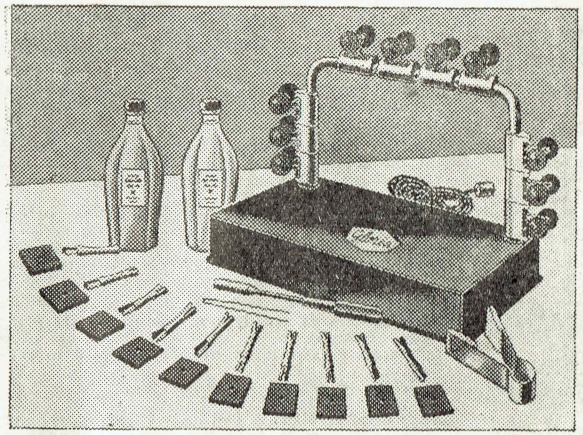
"SAFESTOCK"

PERM Your Hair— YOURSELF—at Home

Yes! Now you can cut out those tedious time-wasting hairdressing appointments. All you need is—

The "GLORIA" HOME PERMANENT WAVE Outfit

With the "GLORIA" Outfit you will be able to PERM YOUR OWN HAIR IN YOUR OWN HOME, easily obtaining a PERM of professional quality — waves and curls of lasting loveliness, with self-setting ends. The "Gloria" is ready for service any time of the day or night. The parts of the "Gloria" Outfit are extremely easy to use, and by following the instructions you will immediately be able to "perm" your own hair and also that of other members of the family, if desired!



ASSURES A PERM OF PROFESSIONAL QUALITY. We illustrate the complete outfit above. It is, in principle, the same as used in any modern Beauty Salon. No experience or training is necessary with the "GLORIA" Permanent Wave Outfit. Those who live in the country will find this outfit will soon pay for itself by the saving of time and expense of going to town for perms.

Complete Outfit **£5/14/-** only. Cat. No. SE105

Includes: 130-watt, 230-volt Permanent Waving Machine; 10 Heater Clamps; 10 Spring Winding Rods; 10 Rubber Pads; 1 bottle Waving Solution; 1 bottle Setting Lotion; 1 Damper; 1 Winder; 1 Instruction Book. Extra Parts and Refills of Waving and Setting Solutions can be bought separately.

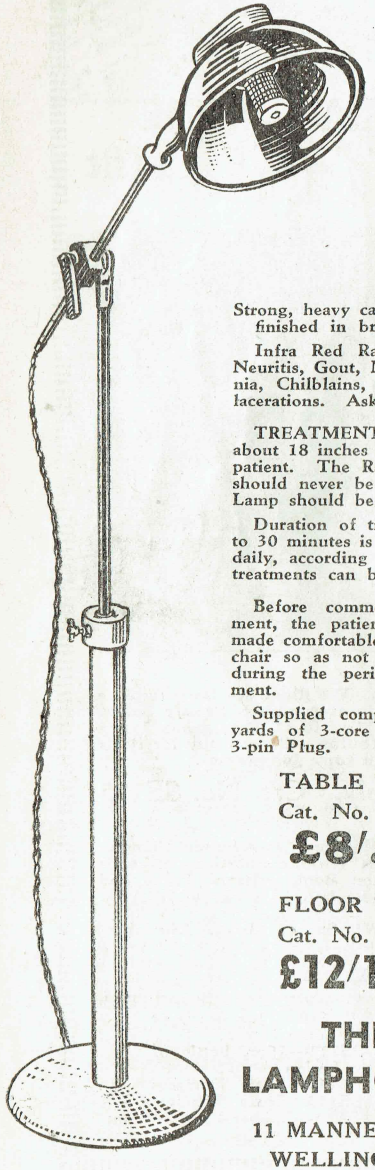
Our Guarantee Protects You! SEND FOR ONE NOW! Spares Always Available!

GLORIA WAVER SPARES

	Each
Cat. No. SE106—Heating Clamps	4/3
Cat. No. SE107—Curling Rods . .	2/2
Cat. No. SE108—2½oz. Bottle of Waving solution	3/3
Cat. No. SE109—10oz. Bottle of Waving Solution	10/9
Cat. No. S.E. 110—2½oz. Bottle of Setting Lotion	2/2
Cat. No. SE111—10oz. bottle of Setting Lotion	5/6
Cat. No. SE112—Spare Dampers	4/6
Cat. No. SE113—Spare Winders	4/4
Cat. No. SE114—Rubber Pads	2/3 doz.

HAYMAN'S INFRA RED MEDICAL LAMPS

As supplied to the Auckland Hospital Board and many other hospitals throughout New Zealand. These Lamps allow you to obtain exactly the same Infra Red treatment as given in many of the leading hospitals. Specially designed for use in Hospital Massage Departments, Surgeries, Clinics, Convalescent Homes, Institutions, and in private homes.



SPECIAL FEATURES INCORPORATED ARE:

Infra Red Radiating Element, emitting genuine Infra Red Rays, specially designed for heavy duty performance and long life; tested and proved by medical experts.

Non-luminous type Element.

Special brightly polished reflector to give the right focus of rays to location under treatment.

Switch on bowl to control the Element without disconnection of Wall Plug or Light Socket.

Strong, quick-fixing swivel joints which hold the radiator down firmly in any desired position, vertical or horizontal, with a very wide range of movement.

Strong, heavy cast base prevents standard from falling over. Attractively finished in bright nickel-plating, and wrinkle-finish baked enamel.

Infra Red Ray treatment is recommended for Rheumatism, Sciatica, Neuritis, Gout, Neuralgia, Lumbago, Toothache, Earache, Sprains, Insomnia, Chilblains, Boils, Septic Sores, and for healing open wounds and lacerations. Ask your Doctor.

TREATMENT: Apply the Rays to the bare skin, keeping the bowl about 18 inches away, or according to the sensitiveness of the skin of the patient. The Rays should always be a comfortably strong warmth, and should never be allowed to be so close as to be unbearably hot. The Lamp should be adjusted to suit individual requirements.

Duration of treatment should be according to medical advice, but 20 to 30 minutes is usually long enough for the first treatment, 2 or 3 times daily, according to the ailment and measure of relief received. Longer treatments can be given when accustomed to the Rays.

Before commencing treatment, the patient should be made comfortable in a bed or chair so as not to be weary during the period of treatment.

Supplied complete with 4 yards of 3-core flexible and 3-pin Plug.

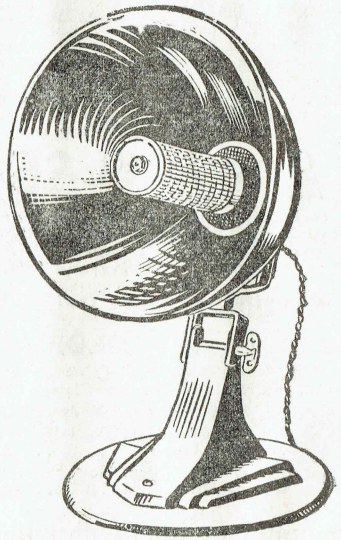
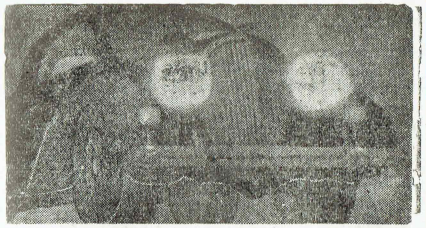


TABLE TYPE
Cat. No. SE86
£8/5/-

FLOOR TYPE
Cat. No. SE85
£12/10/-

THE LAMPHOUSE
11 MANNERS ST.,
WELLINGTON.

MOTOR CAR LAMPS



We can supply Lamps for any type of car, including types with special caps, and if you are in doubt about the type to order, send a sample.

6/8 VOLT SINGLE CONTACT SINGLE FILAMENT LAMPS

Cat. No.	Candle Power.	Equivalent Wattage.	Location.	Price
SL300	6	5	Tail	1/5
SL302	15	12	Stop	2/4
SL303	21	20	Head	2/4
SL304	32	25	Head	2/4
SL305	50	35	Head	2/4

6/8 VOLT DOUBLE CONTACT SINGLE FILAMENT LAMPS

Cat. No.	Candle Power.	Equivalent Wattage.	Location.	Price
SL306	6	5	Tail	1/5
SL308	15	12	Stop	2/4
SL309	21	20	Head	2/4
SL310	32	25	Head	2/4
SL311	50	35	Head	2/4

12/16 VOLT SINGLE FILAMENT SINGLE CONTACT LAMPS.

Cat. No.	Candle Power.	Equivalent Wattage.	Location.	Price
SL312	6	5	Tail	1/5
SL314	15	12	Stop	2/4
SL315	21	20	Head	2/4
SL316	32	25	Head	2/4
SL317	50	35	Head	2/4

12/16 VOLT SINGLE FILAMENT DOUBLE CONTACT LAMPS.

Cat. No.	Candle Power.	Equivalent Wattage.	Location.	Price
SL313A	6	5	Tail	1/5
SL315A	15	12	Stop	2/4
SL316A	21	20	Head	2/4
SL317A	32	25	Head	2/4
SL318	50	35	Head	2/4

6/8 VOLT DOUBLE FILAMENT HEAD LAMPS WITH STANDARD DOUBLE CONTACT CAP.

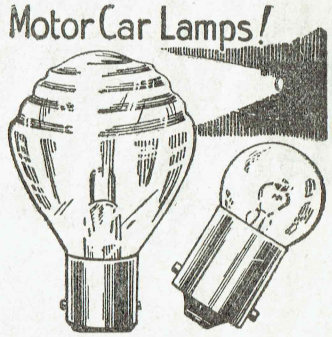
Cat. No.	Candle Power.	Equivalent Wattage.	Price
SL319	21/3 (Ford)	20/3	2/9
SL320	32/6	25/5	2/9
SL321	21/21	20/20	3/6
SL322	32/32	25/25	3/6
SL323	50/50	35/35	3/6

12/16 VOLT DOUBLE FILAMENT HEAD LAMP WITH STANDARD DOUBLE CONTACT CAP.

Cat. No.	Candle Power.	Equivalent Wattage.	Price
SL327	21/3	20/3	2/9
SL328	32/6	25/5	2/9
SL329	21/21	20/20	3/6
SL330	32/32	25/25	3/6
SL331	50/50	35/35	3/6

6/8 VOLT LAMPS WITH SPECIAL CAPS.

Cat. No.	Location.	Wattage.	Cap.	Price
SL350	Head	25/25	Prefocus 836	4/10
SL351	Head	35/35	Prefocus 836	4/10



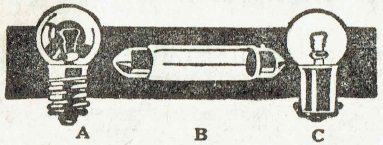
12/16 VOLT LAMPS WITH SPECIAL CAPS.

Cat. No.	Location.	Wattage.	Cap.	Price
SL373	Head	25/25	Prefocus 836	4/10
SL374	Head	35/35	Prefocus 836	4/10

MOTOR CAR FUSES

Cat. No. SS167— 5 amp.
Cat. No. SS168—10 amp.
Cat. No. SS169—20 amp.
} 4D. each 1/6 box of five.

MOTOR CAR LAMPS AND BATTERIES



A B C

A—Ignition Indicator Min. Screw.

B—Trafficator.

C—Ignition Indicator Min. Bayonet Cap.

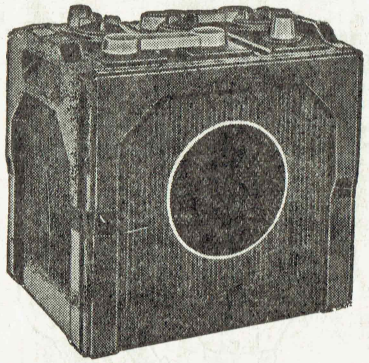
SPECIAL INTERIOR LAMPS, ETC., 6/8 Volts.

Cat. No.	Location.	Size. M.M.	Cap.	Price
SL335	Trafficator	38 x 7½	Tubular 2-cap	1/9
SL336	Festoon	43 x 15	Tubular 2-cap	1/9
SL337	Festoon	32 x 15	Tubular 2-cap	1/9
SL338	Ignition Indicator	—	Min. Screw	1/3
SL339	Ignition Indicator	—	Min. B.C.	1/3
SL340	Dash Board Dial	—	Min. B.C.	1/5

SPECIAL INTERIOR LAMPS, ETC., 12/16 Volts.

Cat. No.	Location.	Size. M.M.	Cap.	Price
SL341	Trafficator	38 x 7½	Tubular 2-cap	1/9
SL342	Festoon	43 x 15	Tubular 2-cap	1/9
SL343	Festoon	32 x 15	Tubular 2-cap	1/9
SL344	Ignition Indicator	—	Min. Screw	1/3
SL345	Ignition Indicator	—	Min. B.C.	1/3
SL346	Dash Board Dial	—	Min. B.C.	1/5

Oxford Motor Car BATTERIES



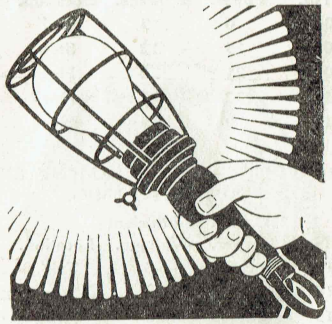
Eighteen months' unconditional guarantee. Solidly built H.D. leak-proof batteries. Thick plates built in N.Z. for N.Z. conditions.

Thick Plates—Carefully Sealed Cells—

Long Life Guaranteed.

Cat. No.		Price
SA40	6-volt, 9-plate. Width 7in. x length 7in. x height 9in.	£3/10/11
SA41	6-volt, 11-plate. English. 7in. x 7⅝in. x 9in.	£3/19/6
SA42	6-volt, 11-plate. Squat.. 7in. x 7⅛in. x 7½in.	£3/19/6
SA43	6-volt, 13-plate. 7in. x 9¼in. x 9in.	£4/6/4
SA44	6-volt, 13-plate. Squat. 7in. x 9¼in. x 7½in.	£4/6/4
SA45	6-volt, 15-plate. 7in. x 10⅜in. x 9in.	£4/17/11
SA46	6-volt, 15-plate. Squat. 7in. x 10⅜in. x 7⅛in.	£4/17/11
SA47	6-volt, 17-plate, 7in. x 11½in. x 9in.	£5/16/7
SA48	6-volt, 17-plate. Squat. 7in. x 11½in. x 7½in.	£5/16/7
SA49	6-volt, 19-plate. 7in. x 12⅝in. x 9in.	£6/7/4
SA50	12-volt, 7-plate. 7in. x 11½in. x 9in.	£5/19/3
SA51	12-volt 9-plate, 7in. x 12⅞in. x 9in.	£6/7/4
SA52	12-volt, 11-plate. 7in. x 14⅜in. x 9in.	£8/0/3
SA53	12-volt, 11-plate. Squat. 7in. x 14⅜in. x 7½in.	£8/0/3
SA54	6-volt, 7-plate. Motor Cycle. 3½in. x 4½in. x 6½in.	£2/1/8

HANDY! SAFE!



The ideal INSPECTION LAMP for workshops, garages, factories, etc. Take the light where you want it most. Wood handle, strong wire protective frame. Fitted with bakelite shockproof lampholder.

Cat. No. SE95 .. .. .. **18/6**

MOTOR CAR CONNECTORS

Useful Connectors for motor car radio installation, etc.

Cat. No.

SS10	Plug	8d. each
SS11	Socket	1/- each
SS12	Socket with space for fuse	1/3 each

C.O. HOUSEHOLD PRODUCTS

An excellent liquid polish for use with vacuum cleaners, mops, etc. ½-pint tins.

Cat. No. SU305 .. .. **1/8** each

Cat. No. SU303—Black .. .. **7½**D. tin

Cat. No. SU304—Dark Brown.. **7½**D. tin

Also White Canvas Cleaner.

Cat. No. SU301 .. .. **1/5** bottle

Cat. No. SU306 .. .. .. **1/5**

For your car, linoleum, etc.

Cat. No. SU300 .. .. .. **1/4½**

Germs' No. 1 enemy. 6 oz. bottles.

Cat. No. SU307 .. .. .. **1/2½**

Mechanics, farmers, housewives, etc., will appreciate the dirt-removing qualities of GREASE CHASER. Packed in useful jar with screw-top lid.

Cat. No. SU302 .. .. **1/8** each

Ditto in tins—SU302A .. .. **1/6** each

STUCKA PHENONIC CEMENT

For repairing Wood, China, Bakelite, Glass, in fact, Stucka will stick anything which can be mended. Can also be used as insulating varnish, for doping coils, etc.

Cat. No. SU160 .. .. .. **2/3** jar

"3-IN-ONE" OIL

"3-in-One" works miracles in brightening dull furniture and woodwork. A few drops on any soft cloth wrung out in water give you a dusting and polishing cloth that not only polishes but also cleans and protects the finest finish. Use it for all appliances.
Cat. No. SU151—

Contents 3oz., in bottle **1/10½**

LIQUID CASEIN GLUE— "ATAGLUE"

Waterproof. A high-class, ready to use, casein liquid glue. Ataglu eliminates loss of time preparing hot glues. Does not stain. Gives a better spread than ordinary cold glues.

Cat. No. SU157 .. .. Tin **1/10½**

Electro-shine

Rubbed on
BRASS, COPPER or BRONZE
gives a brilliant
SILVER finish
Clean article thoroughly and apply Electroshine with soft cloth. If used outside, cover finished article with lacquer.

Cat. No. SU1 .. **2/3** bottle.

PATCHING SOLUTION.

"Panacs" Rubber Patching solution for Motor Car, Bicycle, and all rubber repairs. Supplied in handy Tube.

Cat. No. SU158 .. .. .. **1/-** each

C.M. PUTTY.

Ready for use, simply by mixing with water. Dries rock hard without shrinking. Easy to apply, and can be used on wood, plaster, stone, and similar material. Can be coloured or varnished.

Cat. No. SU163 .. .. **1/8** per tin

SU165—Large size (16oz) .. **2/8** per tin

C.O. WOOD WAX.

Stain and polish combined in one. A highly concentrated wax polish and a rich stain combine for imparting a lasting brilliance, concealing scratches and restoring colour to furniture, window ledges, stained floors, radios, leather, etc., etc.

Cat. No. SU309 .. .. **1/5**

C.O. METAL POLISH.

Brightens brass brilliantly. For cleaning all metals, and nickel plate.

Cat. No. SU308 .. .. .. **1/1½**

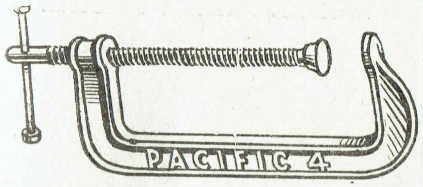
"ATAMAX"

Efficient cleaner for Gas and Electric Stoves. Removes old grease with speed and ease, even though the grease has been on for years.

Cat. No. SU164 .. .. .. **2/-**

"G" CLAMPS

Handy Clamps for your workshop. Malleable Iron.



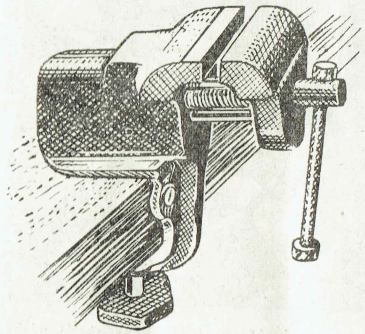
Cat. No. SU701 4in. jaw **13/9**
Cat. No. SU702 6in. jaw **15/6**
Cat. No. SU703 8in. jaw **27/-**
Cat. No. SU704 10in jaw .. **34/-**

HACK-SAW BLADES

BEST QUALITY.

Cat. No. SU700 .. .. .. **6D.** each

BENCH VICE



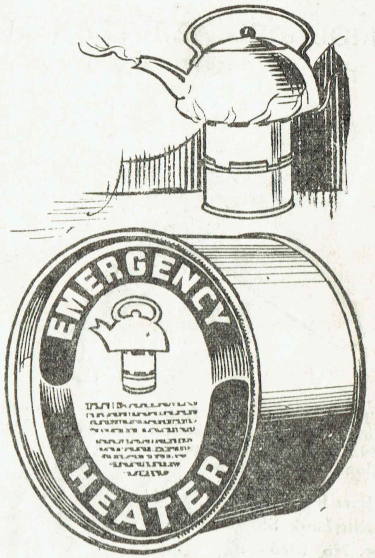
A tool which should be in every workshop. Complete with fixing clamp. Width of jaws 2 in., jaw expansion 1¾ in.

Cat. No. SU710 ..... **21/-** each

SUPREMACY

The New and Fascinating Game that is Sweeping New Zealand!

EMERGENCY HEATERS.



Every home should have at least one of these Emergency Heaters on hand. Tin contains solid fuel, which ignites immediately a match is applied. Supplied complete with tin kettle rest as illustrated.

Each tin contains sufficient heat to boil approximately 12 pints, and boils one pint in about 5 minutes. Besides being invaluable in an emergency, these Heaters are ideal for picnics, launches, camps, or week-end baches.

Extinguished by simply placing the lid on tin.

Cat. No. SU44—Emergency Heater with Kettle Support **5/9**

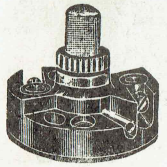
Cat. No. SU145—Fuel Refills .. **3/9**

NEW GRIP.

Universal cellulose cement and adhesive. Mends crockery, glassware, canvas, leather, paper, etc. Mends everything except rubber. Supplied in handy tube.

Cat. No. SU156 ..... **1/7** each

TABLE LAMP SWITCH



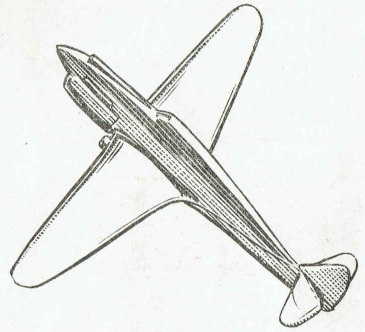
Small Push Button for mounting in the base of table lamps, etc. Single hole mounting.

Cat. No. SG117

3/9 each

JOYS FOR BOYS

MOULDED AEROPLANES



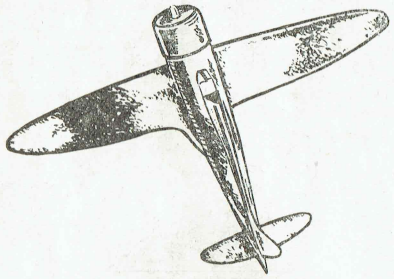
These are moulded from Bakelite to drawings issued by the Aeronautical Production Dept., R.N.Z.A.F., and are produced to teach recognition of friendly and enemy aircraft.

Excellent toy, or a useful decoration.

Kittyhawk SS/F Model. Mottled Bakelite.

Cat. No. SU6 .. .. .. **3/6** each

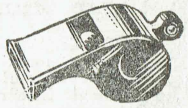
SU7—Cream Perluxe Ware .. **6/-** each



Model of Mitsu SS/F, in attractive mottled Bakelite. Size 8½in. x 6in.

Cat. No. SU11-Special Reduced Price **3/-** ea.

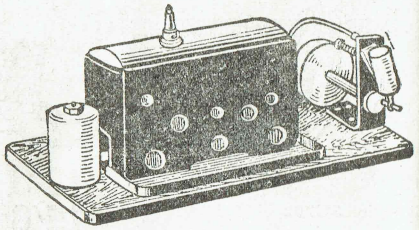
WHISTLES



Nickelplated Whistles, as used by E.P.S. Wardens, etc.

Cat. No. SU5 .. .. **1/3** each

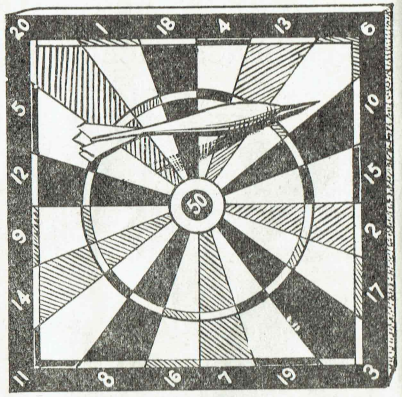
MODEL STEAM ENGINE



Real working model for driving models, etc. Uses methylated spirits for heating. Safety valve provided. Limited quantity only available. Ideal present for boy.

Cat. No. SU3 .. .. .. **37/6**

DART BOARDS



The good old game of Darts, made of Pinex, these boards will stand any amount of hard wear. Size of board 9¾ x 9¾.

Cat. No. SU8—Board ..... 1/6 each

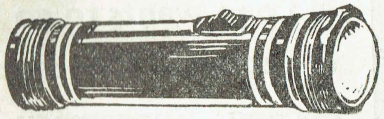
Cat. No. SU9—Darts ..... 4½d. each

DOMINO SETS

Sets of Dominoes, made from heavy cardboard. Clearly marked; long lasting

Cat. No. SU10 ..... **11½D.** set

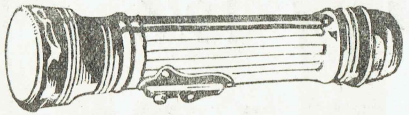
TORCHES



"Usalite" standard 2-cell Torches. Metal case. Reliable switch. Made in U.S.A. Non-focus broad beam type. Complete with lamp.

Cat. No. ST803 without Batteries **7/-**

Cat. No. ST803A with Batteries **8/3**

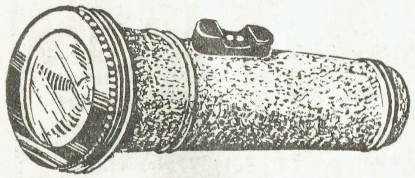


USALITE BABY—ST806

Usalite "Baby" Two-Cell Torch, takes 2 baby unit cells (935). Metal case. A reliable small torch. Complete with bulb.

Cat. No. ST806—Without Batteries **6/10**

Cat. No. ST806A—With Batteries .. **8/1**



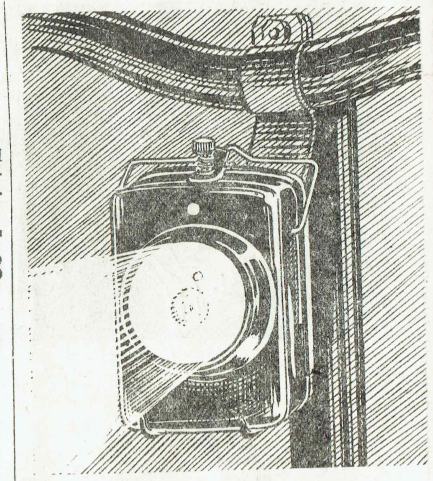
VICTORY—ST804

Victory Torch, takes two standard unit cell batteries. Moulded case. Solid, easy to work switch. Complete with bulb.

Cat. No. ST804—Without Batteries **12/3**

Cat. No. ST804A—With Batteries **13/6**

CYCLE LAMP



British made Cycle Lamp, with fixing bracket. Moulded back. Switch on top. Complete with bulb.

Cat. No. ST802—Without Battery **5/-**

ELECTRIC JUGS

Ambrico Electric Jugs — Cream Porcelain type, 3 pint size. Fitted with patent element which cannot be burnt out, even if jug is boiled dry. Complete with appliance plug without cord.

Cat. No. SE821 ..... **37/6** each

(When available cord can be supplied at about 1/- yard extra.)

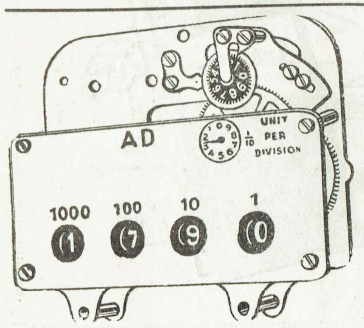
MAJESTIC IRONS

Tailors' and Laundry Irons—Can only be supplied to essential users.

SE724—8½lb. Laundry Irons .. **£4/2/6**

SE719—10lb. Laundry Irons .. **£4/5/-**

SE720—12lb. Tailors' Irons ..... —



K.W.H. COUNTERS

An exceedingly useful unit, which can be put to a variety of uses by the average experimenter. Can be adapted to count turns when winding coils, chokes, transformers, etc. Will register up to 9,999 9-10ths and down to 1-10th of turn. These units have been removed from electricity measuring meters and can be adapted by the experimenter or engineer to do any counting job.

Cat. No. SU140 ..... each **2/6**

RADIO SECTION

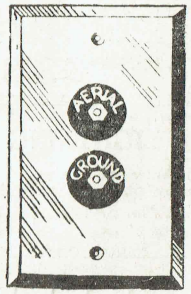
AERIAL EQUIPMENT

AERIAL EARTH PLATES

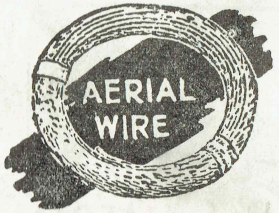
Eliminate unsightly wires to your set, having them concealed in the wall. Beautiful bakelite plate. Has attractive and neat appearance.

Cat. No. SA431—

3/2 each



AERIAL WIRE—Plain Copper



Cat. No. SA252—7/22, 100ft. 6/-

Cat. No. SA254—7/22, 50ft. 3/1

Cat. No. SA267—7/22, 100ft., Tinned

LEKTRITE

11-strand Conductors with a strong compounded insulation which is waterproof. Suitable for both indoor and outdoor use.

Cat. No. SA268—25ft. coils .. ..

Cat. No. SA269—50ft. coils .. ..

Cat. No. SA270—75ft. coils .. ..

Cat. No. SA271—100ft. coils .. ..

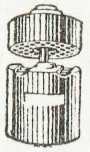
INSULATORS—EGG

Egg Insulators are almost universally used in N.Z. To secure good results you should put two or three on each end of the aerial. N.Z. made.

Cat. No. SA313 .. .. .. **4**D. each

CLAMP INSULATORS

Used for taking wires along outside walls, etc. Made in two pieces, and when screwed up, grip the wire and make a neat and efficient job. 1¾ in. high, 1⅜ in. diameter.

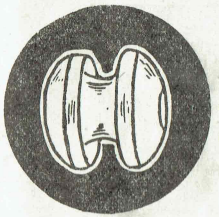


Cat. No. SA351 .... **7**D. each

Fence Button INSULATORS

1¾in. x 1¼in. Specially made in N.Z. for electric fences.

Cat. No. SA354 — **4**D. each. **3/10** doz.



INSULATORS

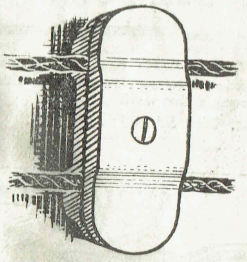
Corner type. For electric fences.

Cat. No. SA355—

10D. each

CLEAT INSULATORS.

Cleat Insulators for running two wires along walls, etc. 2¾in. long, 15/16in. wide, ¾in. high.



Cat. No. SA356—

7D. pair

ENSIGN LEAD-IN WIRE

Tough rubber-covered Lead-in Wire. Very flexible. Will withstand constant swaying. Diam. 4 mm.

Cat. No. SA258

4D. yard

LAMPHOUSE ANNUAL

This Catalogue contains particulars of goods which we expect to have in stock during the 1944/5 Radio season. There are times when certain lines will be out of stock. When ordering, please advise whether you wish us to substitute with the nearest goods available, or not.

AERIAL EQUIPMENT

PULLEYS—GALVANISED

SA412

SA413

1 in. Galvanised Pulleys for halyards, etc.
Cat. No. SA412 .. .. .. each

NON-JAM PULLEYS

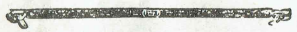
These pulleys are specially constructed so that the guy wire cannot jam. Heavily galvanised.
Cat. No. SA413 .. .. .. each

LEAD-INS, EBONITE

Lead-ins are used for putting through the wall. Consists of brass rod insulated with ebonite. With a nut and washer on each end. Diameter ⅜ in.

Cat. No. — Each
SA402—Ebonite Lead-in, 9in. long .. 1/-
SA404—9in. x ½in. diameter, heavy Ebonite Lead-in. 1/3

WINDOW LEAD-INS



This type is flexible and can be fitted under windows, when it is not desired to bore a hole through the wall.
Cat. No. SA405 .. .. .. 8D. each

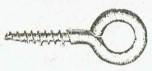
AERIAL CLEATS

Galvanised iron cleats for securing halyard ropes.
Cat. No. SA414— 7D. each

STAPLES

Coppered Staples (not insulated), for fastening earth wires, etc.
Cat. No. SS119—

GALVANISED SCREW EYES

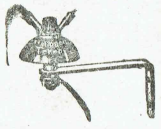


Cat. No. SA411—Galvanised Screw Eyes 4D. ea.

BRACKET TYPE

LIGHTNING ARRESTORS

Here is a de luxe approved Lightning Arrestor which is not only efficient in every respect, but will give an enhanced appearance to your aerial system. Supplied complete with fixing bracket as illustrated.

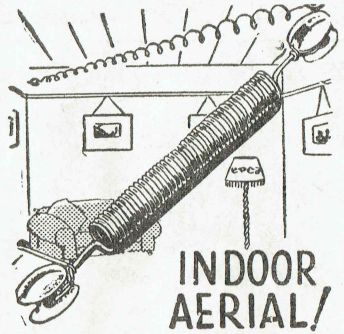


Cat. No. SA427 3/6 ea.

LIGHTNING ARRESTORS

American type. Glazed porcelain with terminals.

Cat. No. SA429 1/3 each



An indoor spring type aerial that will stretch out to about 12 feet across an ordinary room, and will remain in its spiral form. Made from pure copper wire.
Cat. No. SA285 ..... 3/3 each

THE WORLD'S BEST AERIAL

Mastless. No unsightly pole required. Enables you to tune in stations never heard before on your set. Neat and unobtrusive, yet the last word in aerial efficiency. The Mastless enables everyone, even flat-dwellers, to obtain an unobtrusive outdoor aerial at minimum cost and inconvenience of erection, yet giving the maximum efficiency.

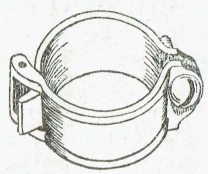
Designed by experts on the latest scientific principles, the Mastless Aerial has received the unqualified approval of the world's best-known radio authorities.

The cost of the Mastless Aerial is definitely less than that of erecting a pole aerial. It can be erected in 20 minutes by anyone who can knock in six nails, and once fixed cannot be blown down. Complete with fittings.
Cat. No. SA296. Postage 1/3 extra. 19/-

EARTH CLAMPS

Heavy brass type, N.Z. made. Will ensure a good permanent earth on a water pipe, etc.

Cat. No. SA436—
½in. water pipe size (will fit pipes up to ¾in. outside diameter). 9D. each



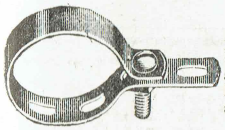
Cat. No. SA437—
¾in. water pipe size (will fit pipes up to 1in. outside diameter). 10D. each

Cat. No. SA438—1in. water pipe size (will fit pipe up to 1¼in. outside diameter). 11D. ea.

EARTH TUBES

Coppered Earth Tube. When hammered into the ground will make a good earth connection. Provided with screw for attaching earth wire. 27in. long.
Cat. No. SA433 ..... 3/2 each

EARTH CLIPS



Light adjustable pattern. Has a number of holes so that screw can be shifted. Fits practically all sizes of pipes.
Cat. No. SA434 ..... 3D. each

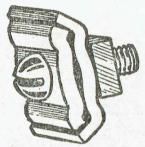
WIRE, TINNED EARTH

7/.029 Bare Tinned Copper Earth or Aerial. Wire.
Cat. No. SA264—7lb. coils, per coil 29/6
Cat. No. SA267—100ft. coils, per coil

KNIFE SWITCHES

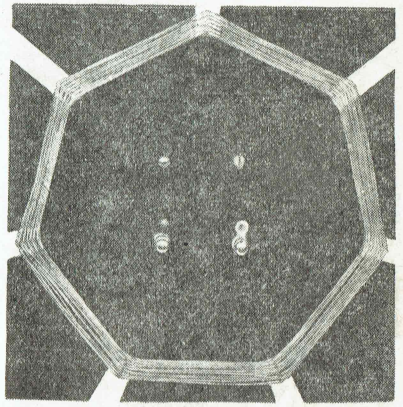
Single Pole Double Throw Aerial-Earth Switches. Bakelite base. British.
Cat. No. SS490 .....

AERIAL WIRE CONNECTOR



Recommended for use in any type aerial system for splicing or connecting wires without soldering. A positive and permanent mechanical and electrical connection is assured by tightening the screw. Made of heavy guage steel, cadmium plated.
Cat. No. SA408 ..... 6D. each

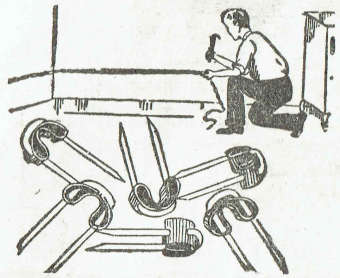
AERIAL FOR PORTABLES



Loop Aerial for portable receivers, matched for standard Ensign Coils and fitted with primary winding for use with ordinary aerial when required. Physical dimensions 8in. x 7¾in.
Cat. No. SA300 ..... 12/-

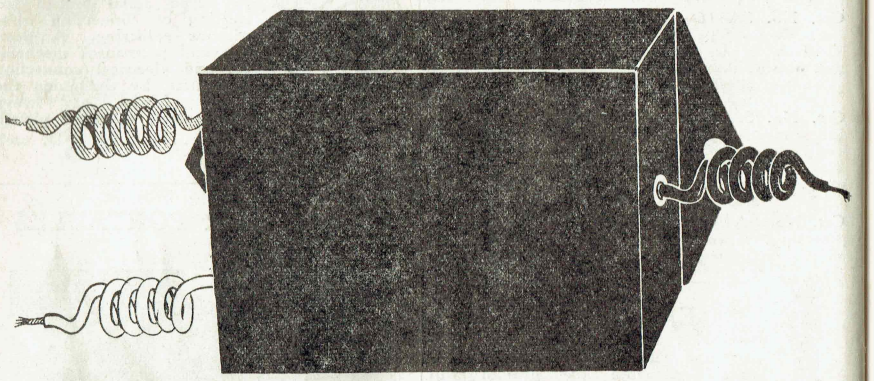
INSULATED STAPLES

Makes a Neat Job!



Insulated Staples are used by all who wish to make a neat job. The fibre insulation in these staples protects the wire and guards against loss of signal strength. British made.
Cat. No. SS118 ..... 3½D. doz.

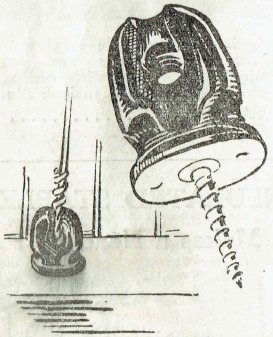
THE NOTENNA AERIAL ELIMINATOR.



Equally successful on both broadcast and shortwaves. Replaces aerials of all types. Very compact size. No lightning arrestor required. Reduces noise, interference and man-made static. Simply attached between aerial and earth terminals on your set and to earth wire. Money back if you are not more than satisfied. Dimensions 4in. x 2¼in. x ⅜in.

Cat. No. SA310 ..... **8/5**

HOUSE INSULATOR



Used for insulating electrical equipment from the house. Very solidly constructed; has a screw of 2 in. length and the porcelain portion measures 3 in. x 2½ in.

Cat. No. SA327 ..... **2/4** each

BUY UNDER THE LAMPHOUSE GUARANTEE

Any goods that prove in any way unsuitable may be returned within seven days from receipt and your money will be refunded in full.

LAMPHOUSE CIRCUIT BOOK

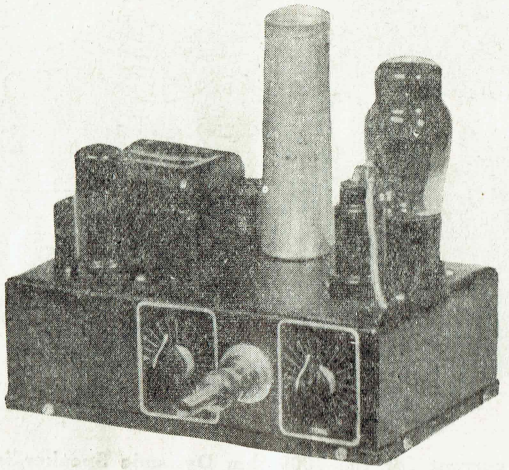
Contains 80 pages, with about 200 different circuits. This book has been prepared in response to hundreds of inquiries which we receive for a publication containing a comprehensive range of Radio circuits. All the circuits have already appeared in various numbers of the Lamphouse Annual or the "Radiogram," and no claim is made that the book contains new circuits.

Radio enthusiasts will find the book of great use for reference purposes. Circuit diagrams only are given, there being no constructional details. The circuits include Electric Fences, Power Packs, S.W. Converters, Wave Traps, Testing Equipment, Code Oscillators, Aerial Systems, Amplifiers, Crystal Sets, and Electric and Battery Sets of every description.

LAMPHOUSE RADIO CIRCUITS—PRICE 2/6. Postage 3d.

Cat. No. SB100.

VICTORY JUNIOR AMPLIFIER



Cat. No. SR851. (Speaker Extra) Price **£8/19/6**

Features include Mike and Gramophone Input, Full Range Tone Control, Inverse Feedback, 5 watt output.

A small Amplifier which will give astounding reproduction. Compact and attractive, suitable for Velocity, Crystal and Dynamic Microphones, continuously Variable Tone Control.

Wide range frequency response, Hi-Fidelity Phone Reproduction.

TECHNICAL SPECIFICATIONS.

Peak Output, 8 watts; Rated Output, 5 watts; Input, Microphone and Gramophone; Gramophone gain, 76 D.B.; Hum Level, 55; Variable Tone Control; Output Impedence, 5,000 ohms to Speaker Transformer.

HERE IT IS! New Zealand's Miracle Amplifier Value!

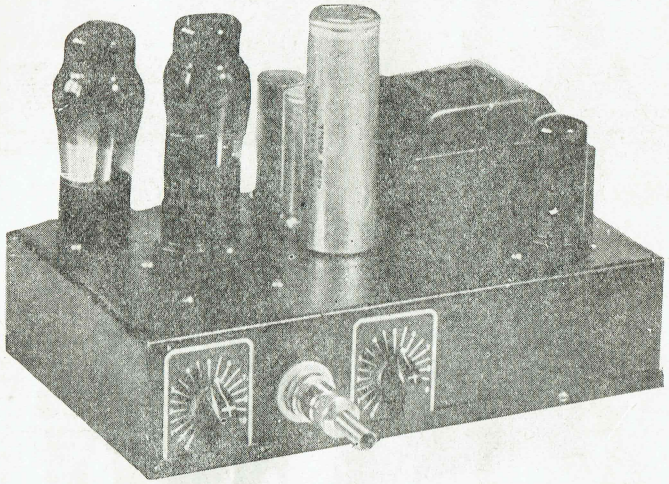
This 5-watt Amplifier offers to users of small P.A. equipment the Lowest price high-gain Amplifier available on the market to-day, its competition-defying price indicates no compromise in quality.

VARIABLE TONE CONTROL.

Control is provided for compensation of accoustics when using in various locations. An ideal Amplifier for Offices, Stock Rooms, Cafeterias, and Restaurants, Factories, Window Demonstrations, Meetings, and Small Orchestras, etc.

The Victory Amplifier offers for the first time an intermediate Power Amplifier with every feature usually found in units selling at double the price. Splendid for use in Meeting Halls, Office Systems, Night Clubs, Auction Rooms, etc.

VICTORY SENIOR AMPLIFIER



The field current for the 1000-ohm Dynamic Speaker is supplied by the Amplifier. Cat. No. SR850 .. .. Price **£11/12/6**

Amplifier as described, but with addition of microphone "Pre-Amp" stage. Cat. No. SR852 .. .. **£13/12/6**

Features include MIKE and GRAMOPHONE INPUT.

POLARIZED CONNECTIONS. BEAM POWER OUTPUT
FULL-TONE CONTROL. VARIABLE PHASE INVERTER.

A high-quality low-cost Amplifier intended for installations where moderate coverage is required. Suitable for Dance Halls, Public Meetings and small Outdoor gatherings. Comes complete, ready to connect up quickly and easily.

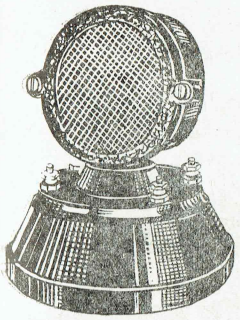
Full 10w. output with remarkably true Tonal Fidelity. Variable Tone Control is provided to accentuate bass or treble as desired and to aid in compensating for varying accoustical conditions. Each Amplifier is carefully tested before despatch to make sure of perfect operation when it reaches you.

LATEST CIRCUIT.

Latest valves used 1 5Z4, 1 6N7, 2 6V6G.

Suitable Speaker for the above Amplifier is Rola Model F.12 (Extra).

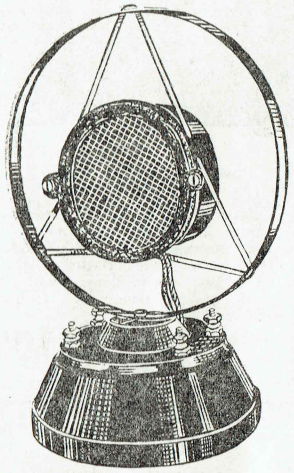
THE LAMPHOUSE, 11 Manners Street, Wellington, C.1.



TELSEN MIKE

Suitable for the experimenter and home amusement. Fitted in a bakelite case containing all the terminals necessary and special matching transformer. Only requires a 4½ volt battery to energise it. Complete with full instructions.

Cat. No. SM511 ..... **17/6** each

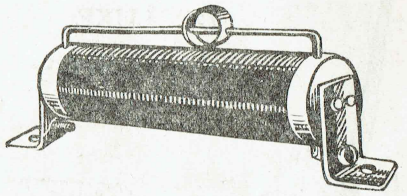


Is the same as the above mentioned microphone, but this type is constructed in a slightly better quality bakelite case.

Cat. No. SM510 ..... **22/-** each

ENSIGN 3 IN 1 TUNERS.

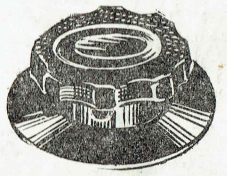
AERIAL TUNER WAVE TRAP
AERIAL ELIMINATOR



Depending on the manner it is connected, this useful piece of apparatus serves any of the above functions. Operates on any make or model of radio receiver, greatly enhancing the performance. As an aerial tuner it will improve the reception of weak stations. As a wave trap it will prevent interference between stations and improve selectivity. As an aerial eliminator it makes an outdoor aerial unnecessary. The tuner can also be used as the tuning coil of a crystal or other small set. Supplied complete with instructions and can be fitted by anyone in a few minutes. Size 5 in. long x 2¼ in. high and 1¼ in. wide.

Cat. No. SC300 ..... **4/6**

INSTRUMENT KNOB.



Black Moulded Instrument Knob, fits ¼ in. shaft. Metal inset. Fixed by grub screw. Diam. 2 in.

Cat. No. SD5 ..... **2/6** each

Heavy Duty MOTOR FILTER

This filter eliminates all noises which occur by reason of feed-back from power mains, and also electrical disturbances caused by such things as electric motors, refrigerators, violet ray plants, etc., and it has a carrying capacity of 5 amps. It is made specially for use with motors of the heavy duty type, such as used in factories, etc.

Cat. No. SF501 ..... **45/-**

FRACTIONAL H.P.

MOTOR FILTER

This filter eliminates all noises which occur by reason of feed-back from power mains, and also electrical disturbances caused by such things as electric motors, refrigerators, violet ray plants, etc. It connects between the offending motor and the power.

Cat. No. SF502 ..... **19/6**

MAIL ALL ORDERS TO

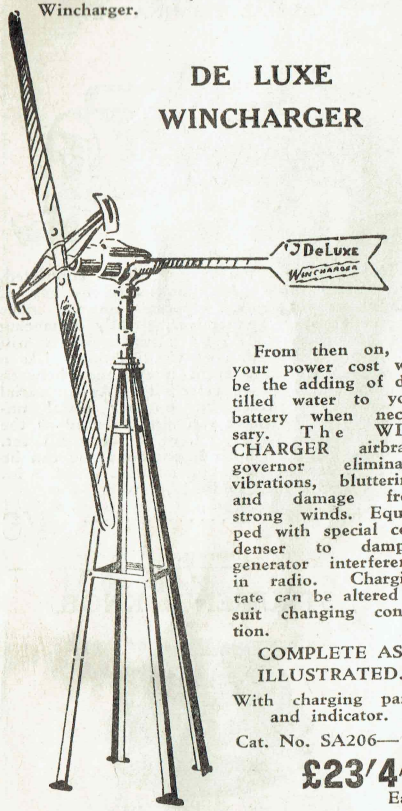
THE ELECTRIC LAMPHOUSE LIMITED,

11 MANNERS STREET, WELLINGTON, C.1.

FREE POWER

The wind will keep all your batteries charged Free the moment you install a De Luxe Wincharger.

DE LUXE WINCHARGER



From then on, all your power cost will be the adding of distilled water to your battery when necessary. The WINCHARGER airbrake governor eliminates vibrations, bluttering, and damage from strong winds. Equipped with special condenser to dampen generator interference in radio. Charging rate can be altered to suit changing condition.

COMPLETE AS ILLUSTRATED.

With charging panel and indicator.

Cat. No. SA206— **£23/4/-** Each

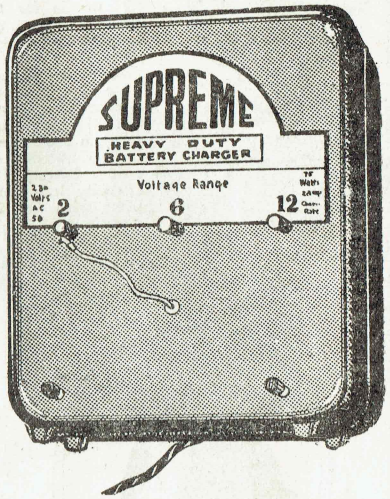
Length of Propellor, 6ft.

Height of Metal Stand, 10ft.

12-Volt Special Heavy Duty Model—

Cat. No. SA207 ..... **£43/10/-**

SUPREME BATTERY CHARGERS



Heavy duty type Battery Chargers. For operation from 230 Volt A.C. mains. Current consumption approximately 75 Watts. Will charge 2, 6, or 12 Volt Batteries at 2 amps. Size 9in. x 10½in. x 4in. deep. Complete with 3 wire cord, and instructions. Contained in strong metal case.

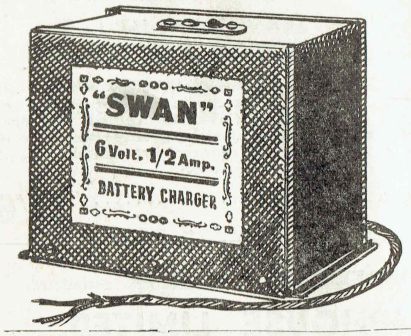
Cat. No. SA605 ..... **£10/15/-**

SPARE BULBS FOR BATTERY CHARGERS

(TUNGAR TYPE.)

Cat. No. SA189—2 amp. .....

Cat. No. SA190—6 amp. .....



TRICKLE CHARGER

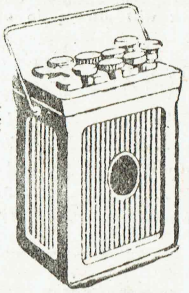
Never be stuck with a run down radio or car battery. These Chargers simply plug into a 230 Volt light socket or wall plug, and are then connected to your battery. Incorporates dry metal type rectifier. Size of case 5¼ in. x 4½ in. x 2¾ in.

Cat. No. SA607, ½ amp. **£4**

THE LAMPHOUSE, 11 Manners Street, Wellington, C.1.

OXFORD RADIO BATTERIES

OXFORD NON-SULPHATING SPECIAL TYPE RADIO BATTERIES



Heavy duty solidly constructed leak-proof Batteries that deliver maximum power. Thick plates, carefully sealed cells; built for long, enduring, trouble-free service. With radio type terminals. 18 months' unconditional guarantee.

Batteries are supplied dry unless specially requested otherwise. They can also be supplied charged and filled with acid, at no extra cost, but freight is payable by purchaser on all charged batteries.

Cat. No. SA20— 2-volt, 100 amp., 4½ x 7 x 9⅜ **£1/17/-**

Cat. No. SA22— 2-volt, 140 amp., 4½ x 7 x 9⅜ **£2/3/-**

Cat. No. SA23— 6-volt, 100-amp. 7 x 9¼ x 9⅜ **£4/7/10**

Cat. No. SA24— 6-volt, 140 amp., Type for Vibrators, 7 x 11½ x 9⅜ **£5/6/2**

Cat. No. SA26— 6-volt, 160 amp., Type for Vibrators, 7 x 12⅝ x 9⅜ **£6/3/3**

WORKS LIKE MAGIC

OLD BATTERIES MADE LIKE NEW!

"TAR-MAG" Battery Tonic

WHAT "TAR-MAG" DOES

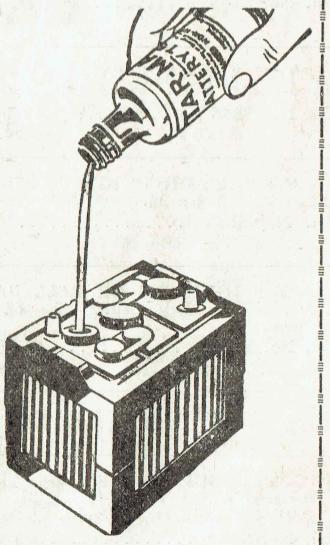
TAR-MAG dissolves the gradual deposit of Basic Sulphate of Lead crystals which impregnate the active paste material on the plates, thus preventing the electrolyte contacting with it, with the result the battery ceases to function although there is still plenty of life and usefulness.

TAR-MAG dissolves the crystals and enables the battery to function as new.

TAR-MAG will bring your old battery up to full strength—will increase life of new batteries up to 50 per cent.

For Better Lighting and Split-Second Starting, try TAR-MAG.

TAR-MAG is a liquid which is simply poured into the cells. Complete with instructions.



Cat. No. SA70—Charge for 6-volt Battery .. **2/9**

Cat. No. SA70A—Charge for 12-volt Battery **5/6**

DRY BATTERIES

FAMOUS EVEREADY BRAND OF BATTERIES NOW MANUFACTURED IN N.Z.

Batteries are in very short supply, sometimes being practically unprocurable. We cannot guarantee to execute orders, but will always do our best.

STANDARD TORCH REFILLS

Cat. No.		Each
SB31	—Standard Unit Cells	7½d.
SB32	—Baby Unit Cells	7d.
SB33	—Midget (Bijou 2-Cell)	7½d.
SB34	—Penlite (2-Cell)	10d.
SB36	—Cycle (2-Cell Twin)	1/6

RADIO BATTERIES

"A" BATTERIES

1½-VOLT "A" BATTERY—For home sets. Size 9¼ x 4¾ x 5⅝. Weight 10¾lbs.

Cat. No. SB55 ..... £1/3/8 each

1½-VOLT "A" BATTERY—For portable sets. Size 4¼ x 2¾ x 5¼. Weight 3lb. 2oz.

Cat. No. SB56 ..... 8/6 each

6-VOLT "HOTSHOT" IGNITION BATTERY Size 7¼ x 10⅜ x 2¾.

Cat. No. SB39 ..... 22/1

1½-VOLT IGNITION OR BELL BATTERY. No. 6 type Dry Cell. Size 6½ x 2½in. round.

Cat. No. SB40 ..... 3/9½ each

"B" BATTERIES

45-VOLTS SUPERDYNE—Large size "B" Batteries. Size 7⅞ x 4⅜ x 8⅛. Weight 11¼lbs. Tapped at 22½ volts.

Cat. No. SB42 ..... 24/1

BIAS or "C" BATTERIES

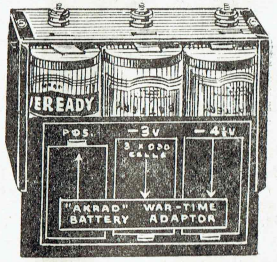
9-VOLT "C" BATTERY—Size 3⅛ x 1 in. x 5¼. Tapped at 1½, 3, 4½, 6, 9 volts.

Cat. No. SB51 ..... each

4½-VOLT "C" BATTERY—Size 3¾ x 1⅜ x 4. Tapped at 1½, 3 and 4½ volts.

Cat. No. SB50 ..... 3/1

4½-VOLT BATTERY CASES



Metal cases for holding 3 standard torch cells. Contacts are provided so that when cells are inserted the terminals on the top give — +3 and +4½ volts. When batteries are discharged they can be removed and new ones put in. In view of the acute shortage of low voltage batteries this is a very useful unit, especially for owners of small sets such as the Hikers One, etc.

Cat. No. SB1 ..... 5/6 each

4½-VOLT HEAVY DUTY BATTERIES

Made up from three heavy duty cells. Tapped at 3 volts.

Cat. No. SB52 ..... each

"ENSIGN" COILS

"ENSIGN" BROADCAST MIDGET COILS

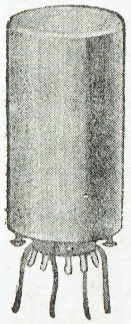
In 1⅜in. Square Cans.

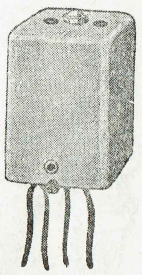
Cat. No. SC504—Aerial, high impedance, Litz 8/3

Cat. No. SC510—R.F., high impedance, Litz 8/3

Cat. No. SC517—Oscillator, 175 K.C., Litz 7/6

Cat. No. SC515—Oscillator, 465 K.C., Litz 7/6





"ENSIGN" BROADCAST OSCILLATOR COILS

Cat. No. SC513—175 K.C. on 1 in. Former in 2in. x 2½in. round cans 6/3

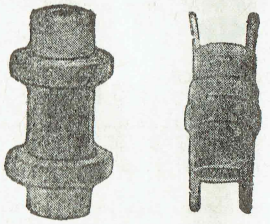
Cat. No. SC514—465 K.C. on 1 in. Former in 2in. x 2½in. round cans 6/3

Cat. No. SC515—465 K.C. on ⅜ in. Former in 1⅜in. x 2½in. square midget cans 7/6

Cat. No. SC516—465 K.C. on ⅜in. Former Unshielded Litz wound .. 4/9

Cat. No. SC517—175 K.C. on ⅜in. Former Litz wound in 1⅜ x 2½ in. square cans 7/6

I.F. BOBBINS.



Cat. No. SC526—175 K.C. Air Core .. 2/3

Cat. No. SC527—465 K.C. Air Core Litz wound 3/-

"ENSIGN" Intermediate Frequency TRANSFORMERS.

Cat. No. SC522—465 K.C. Iron Core Litz wound in 1⅜ x 3⅛in. square cans 12/6

Cat. No. SC523—465 K.C. Air Core Litz wound in 1⅜ x 3⅛in. square cans .. 11/6

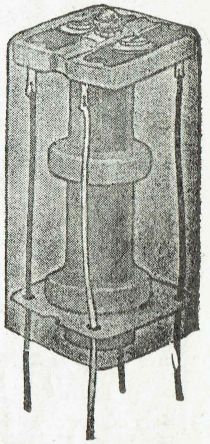
Cat. No. SC525—175 K.C. Air Core in 1⅜ x 3⅛in. square cans 10/6

Cat. No. SC520—550 K.C. I.F. Transformers 12/6

Note.—Cat. No. SC522 I.F.'s are recommended for use in High Fidelity Receivers.

I.F.'s.

ENSIGN I.F. TRANSFORMERS have been carefully designed by experts to give maximum results. Types suitable for midget, commercial or high fidelity receivers are available. These factors allow the experimenter and home constructor more scope than before when designing a receiver.



"ENSIGN" BROADCAST COILS.

In 2 in. Round Cans.

Cat. No.		Each
SC500	—Aerial Coils, low impedance ..	6/3
SC501	—Aerial Coils, high impedance ..	6/9
SC503	—Aerial Coils, band pass	10/6
SC507	—R.F. Coils, low impedance ..	6/3
SC528	—R.F., with reaction	7/3
SC513	—Oscillator Coils, 175 K.C.	6/3
SC514	—Oscillator Coils, 465 K.C.	6/3

Design, workmanship and materials are the main factors which govern the construction of ENSIGN solenoids and which justify their marked superiority in all fields.

All ENSIGN coils and I.F. transformers are matched and tested to standards, and are wax impregnated, ensuring even performance under any climatic conditions.

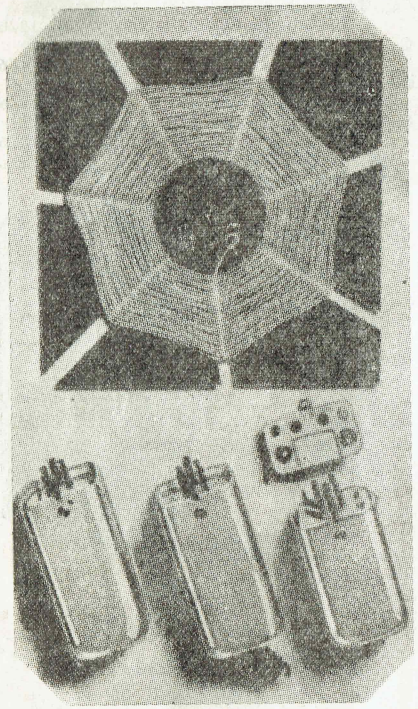
DUAL WAVE COIL KITS

Dual Wave Band Pass Coils, consisting of Aerial and Oscillator 465 K.C. Coils in 2 in. x 4 in. Aluminium Cans. Suitable for 6A7 or 6A8 Converter. Short Wave range 16-50 metres.

Cat. No. SC488 ..... 22/6 set

COILS AND COIL UNITS

"ENSIGN" PORTABLE COIL KIT.



Special Coil Kit for portable sets. Consists of "Ensign" Loop Aerial, 8in. x 8in. (matched to standard "Ensign" coils and fitted with primary winding for use with outdoor aerial when required); Midget Oscillator Coil; 2 "Ensign" Midget I.F. Transformers and Padder.

Cat. No. SC449 .... **44/-**

Aerial only. Cat. No. SA300 ..... **12/-**

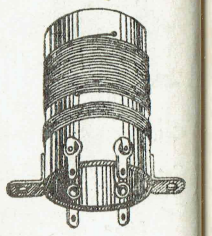
HIKER'S ONE COILS

Ready wound coils for the famous Hiker's One sets.

Cat. No. SC362 ..... **3/9** each

OXFORD T.R.F. COILS.

These Coils have been developed for constructors wanting low priced yet well made T.R.F. Coils. Wound with enamelled wire on bakelite former 1¼in. diam.



Cat. No.

SC530—Aerial **3/3**

SC531—R.F. .. **3/3**

SC532—R.F. With Reaction. **3/9**

MIDGET T.R.F. COILS

The following Coils are wound on a ¾ in. bakelite former approximately 2 in. long, and are used where space is a big consideration in the design of the receiver. All Coils are carefully matched, and are designed to be used with .00035 condenser.

Ensign Midget Aerial T.R.F. Coils.

Cat. No. SC533 .. **5/6** each

Ensign Midget R.F. Coils with reaction winding.

Cat. No. SC534 .. **5/6** each

The above coils are unshielded.

CHOKES

H.F. CHOKES

Honeycomb wound H.F. Chokes. 10 M.H.

Cat. No. SC140 ..... **1/9** each

L.F. CHOKES

30 hy. 50 M.A. Filter Chokes.

Cat. No. SC141 ..... **16/6**

30 hy. 100 M.A. ditto.

Cat. No. SC142 ..... **25/-**

VIBRATOR CHOKES

"A" 4.5 ohms ..... SC143 .... **11/6**

"A" .5 ohms ..... SC144 .... **12/3**

"B" Filter 30 hy. .. SC145 .... **14/6**

THE LAMPHOUSE, 11 Manners Street, Wellington, C.1.

CONDENSERS

FIXED CONDENSERS

T.C.C. TUBULAR CONDENSERS
Non-Inductive Condensers with wire ends.
350 volts. (Working).

Cat. No.	each
SC673—.05 mfd.	11d.
SC674—.1 mfd.	1/4
SC676—.25 mfd.	1/7
SC677—.5 mfd.	2/2
SC678—1 mfd.	2/11

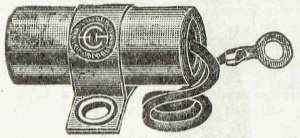
T.C.C. 600 VOLT WORKING.

Cat. No.	each
SC700—.0001	1/1
SC701—.0002	1/1
SC702—.00025	1/1
SC703—.0003	1/1
SC704—.0005	1/1
SC705—.001	1/1
SC706—.002	1/1
SC707—.003	1/1
SC708—.004	1/1
SC709—.005	1/1
SC710—.006	1/1
SC711—.01	1/1
SC712—.02	1/4
SC713—.05	1/4
SC714—.1	1/7
SC715—.25	2/3
SC716—.5	3/6
SC717—1 mfd.	4/-

T.C.C. 1000 VOLT WORKING.

SC723—.1	1/9

GENERATOR CONDENSERS



Special Condensers for noise suppression on motor car radio installations, etc. .5mfd. Metal case.

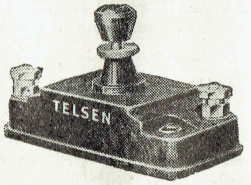
Cat. No. SC637 ..... **3/6** each

AEROVOX SPECIAL FIXED CONDENSERS

.5 mfd. R.F. Condensers, 200 w.v. with shielded connections.

Cat. No. SC638 ..... **1/9** each

PRE-SET CONDENSERS



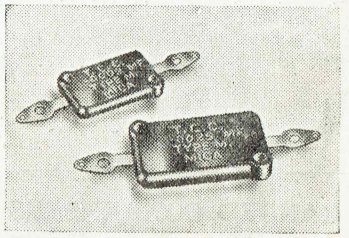
The very low minimum capacity of these Preset Condensers gives a wide range of selectivity adjustment when used in the aerial circuit. They are substantially made, easily adjusted and provided with a locking ring. High insulation and low loss.

Cat. No.

SC851—.001 mfd. to .0002 mfd. **2/3** each

T.C.C. MICA CONDENSERS

T.C.C. Type M Mica Fixed Condensers.



Cat. No.	each
SC692—.00005	1/1
SC679—.0001	1/1
SC79A—.00015	1/1
SC680—.00025	1/1
SC680A—.00025	1/1
SC681—.0003	1/1
SC682—.0005	1/7
SC683—.001	1/10
SC683A—.0015	1/-
SC684—.002	1/10
SC685—.003	1/10
SC686—.005	2/5
SC687—.006	2/8
SC688—.01	3/2

ELECTROLYTIC CONDENSERS

PLESSEY.

Cat. No.	Each
SC579—8 mfd. in Cardboard Cases with bracket for upright mounting	6/9

ELECTROLYTIC CONDENSERS IN SQUARE CARDBOARD CONTAINERS.

Cat. No.	Each
SC560—4 mfd.	5/6
SC561—4 x 4 mfd.	7/6
SC562—8 mfd.	5/6
SC563—8 x 8 mfd.	10/6

ELECTROLYTIC CONDENSERS IN ROUND CARDBOARD CONTAINERS.
Tubular Type—Dry.

Cat. No.	Each
SC564—8 mfd.	6/9
SC565—16 mfd.	7/6
SC570—50 mfd.	3/2
SC571—25 mfd.	3/2
SC572—10 mfd.	3/2
SC566—12 v. 500 mfd.	5/6
SC567—50 mfd. 350 volt	7/6

HIGH VOLTAGE BUFFER CONDENSERS

Cat. No. SC639—.004 1600 v.w. **1/9**

Cat. No. SC640—.01 1600 v.w. **2/-**

PADDERS AND TRIMMERS

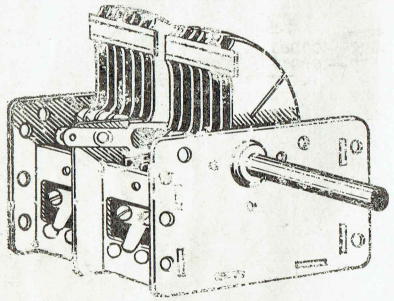
Single Trimming Condensers, capacity 30 mmfd. Each
Cat. No. SC886 **1/2**

2-Bank Trimming Condensers, capacity 30 mmfd. Cat. No. SC887 ..... **1/6**

Padders, single hole mounting, 600 mmfd.
Cat. No. SC889 ..... **2/-**

Padders, single hole mounting, 1000 mmfd.
Cat. No. SC890 ..... **2/4**

GANGED CONDENSERS



PLESSEY GANGED CONDENSERS.

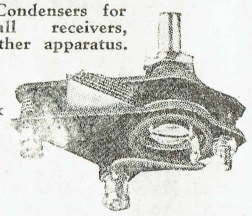
British-made reliable Condensers will match up with Ensign and Exelrad Coil Kits.. ⅜in. shafts, anti-clockwise rotation. Capacity .000375. Supplied complete with trimmers.

Cat. No. SC922—2-gang **14/-**

Cat. No. SC923—3-gang **16/6**

MIDGET VARIABLE CONDENSERS

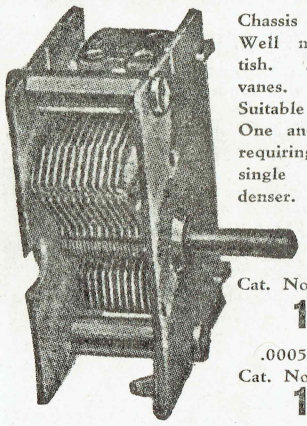
Very compact Condensers for constructing small receivers, wave traps and other apparatus. Solid dielectric type. ¼in. diam. shaft. Overall dimensions, 1¾in. x 1¼in. x ⅜in. thick. Shaft assembly 1in. long.



Cat. No. SC918—.0003 ..... **6/3** each

Cat. No. SC919—.0005 ..... **6/9** each

ENSIGN CONDENSERS



Chassis mounting. Well made. British. Air - spaced vanes. ¼ in. shaft. Suitable for Hiker's One and other sets requiring a good single gang Condenser. .0003—

Cat. No. SC914 **10/3** each

.0005—
Cat. No. SC915 **10/3** each

SPECIAL SHORT WAVE TYPE
.00015—Cat. No. SC913 ..... each

INSUVARN

QUICK DRYING INSULATING VARNISH.

Fresh stocks just on hand. Insuvarn is a fast-drying moisture-proof Coil Dope. Painted over Coil Windings it will hold them rigidly in place and prevent the atmosphere getting at the windings. Excellent for coating Coil Formers before they are wound, and for impregnating wood panels so as to ensure they do not absorb moisture. Insuvarn can also be used for mending Speaker Cones, and a hundred and one other Radio jobs requiring a first-class insulating varnish or cement.

Insuvarn is also sold under the trade brand "Stucka" as a liquid glue, and can be used for mending Wood, Bakelite, China, Glass, etc., etc. Every serviceman and home experimenter should have a jar of Insuvarn on hand.

Cat. No. SU159 **2/3** jar

SUPPLY POSITION

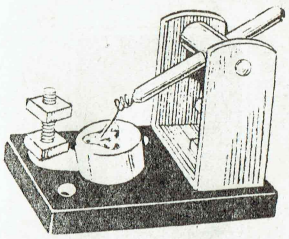
We will not have all of these goods all of the time. Please indicate on your order if we may substitute with the neares available.

THE LAMPHOUSE GUARANTEE.

If for any reason you are not well pleased with any purchase, return it within 7 days and we will refund your money in full.

THE LAMPHOUSE, 11 Manners Street, Wellington, C.1.

CRYSTAL SET PARTS



All Brass Detector, mounted on ebonite base. Supplied complete with crystal and catswhisker.
Cat. No. SC253 ..... **3/11** each

Spare Crystals for above.
Cat. No. SC255 ..... **1/-** each

CORDS, HEADPHONE

Headphone Cords, 4 lugs one end, 2 tips the other. 6ft.
Cat. No. SC203 ..... **4/8**

DETECTORS, RED DIAMOND

Red Diamond Detectors are the semi-permanent type. Can be adjusted by moving the plunger. Sensitive, and give good results.
Cat. No. SC254 .....

Spare Pairs of Crystals for Red Diamond Detectors—
Cat. No. SC252 ..... **2/6** pair

SPARES FOR HEADPHONES

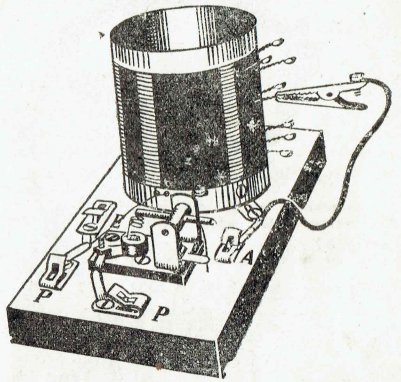
Spare Ear Caps for Frost Phones.
Cat. No. SC286 ..... **2/-** each

Spare Diaphragm for Frost Phones.
Cat. No. SC287 ..... **1/-** each

HEADPHONES

Headphones are out of stock at the time of going to press. Further supplies are on order.

ECONOMY CRYSTAL SET



A very simple and inexpensively designed but efficient Crystal Set, comprising a multi-tapped Coil and Catswhisker type Crystal Detector mounted with Fahnstock Clips on wooden baseboard. Simple in operation. Full instruction enclosed with each.

Price does not include Headphones.
Cat. No. SC290 ..... **12/6** each

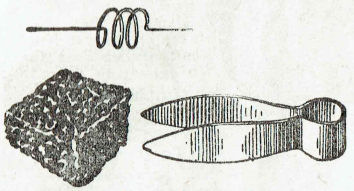
GALENA CRYSTALS

Mineral Galena Crystals. Specially selected pieces. Packed in envelopes. Very sensitive.
Cat. No. SC256 ..... **1/-** each

COILS—CRYSTAL SET

Coils for Crystal Sets. Consist of 70 turns, 24-gauge D.C.C. Wire on 3in. diam. bakelite former. Tapped every tenth turn.
Cat. No. SC266 ..... **4/-** each

CRYSTALS, HERTZITE

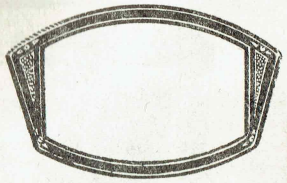


Hertzite Crystals, packed in boxes, complete with tweezers and catswhiskers. British.
Cat. No. SC268 ..... **1/-** each

THE LAMPHOUSE, 11 Manners Street, Wellington, C.1.

DIAL ACCESSORIES

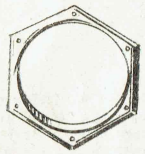
ESCUTCHEONS



A

A.—Oval shape. Black bakelite. Outside measurements 8¾ x 7½; Inside 6⅝ x 5⅜. Fitted with glass—
Cat. No. SD200 ..... **2/6** each

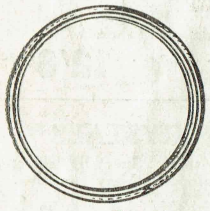
(Glasses for above SD201, 1/3 each)



C.—Chrome. Outside 5⅜in. Inside diameter, 3¾in.
Cat. No. SD204— **3/-** each

(Glasses for above SD205 9d. each)

C



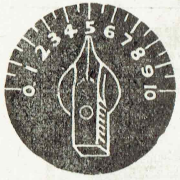
F

H

F.—Round Chrome. Outside diam., 7⅛in.; Inside, 6⅝in. No glass.
Cat. No. SD210 ..... **3/6** each

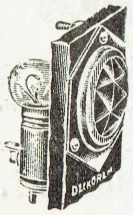
H.—Square Brown Bakelite. Outside 5½ x 5½; Inside 4½ x 4½. Without glass.
Cat. No. SD214 ..... **2/3** each

DIAL PLATE



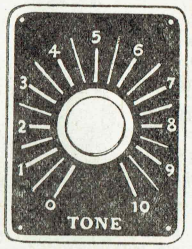
Indicator Plates, engraved from 0 to 10 degrees. Diameter 1¾in., hole ⅛in. (Note: Pointer Knobs are not available at the time of going to press.)
Cat. No. SD341 **1/9**

RUBY WINDOW BRACKET FITTING.



An inexpensive accessory, comprising nickel-plated bezel with ruby lens and bulb-holder. Fixed by 3 screws provided. Takes all M.E.S. bulbs.
Cat. No. SD501 **4/1** each

INDICATOR PLATES



Metal Indicator Plates marked 0/10 with 20 divisions. Size 1¾in. x 2¾in.
Cat. No. SD33 ..... **2/3** each

LAMP HOLDERS FOR DIALS.

With clip style bracket, made to clip over condenser, etc.
Cat. No. SD504— **6**D. each

As above, but without clip—SD506 **6**D. each

DIAL LAMP HOLDERS similar to above, but to take miniature bayonet type Dial Lamps.
Cat. No. SD505 ..... **7**D. each

METAL MAGIC EYE ESCUTCHEONS.

Overall measurements 2¼in. x 1⅜ in. Finished Florentine bronze.
Cat. No. SS226— **1/6**

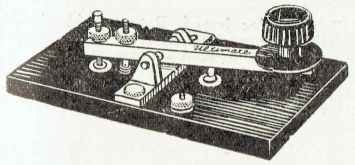
WOODEN KNOB

Round shaped light oak coloured knob, complete with grub screw. One inch diameter for ¼ in. shaft.
Cat. No. SD44 .. **1/-** each

MAIL ALL ORDERS TO
THE ELECTRIC LAMPHOUSE LIMITED
11 MANNERS STREET,.
WELLINGTON, C.1..

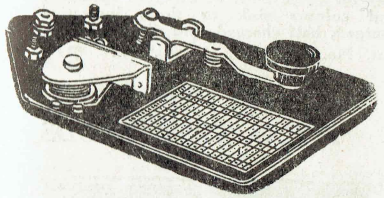
MORSE KEYS, ETC.

ULTIMATE MORSE KEY



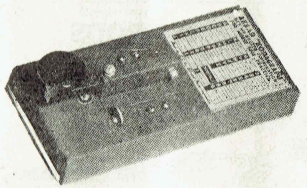
Heavy brass arm and bridge. Fine adjustment of spacing and tension provided. Wooden knob, and finger rest flange, ensuring comfortable operation grip. Mounted on wooden base, finished in varnish. Measures 6 ins. long, 3 ins. wide, 3 ins. high (overall).
Cat. No. SH111 ..... **17/8** each

MORSE PRACTICE SETS



British-made Morse Practice Set has Morse Code embossed on base. Stroke of key can be adjusted to individual requirements. Terminals are provided so that the Set can be used in conjunction with another set. Containing Key and Buzzer on One Base. Light Pattern. Measurements 4½in. long, 2⅜in. wide, 1⅛in. high.
Cat. No. SH110 ..... **8/9**

BUZZAGRAPH



A compact key, buzzer and battery combination practice set. Fits into the pocket. Uses high note buzzer, which is adjustable by means of wing screw. Key section incorporates adjustable spring tension and adjustable movement. Complete with two Standard torch cells. The Morse code is included on a gold and black transfer, as shown in the illustration. Unit measures 5in. x 3in. x 1in. deep. The ideal unit for Morse practice.
Cat. No. SH3 ..... **25/6**

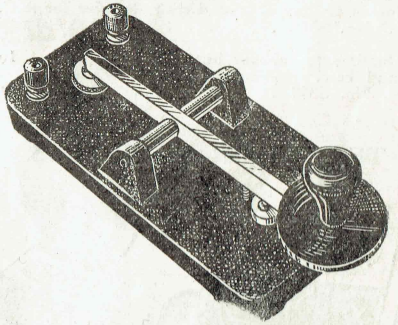
PRACTICE KEYS.

Low-priced practice Keys. Good movements. Steel fittings.
Cat. No. SH4 ..... **13/6** each

KEY KNOBS

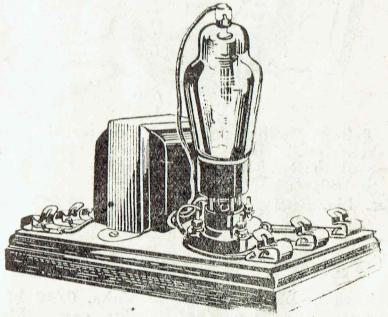
Special Wood Knobs for Morse Keys, etc.
Cat. No. SH20 **1/4** each

HEAVY MORSE KEYS



Measure 6in. x 3in. Heavy cast base; silver contacts, chrome-plated arm. Adjusting screw.
Cat. No. SH5 ..... **25/-**

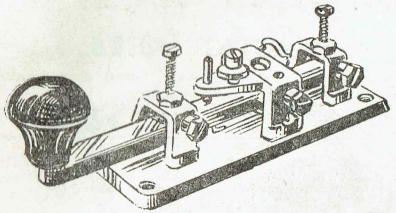
MORSE CODE OSCILLATOR



Valve Audio Oscillator for Morse Code practise. Consists of transformer and valve mounted on wood base, with terminals for Phones, Key and Batteries. Requires a 4½ volt battery to operate it. Price with valve but without batteries
Cat. No. SH9 ..... **£1/11/9**

As above, but with longer base and with key—
Cat. No. SH10 ..... **52/-**

MORSE KEY



This key is very compactly constructed on a bakelite base measuring 3½ in. x 1⅝ in. Very efficient for sending Morse at a high speed, and is complete with fine adjusting screw. As used by Air Force and other services.
Cat. No. SH6 ..... **26/6** each

SIFAM METERS

Sifam Milli amp. Meters, made in England. 0/1 M.A. 2 inch Scale. Square moulded case. Moving Coil type. Fitted with Rectifier for A.C.
Cat. No. SM4 ..... **£9/4/6**

Similar to above but 2½ inch Scale. In round case.
Cat. No. SM5 ..... **£9/6/6**

TEST YOUR BATTERIES

Telsen Double Range Voltmeter in neat bakelite case. Every battery owner should have one of these useful meters. Ranges 0 to 9 and 0 to 180 volts.
Cat. No. SM101 ..... **16/6** each

TRIPLE RANGE MODEL

Ranges, 0/9 Volts, 0/180 Volts, 0/30 M.A. Pocket Type Meters in Bakélite case. Made by Telsen, England.
Cat. No. SM6 ..... **27/-** each

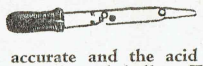
METER FUSES

Spare Tubular Fuses for Pifco and other meters.
Cat. No. SM50 ..... **9**D. each

HYDROMETERS

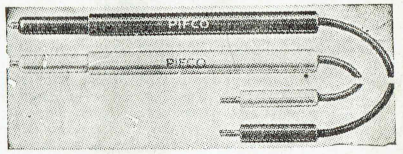
English Guidor brand. Patent guide in glass container prevents float from sliding and gives an instantaneous dead beat reading. Float is protected by rubber guide ring to prevent breakage. Glass parts protected by best quality rubber parts at each end to prevent breakage.
Cat. No. SM303 ..... **7/6** each
Spare Floats—Cat. No. SM304.. **3/3** each

Midget Ball HYDROMETERS



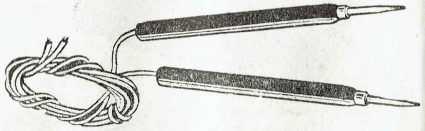
These are accurate and the acid is tested by means of three coloured balls. The condition of the accumulator is shown instantly by the way the three balls of different specific gravities and colours sink or float, indicating fully charged, half charged, and discharged. (British.)
Cat. No. SM302 ..... **3/4** each

PIFCO TEST PRODS



English test prods. One red, one black, 5 in. long, provided with 18in. flexible rubber covered leads and insulated plugs. A really nice addition to your test gear.
Cat. No. SM7 ..... **15/-** pair

TEST PRODS



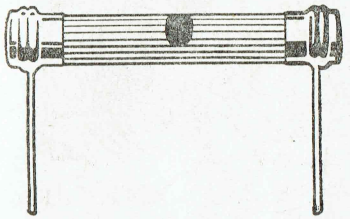
Polished ebonite handles and complete with flexible leads.
Cat. No. SM1 ..... **7/-** pair

PRICES ARE SUBJECT TO ALTERATION !

All prices in this book must be regarded as an indication only—all orders will be executed at ruling prices.

RESISTORS — POTENTIOMETERS

COLOUR CODED RESISTORS



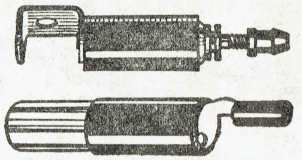
Conservatively rated at 1 watt. They will stand up to 50 per cent. overload without injury. Colour coded to the R.M.A. standard. They are accurate to within 5 per cent. of stated values, which remain constant whether in use or in stock. Perfectly noiseless and completely free from hand capacity effects. All one watt size.

Cat. No.	Ohms.	
SR210—	100	ALL 9D. EACH
SR211—	200	
SR212—	250	
SR213—	300	
SR214—	400	
SR215—	500	
SR216—	750	
SR182—	1,000	
SR183—	2,000	
SR184—	3,000	
SR185—	4,000	
SR186—	5,000	
SR187—	7,500	
SR188—	10,000	
SR189—	15,000	
SR190—	20,000	
SR191—	25,000	
SR192—	30,000	
SR193—	50,000	
SR194—	75,000	
SR195—	100,000	
SR196—	150,000	
SR197—	200,000	
SR198—	250,000	
SR199—	300,000	
SR200—	500,000	
SR201—	1 megohm	
SR202—	2 megohm	
SR203—	3 megohm	
SR204—	4 megohm	
SR205—	5 megohm	
SR206—	6 megohm	
SR207—	7 megohm	
SR208—	8 megohm	
SR209—	10 megohm	

½-WATT RESISTORS.

Cat. No.	Ohms.	
SR150—	1,000	9D. EACH
SR151—	2,000	
SR152—	5,000	
SR153—	10,000	
SR154—	15,000	
SR155—	20,000	
SR156—	25,000	
SR157—	50,000	
SR158—	100,000	
SR159—	200,000	
SR160—	250,000	
SR161—	300,000	
SR162—	500,000	
SR163—	1 megohm	
SR164—	2 megohm	
SR165—	3 megohm	
SR166—	5 megohm	

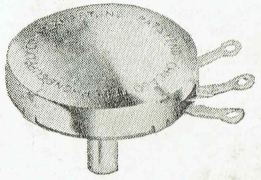
MOTOR RADIO SUPPRESSORS



Spark Plug Type (top illustration). A sturdy unit which meets the most exacting demands for spark plug suppression.
SR229 ..... **3/6**
Distributor Type Cat. No. SR228 .. **2/9**

The above suppressors will not affect power or petrol consumption of your engine.

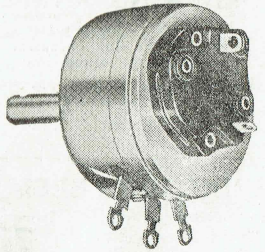
POTENTIOMETERS—Carbon



Carbon type employs a full wiping contact between the movable contact member and the hard smooth composition resistance element.

Cat. No.	Ohms.	
SP48—	5,000	ALL 3/9 EACH
SP49—	10,000	
SP50—	25,000	
SP51—	50,000	
SP52—	100,000	
SP53—	250,000	
SP54—	500,000	
SP55—	1 megohm	
SP57—	2 megohm	

POTENTIOMETER with Switch

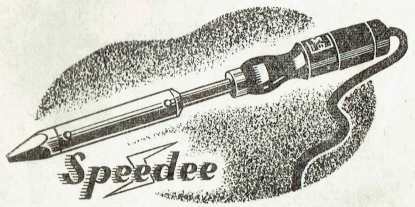


Cat. No. SP64—500,000 ohm, carbon **5/6**

BUY UNDER THE LAMPHOUSE GUARANTEE.

SOLDERING EQUIPMENT

"Speedee" SOLDERING IRONS



Consumes 100 watts—no more than a small light bulb. Indispensable to the handy man in workshop or home.

Cat. No. SS406 .....

Spare Elements for above.
Cat. No. SS407 ..... **2/6** each
Two required for each Iron)

"Speedee" HEAVY DUTY IRONS

Designed for commercial use requiring a heavy iron for long periods. Watts, 180. Weight, 3½ lb.

Cat. No. SS396 ..... **55/-** each

Spare Elements for above.
Cat. No. SS397 ..... **16/-**

B.E. SOLDERING IRON

N.Z. Made Soldering Iron. For radio and small electrical work. 230 Volt. Complete with cord.

Cat. No. SS405 ..... **30/-** each

SOLDER 34/66

Full size sticks.

Cat. No. SS418 ..... each **2/-**

SOLDERING PASTE

Morton's Super Soldering Paste. An ideal paste for use instead of flux or resin. Can be used on all metals except aluminium.

Cat. No. SS423—2 oz. tins **1/8**

Cat. No. SS424—4 oz. tins **2/6**

SOLDERING IRON ELEMENTS

Elements for Solon Soldering Irons.
Cat. No. SS394 ..... **7/6** each

Elements for Mysto Soldering Irons.
Cat. No. SS395 ..... **7/6** each

Resin Core Solder is recommended for the home constructor. It looks like wire and is filled with a resin preparation which eliminates the necessity for using flux or spirits of salts, etc.

Instructions for Using:

1. The joints to be soldered should be thoroughly cleaned and free from acid or grease. On plated parts (nickel or chromium) the "plate" should be filed away where the joint is to be made.
2. Heat the soldering iron just enough to melt the solder. "Tin" the copper bit by first filing lightly and then rubbing with the cored solder until coated. The area of this coat should extend about half-an-inch from the tip of the bit and completely round it.
3. Heat again for working, but not to red heat.
4. Apply the bit and the cored solder to the work, rubbing the bit well down to transmit the heat. It is important that the bit, cored solder and joint should come into contact simultaneously.

There is no necessity to clean the joints after soldering: the ratio of the flux to the solder is such as to obviate this.

Cat. No. SS411—
Small reel, about 27 inches ..... **7**D. each

Cat. No. SS413—1lb. reel **7/6**

CHASSIS BASES.

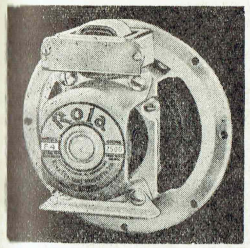
We have purchased a manufacturer's stock of steel chassis bases. Prices are half present-day costs.

Size 10in. x 6½in. x 2¼in. Drilled and cut for gang condenser, and Dial mounting, Transformer, Electrolytics, 7 coil or valve holes.
Cat No. SC1000 ..... **6/6** each

Size 10½in. x 6¾in. x 2¼in. drilled and cut for gang Condenser and Dial mounting, Transformer, Electrolytics, 8 coil and valve holes.
Cat. No. SC1001 ..... **6/6** each

Size 9½in. x 6¾in. x 2¼in. Battery set Chassis. Drilled and cut for Gang condenser and Dial (mounted off centre). 10 Valve and Coil Holes.
Cat. No. SC1002 ..... **6/6** each

THE LAMPHOUSE, 11 Manners Street, Wellington, C.1.



ROLA SPEAKERS

Prices as at 1/5/44

At the time of going to press, the Speaker stock position is very bad—5 and 6 inch Speakers will not be available for some time, but small releases of the other types are expected during the season.

Electro-Dynamic.

Cat. No.	Type No.	Overall diameter.	Voicecoil diameter	Voicecoil impedance	Normal field excitation	Maximum weight of field coil.	Prices.
SS921	F-12	12½in.	1 in.	2.3 ohms	8 watts	1½ lbs.	£2 18 3
SS922	K-8	8 in.	1 in.	2.3 ohms	8 watts	1½ lbs.	£2 11 0
SS923	F-5B	6¾in.	¾in.	3.7 ohms	6 watts	¾ lb.	£2 1 6
SS924	F-4	5 in.	¾in.	3.7 ohms	6 watts	¾ lb.	£2 1 6

Permanent Magnet.

SS926	12-20	12½in.	1 in.	2.3 ohms	—	—	£3 10 8
SS927	8-20	8 in.	1 in.	2.3 ohms	—	—	£3 2 3
SS928	6-8	6¾in.	¾in.	3.7 ohms	—	—	£2 2 5
SS929	5.8	5 in.	¾in.	3.7 ohms	—	—	£2 2 5

ENSIGN SPEAKER EXTENSION ADAPTORS.

Extension Speaker Adaptors. The problem of fitting an extension speaker to your electric set has been solved! All you do is remove the output valve, plug in the adaptor, then put back the valve on top of the adaptor. The adaptor can also be used as a tone improver.

Can be used in conjunction with all P.M. speakers which have output transformers fitted.

Cat. No. SS780—4-pin ..... 7/6 each
Cat. No. SS781—5-pin ..... 7/6 each
Cat. No. SS782—6-pin ..... 7/6 each
Cat. No. SS783—Octal ..... 8/6 each

SPEAKER TRANSFORMERS—ROLA ISOCORE

Genuine Rola Speaker Transformers for replacing burnt out Transformers on Speakers.

ST705—Small 10,000 ohm C.T. **18/6** ea.
ST706—Small 7,000 ohm ..... **18/-** ea.
ST707—Large 7,000 ohm ..... **18/-** ea.
ST708—Large 5,000 ohm C.T. **18/6** ea.
ST709—Large 10,000 ohm C.T. **18/6** ea.

Transformers with resistances other than those listed can be made to order, provided material and labour are available.

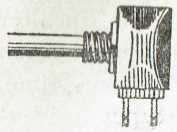
TOGGLE SWITCHES

230 Volt. Quick make and break. Single pole. 2 Way.
Cat. No. SS443 **5/6** each

THE LAMPHOUSE, 11 Manners Street, Wellington, C.1.

SWITCHES AND SOCKETS

ROTARY RADIO SWITCHES

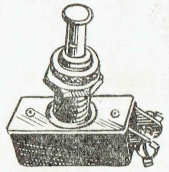


Rated 230 volt, 2 amp. These are the rotating type of switches and are supplied with ¼in. shaft, so that a knob can be fitted to match the other controls on the set. One hole fixing. Switch mounted in hermetically sealed cases, perfectly reliable contact, durable construction.

Cat. No. — Each

SS447—Single pole change-over **6/9**

PUSH PULL SWITCHES.



Reliable Push Pull Battery Switches for motor-cars, or Radio, Single Hole Fixing.

Cat. No. SS439— ..... **3/-** each

MINIATURE SWITCHES

Here's a handy little switch suitable for radio and motor-car work. Positive action. Nicely finished (nickel plated). British made.

Cat. No. SG118 **2/3**

SELECTOR SWITCHES

18-point Rotary Selector Switches. Lug connection to each point. Shaft ¼in. diameter.

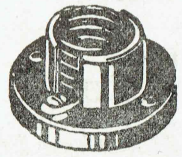
Cat. No. SS437 ..... each

WAVE CHANGE SWITCHES.

Ruggedly constructed Wave Change Switches. 3 bank, 3 position. Complete with long ¼in. diam. shaft.

Cat. No. SS453 ..... **14/6** each

MINIATURE SCREW HOLDERS



Bakelite Lampholders, miniature screw thread which takes torch and similar lamps.

Cat. No. SS223—

1/8 each

PUSH PULL SWITCHES

Telsen (4 point D.P. On/Off) Switches for panel mounting.

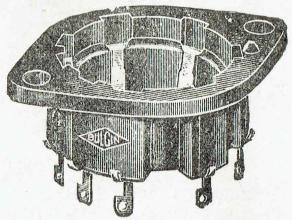
Cat. No. SS438 ..... **3/5** each

EBY WAFER SOCKETS

Ruggedly constructed. Certain connection with three points contacting each of the valve pins. Standard mounting centres.

Cat. No SS631—4-pin ..... 7d.
Cat. No. SS632—5-pin ..... 7d.
Cat. No. SS633—6-pin ..... 7d.
Cat. No. SS634—7-pin ..... 7d.
Cat. No. SS635—8-pin (Octal) ..... 7d.
Cat. No SS636—Loctal ..... 10d.
Cat. No. SS637—Sockets for Midget Valves (1S4 Series) ..... each 1/9

SIDE-CONTACT CHASSIS VALVE-HOLDERS.



8-CONTACT.

Moulded bakelite chassis valve holders for the side-contact valves. Fitted with eight leaf contacts and integral solder tags. Very efficient and reliable contact is made with valves of the type concerned.

Cat. No. SS658 ..... **1/9**

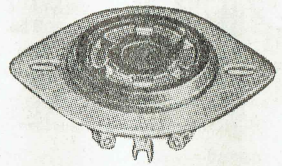
SOCKETS

Baseboard Mounting.

For American base valves. Made of bakelite with screw terminals. Special spring contacts ensure a good connection.

Cat. No. SS605—4-pin (U.X.) **1/6**

AMPHENOL VALVE SOCKETS

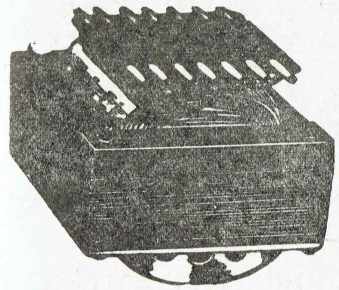


Amphenol Valve Sockets, complete with metal mounting plates.

Cat. No. SS614 .... 4 pin ... 10d. each
Cat. No. SS615 .... 5 pin ... 10d. each
Cat. No. SS616 .... 6 pin ... 10d. each
Cat. No. SS617 .... 7 pin ... 10d. each
Cat. No. SS619 .... 8 pin ... 10d. each

TRANSFORMERS

POWER TRANSFORMERS



Supplies of Transformers are very short, but at the time of going to press the following types are available:—

230 VOLT PRIMARIES.

Secondary Windings: 350/350 Volts 60 M.A.; 5 Volt 2 amp.; 6.3 Volt 2 amp.

Cat. No. ST650 ..... **39/6** each

385/385 Volts 100 M.A.; 5 Volt 2 amp.; 6.3 Volt 4 amp.

Cat. No. ST651 ..... **47/6** each

400/400 Volts 150 M.A.; 5 Volt 3 amp.; 6.3 Volt 3 amp.

Cat. No. ST652 ..... **59/6** each

350/350 Volt 60 M.A.; 5 Volt 2 amp.; 2.5 Volt 5 amp.

Cat. No. ST653 ..... **39/6** each

385/385 Volts 100 M.A.; 5 Volt 2 amp.; 2.5 Volt 10 amp.

Cat. No. ST654 ..... **47/6** each

CLASS B TRANSFORMERS.

Class B Interstage Transformers, for Battery sets, etc. Heavy robust job. Offered at special low price owing to our having made a fortunate purchase.

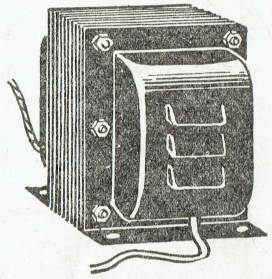
Cat. No. ST605 ..... **12/-** each

UNIVERSAL OUTPUT TRANSFORMERS.

These Transformers have been designed to meet the needs of engineers, experimenters, and servicemen, for a single unit so constructed as to provide the correct impedance matching between various types of Audio Output Tubes in a single Push-Pull, Parallel, or Class B Circuit, and any Dynamic Speaker. Full instructions are given with each Transformer.

Cat. No. ST602 ..... **17/6** each

STEPDOWN TRANSFORMER

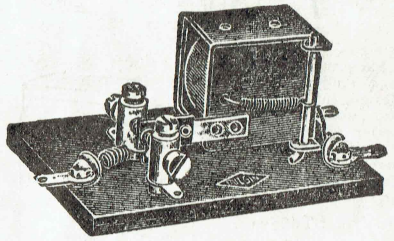


Stepdown from 230 to 110 volts. Rating 60-80 watts.

Cat. No. ST622 ..... **37/6**

Larger or special stepdown transformers can be made to order, provided material is available.

GENERAL PURPOSE ELECTRO MAGNETIC RELAY



Handling capacity 1-amp. at 2-volts or 10 M.A. at 250-volts for non-inductive circuits. Suitable for transmitter circuits, remote control, etc. Operating current 7-10-MA internal resistance 7,000 to 7,500 ohms. D.C. (operating voltage 50/70 average).

Cat. No. ST500 ..... **17/-**

FILAMENT TRANSFORMERS.

Cat. No. ST632—6.3 volts 2 amp. .. **15/-**

SPECIAL TRANSFORMER.

In response to many enquiries we have now available a special transformer for valve testers, experimenters, etc. It has a 230-volt primary and secondary tappings of 2 amps., as follows—1.5 volts, 2 volts, 2.5 volts, 4 volts, 5 volts, 6.3 volts, 7.5 volts, 12.5 volts, 25 volts and 30 volts.

Cat. No. ST616 ..... **47/6**

ENSIGN REPLACEMENT TRANSFORMERS.

Made from the best stalloy steel and wire and under strict supervision these transformers are ideal for replacement in all makes of speakers, etc.

ST714—Single Pentode **10/1**

ST715—Push Pull Pentode **10/7**

ST716—Single Triode **10/1**

ST717—Push Pull Triode **10/7**

ENSIGN SPEAKER TRANSFORMER COILS.

Will fit practically all types of Speaker Transformers, thus doing away with the necessity of replacing the complete transformer.

Cat. No. ST730—Single Pentode .. **6/10**

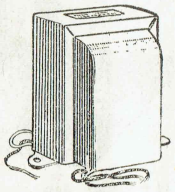
Cat. No. ST731—Single Triode **7/6**

Cat. No. ST732—P.P. Pentode **7/6**

Cat. No. ST733—P.P. Triode **7/6**

ENSIGN AUDIO TRANSFORMER.

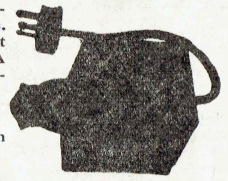
Vacuum Sealed Interstage Audio Transformer. Wound on first grade core using best quality copper wire flexible leads to ensure higher efficiency. Ratio 3 to 1. Size, 2¼ins. high, 3ins. wide and 2ins. deep.



Cat. No. ST606— **16/-** each

VOLTAGE REDUCER. "OXFORD."

This reducer supplies 6 volts 5 amps. from the 240-volt light or power. A plug outlet is provided.



Cat. No. ST623— **35/-** each

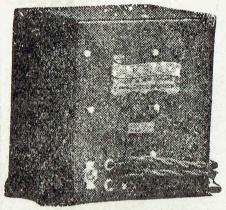
ENSIGN VIBRATOR POWER TRANSFORMERS.

Manufactured from the first grade material.

150 volt, 25 M.A.—6 volt.
Cat. No. ST625 ..... **22/6**

150 volt 30MA, 32 volts.
Cat. No. ST620 ..... **30/-**

AKRAD VIBRATOR PACKS



Compact, quiet in operation, and hash-free. Completely filtered A and B; equipped for 4-pin outlet Socket. The connections are Plate H.T. 135 Volts. Grid and adjacent filament pin. A and B negative and positive filament pin is filtered "A" positive. Use with 6 Volt Battery delivers 135 Volts.

Cat. No. SA213 ..... **£5/10/6**

VIBRATORS—UTAH.

Vibrator Units for replacements or for constructors. Positive starting long-life Vibrators. Low cost per hour. Trouble-free operation.

6-volt Non-synchronous 4-pin type.

Cat. No. SB60 ..... **27/6**

6-volt Synchronous 5-pin type (for special Utah socket).

Cat. No. SB61 ..... **27/6**

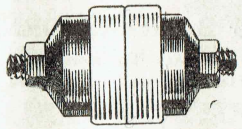
6-volt Synchronous 5-pin type (standard socket).

Cat. No. SB62 ..... **27/6**

Sockets for Vibrators—5-pin special type.

Cat. No. SB63 ..... **1/-**

"FEED THRU" INSULATOR TERMINALS



Insulator-terminal 4BA for fitting on to metal chassis, etc. Consists of terminal with nuts on each end for attaching wires, etc. Two porcelain insulating washers with raised lip in centre. Insulates terminal from metal panel, etc. Suitable for panels up to 3/32 in. thick. Length 1¾ in.

Cat. No. SA359 ..... **1/-** each

LAMPHOUSE GUARANTEE

Any goods that prove in any way unsuitable may be returned within seven days from receipt and your money will be returned in full.

TERMINALS

SOLDERING LUGS.

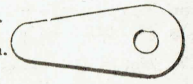
4 B.A. Double Ended Soldering Lugs (tinned).

Cat. No. ST7 **3**D. doz.

PEAR-SHAPED LUGS

Small, ¼in. long, 5/32in. hole.
Cat. No. ST2 **3**D. doz.

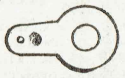
Large, ⅜in. long, 5/32in. hole.



Cat. No. ST3 **3**D. doz.

DROP-SHAPED LUGS

⅜in. long, 7/32in. hole.



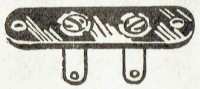
Cat. No. ST4 **3**D. doz.

TERMINALS

American type Terminals, with insulated tops.

Cat. No. ST9 .... **10**D each

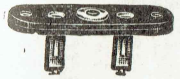
TERMINAL STRIPS



Terminal Screws mounted on insulated strips.

Cat. No. ST27 ..... **9**D each

TWIN TIP JACK UNITS



A strong spring firmly makes contact to any tip inserted within its grip. Mounted on bakelite strip. Metal parts are nickel-plated. Jacks fit any standard 'phone tip.

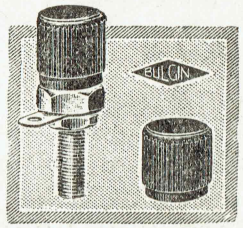
Cat. No. SJ8 ..... **7**D. each

SELF-TAPPING SCREWS

For mounting components on radio chassis, etc. ⅜in. long, No. 6 Gauge.

Cat. No. ST420 **5**D. per dozen
4/9 per gross

SMALL INSULATED TERMINALS—4 B.A.



The illustration is approximately full size. These terminals fill the want of many who seek a small inexpensive insulated type. The heads are removable and have inserts. Without indications, in two colours, red and black.

Cat. No. ST31 ..... **7**D each

FAHNSTOCK CLIPS

N.P. on spring brass. Size ⅜in. x 1in.

Cat. No. ST41 **2½**D.

PHONE TIP JACKS

Jacks to take Phone Tips. Have insulated top.

Cat. No. SJ20 ..... **1/1** each

CLIPS, SCREEN GRID

For attaching leads to the top of screen grid valves, etc.

Cat. No. SC23 .... **1**D. each

Cat. No. SC24—
Screen Grid Caps for metal valves .. **1½**D.

BANANA PLUGS AND SOCKETS

Banana Plugs and Sockets have all sorts of uses, such as for aerial and earth connections, coil tapping, battery connections, etc.

Cat. No. ST23—Banana Plugs only **9**D. each

Cat. No. ST24—Sockets for above **1/-** each

Insulated.

RADIO HARDWARE

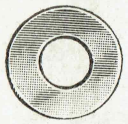
WOOD SCREWS.

Counter-sunk heads. Gimlet points. All sizes can be supplied. The following are in most popular demand:

Bright Mild Steel.

Cat. No.	Size.	Dozen.
ST470	½in. x 1	3d.
ST471	½in. x 2	3d.
ST472	½in. x 5	3d.
ST473	⅝in. x 3	3d.
ST474	⅝in. x 6	4d.
ST475	¾in. x 4	4d.
ST476	¾in. x 6	4d.
ST477	¾in. x 8	5d.
ST478	1in. x 4	5d.
ST479	1in. x 6	5d.
ST480	1in. x 8	6d.
ST481	1¼in. x 8	6d.
ST482	1¼in. x 10	7d.
ST483	1½in. x 6	7d.
ST484	1½in. x 9	8d.

THICK RUBBER WASHERS



Dimensions:

Diameter 11-16 in.; diameter of hole, ¼in.; thickness ¼in.

Cat. No. SS143—

1D. each; **9**D. dozen

STEEL LOCKING WASHERS

Steel locking washers, which make certain that nuts stay put.

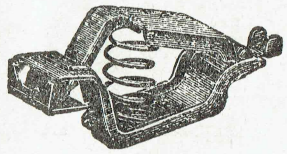
ST410—6 B.A. (7/64) ..	3/9 gross, 4d. doz.
ST411—4 B.A. (5/32) ..	3/9 gross, 4d. doz.
ST412—2 B.A. (13/16)	3/9 gross, 4d. doz.
ST413—¼in.	4/6 gross, 5d. doz.
ST414—⅝in	6/- gross, 7d. doz.
ST415—½in.	13/6 gross, 1/3 doz.

PORCELAIN INSULATING BUSHES.

For insulating bolts, etc., through metal sheet. One has raised lip, while other is recessed. Especially suitable for manufacturers of electric radiators, toasters, etc., and for radio experts. Diam. 9-16 in.; diam. of hole 3-16 in.

Cat. No. SS234 .. **5**D. pair; 4/6 doz. pairs

UNIVERSAL BATTERY CLIPS



British made, these Clips have good strong springs that make a sure contact.

Cat. No. SC20—5 amp. (Pee Wee) each

Cat. No. SC21—10/25 amp. ..... each

Cat. No. SC22—50 amp. ..... each

RUBBER GROMMETS

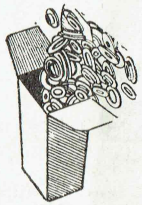
Made of good quality black vulcanised rubber. For fitting in holes in chassis, etc., to insulate and protect cables. To fit ⅝in. hole. Inside diameter ¼in.

Cat. No. SS243 ..... **2**D. each

Ditto to fit ½in. hole. Inside diameter ⅜in.

Cat. No. SS244 .... **2**D. each

INSULATING WASHERS



Insulating Washers for insulating potentiometers and other components from metal panels, etc. ⅝in. diam. x ¼in. diam. hole x 1-16in. thick.

Cat. No. SS230—Fibre.

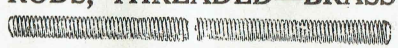
6D. dozen

Ditto, ¾in. x ⅝in. x 1/16in.

Cat. No. SS231—

Fibre ..... **6**D. dozen

RODS, THREADED—BRASS



Threaded Rod is useful for many odd jobs, 6in. lengths, each with four nuts.

Cat. No. SS213—5/32 ..... **8**D. each

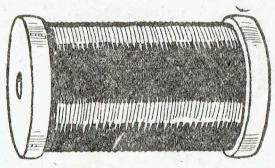
Cat. No. SS214—6/32 ..... **9**D. each

SCREWS AND NUTS

Cat. No. ST426A—Cheese Head, Brass, 1in. x 4, BA	doz.
Cat. No. ST426—Round Head, Brass, 1in. x 4, BA.....	doz.
Cat. No. ST424—Round Head, Brass, 1½in. x 4, BA	doz.
Cat. No. ST429—Round Head, Brass, ¾in. x 6, BA.....	doz.
Cat. No. ST428—Round Head Brass, ½in. x 6, BA	doz.
Cat. No. ST440—Round Head, Iron, ⅝in. x ½in.	doz.

RADIO WIRE

WIRES, ENAMELLED.



Only the Best British Wires stocked.

Prices per reel.

When in stock supplied at ruling prices.

S.W.G.

½lb. Reels.	1lb. Reels.
16—Cat. No. SW1	Cat. No. SW34
18—Cat. No. SW2	Cat. No. SW35
20—Cat. No. SW3	Cat. No. SW36
22—Cat. No. SW4	Cat. No. SW37
24—Cat. No. SW5	Cat. No. SW38
26—Cat. No. SW6	Cat. No. SW39
28—Cat. No. SW7	Cat. No. SW40
30—Cat. No. SW8	Cat. No. SW41
32—Cat. No. SW9	Cat. No. SW42
34—Cat. No. SW10	Cat. No. SW43
36—Cat. No. SW11	Cat. No. SW44
38—Cat. No. SW12	Cat. No. SW45
40—Cat. No. SW13	Cat. No. SW46

WIRES, D.C.C.

S.W.G.

½lb. Reels.	1lb. Reels.
16—Cat. No. SW14	Cat. No. SW47
18—Cat. No. SW15	Cat. No. SW48
20—Cat. No. SW16	Cat. No. SW49
22—Cat. No. SW17	Cat. No. SW50
24—Cat. No. SW18	Cat. No. SW51
26—Cat. No. SW19	Cat. No. SW52
28—Cat. No. SW20	Cat. No. SW53
30—Cat. No. SW21	Cat. No. SW54
32—Cat. No. SW22	Cat. No. SW55
34—Cat. No. SW 23	Cat. No. SW56
36—Cat. No. SW24	Cat. No. SW57

WIRES, D.S.C.

S.W.G.

½lb. Reels.	1lb. Reels.
20—Cat. No. SW25	—
22—Cat. No. SW26	Cat. No. SW58
24—Cat. No. SW27	Cat. No. SW59
26—Cat No. SW28	Cat. No. SW60
28—Cat. No. SW29	Cat. No. SW61
30—Cat. No. SW30	Cat. No. SW62
32—Cat. No. SW31	Cat. No. SW63
34—Cat. No. SW32	Cat. No. SW64
36—Cat. No. SW33	Cat. No. SW65

ENSIGN PUSH BACK WIRE.

Best quality stranded push back wire in assorted colours. 10ft. coils.

Cat. No. SW157 **10**D. Coil, or **1**D. foot

SPAGHETTI INSULATING TUBING

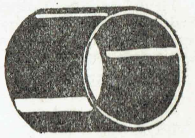
Cat. No. SS1—1 mil., 1 yd. lengths ..	4½d.
Cat. No. SS2—2 mil. 1 yd. lengths ..	5d.
Cat. No. SS3—3 mil.., 1 yd. lengths ..	6d.
Cat. No. SS4—4 mil., 1 yd. lengths ..	8d.
Cat. No. SS5—6 mil., 1 yd. lengths ..	1/-

RUBBER SPAGHETTI TUBING

Rubber tubing for slipping over bare wires as an insulator to prevent short circuits, etc. Will NOT stand great heat.

Cat. No. SS86 ..... **5**D. yard

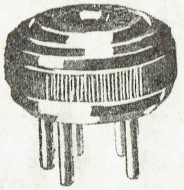
FORMER



This Former Tube for coil winding has very high insulating properties, the surface being made of pure bakelite.

Cat. No.	Each
SF80—1in. dia., 6in. lengths	9d.
SF81—1¼in. dia., 6in. lengths	1/10
SF81A—1¼in. dia., 3in. lengths	11d.
SF83—1½in. dia., 6in. lengths ..... (valve base size)	2/3
SF86—2in. dia., 6in. lengths	2/3
SF87—2½in. dia., 6in lengths	2/4
SF88—3in. dia., 5in. lengths	2/3

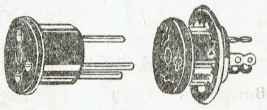
PLUGS—SPEAKER



Made of bakelite. For use with moving coil speakers, etc. Moulded in two threaded pieces and made to ensure perfect contact in standard type valve sockets. Ample internal space permits easy wiring. The knurled grip on the full exterior makes for easy insertion and withdrawal.

	Each
Cat. No. SP251—8-pin Octal	1/-
Cat. No. SP252—4-pin	1/-
Cat. No. SP253—5-pin	1/-
Cat. No. SP254—6-pin	1/-
Cat. No. SP255—7-pin	10d.

CHASSIS PLUGS & SOCKETS



Miniature 3-pin type. Socket mounts on to chassis. Extremely useful unit for connecting external units such as microphones, pickups, &c.

Cat. No. SP270 ..... **1/3** pair

SPECIAL OFFERINGS

Goods on this page cannot be repeated after present stocks are sold.

MANSBRIDGE TYPE CONDENSERS

(Block Type.)

German make. 500 V. D.C. Test.

Cat. No. SC693 .1 m.f.d. .... 9d. each
Cat. No. SC694 .25 m.f.d. .... 11d. each
Cat. No. SC695 .5 m.f.d. .... 1/2 each

PHILLIPS VOLUME CONTROLS

High quality Volume Controls with On/Off Switch. 700,000 ohm. Suitable as a replacement control or as a reaction control on Hiker's One and similar sets.

Cat. No. SP19 ..... **7/6** each

HIGH QUALITY RESISTORS

Order early and obtain a supply of these really good Resistors. Wire ends. Carbon type.

½ watt type.

Cat. No. SR300 330 ohm (330.1)
Cat. No. SR301 27,000 ohm (27K)
Cat. No. SR302 56,000 ohm (56K)
Cat. No. SR303 68,000 ohm (68K)
Cat. No. SR304 100,000 ohm (M1)
Cat. No. SR305 1 meg (1M)

8D. each.

1 Watt Type.

Cat. No. SR306 1,000 ohm (1K)
Cat. No. SR307 4.7 megohm (4M.7R)
Cat. No. SR308 5.6 megohm (5M.6R)

9D. each.

100,000 OHM POTENTIOMETERS

Special purchase—Carbon Potentiometers, ¼in. shaft. Made in U.S.A.

Cat. No. SP56 ..... **3/2** each

JACKS.

SJ22—Bulgin S.C. Jacks ..... **3/6** each

SJ23—Bulgin Single Closed Circuit Jacks ..... **3/6** each

SJ9—Metal S.C. Jacks ..... **2/-** each

ROUND BULB DIAL LAMPS

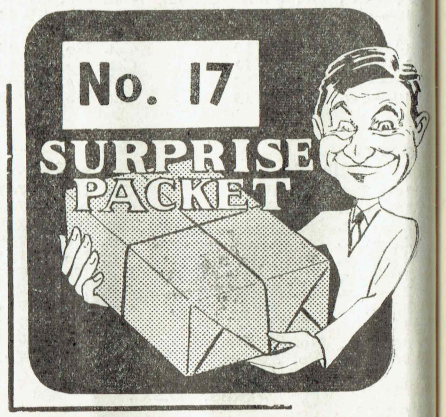
6.3 volt .32 amp Round Bulbs, screw base, Radio Dial Lamps.

Cat. No. SL124— **1/4** each

LOW VOLTAGE LAMPS

Special purchase of 6 and 12 volt Electric Lamps with standard bayonet cap. These lamps have had their caps converted from the motor-car size to standard bayonet cap. This adapation makes them look a little rough, but they are brand new and give excellent service in use.

Cat. No. SL499—6 volt 17 c.p. **2/-** each.



Here's a chance for you Radio Experimenters.. Packet of used and new useful radio parts—Resistors, Condensers, and all manner of useful bits and pieces. Trust the Lamphouse with five bob. You won't be disappointed. Money back if you are not more than satisfied.

Cat. No. SS17 .... **5/-** Postage 1/- extra..

WAVE CHANGE SWITCHES.

Single Bank, 6 pole, 2 position—
Cat. No. SS470 ..... **8/6** each

Single Bank, 3 pole, 3 position—
Cat. No. SS471 ..... **8/6** each

PHONE PLUGS

Bulgin Phone Plugs—Cat. No. SP268 .. **3/-**.

AMERICAN TYPES

If it's Valves you require—why, the Lamphouse, of course, Radiotron, Tungsol, Raytheon, Kenrad, Philips, Brimar, etc. Owing to the import restrictions we cannot guarantee supplies of all types in all brands, and suggest you state 1st and 2nd preference of brand on your orders.

Type.	Price.
OZ4	16/–
01A	9/–
1A4-P	12/–
1A6	13/1
1B4-P	13/–
1B5/25S	11/2
1C4	11/6
1C6	13/2
1D4	12/–
1F4	13/8
1F6	15/4
1K4	11/6
1K5	11/6
1K6	12/–
1R5	12/6
1S4	12/6
1S5	12/6
1T4	12/6
1V	10/–
2A3	15/6
2A5	10/8
2A6	10/3
2A7	12/7
2B7	12/7
2E5	12/–
2X2/879	19/6
5T4	13/6
5W4	10/7
5Z3	10/1
5Z4	13/4
6A3	£1/0/9
6A4	14/–
6A6	13/4
6A7	10/11
6A8	14/–
6AB5/6N5	12/–
6AB7/1853	17/6
6AC7/1852	19/6
6B5	£1/0/1
6B7	12/11
6B7S	11/–
6B8	16/10
6C5	10/7
6C6	10/8

Type.	Price.
6D6	9/9
6E5	13/3
6F5	11/9
6F6	11/9
6F7	14/7
6G5/6H5/6U5	12/–
6H6	10/7
6J5	10/2
6J7	11/7
6K7	12/2
6K8	13/6
6L6	19/8
6L7	14/10
6N7	14/3
6Q7	12/–
6R7	14/5
6S7	12/–
6SA7	10/6
6SC7	12/5
6SF5	10/4
6SF7	9/6
6SJ7	9/6
6SK7	10/2
6SQ7	10/6
6SR7	11/–
6T5	16/–
6U5/6G5	12/–
6V6	13/–
6X5	13/7
7A5	13/–
7A6	13/–
7A7	13/–
7A7LM	13/–
7A8	13/–
7B5LT	13/–
7B6LM	13/–
7B7	13/–
7B8LM	13/–
7C5LT	13/–
7C6	13/–
7C7	—
7Y4	13/–
10	19/6
12A5	14/–

Type.	Price.
12A7	16/8
12C8	13/–
12K8	13/–
12SA7	11/5
12SC7	10/6
12SF5	9/6
12SJ7	10/6
12SK7	10/–
12SQ7	9/6
12SR7	10/6
12Z3	11/2
15	18/6
19	12/1
20	19/–
24A	10/–
25A6	16/–
25L6	12/6
25Y5	£1/0/10
25Z5	9/1
25Z6	12/7
26	7/2
27	7/2
30	8/8
31	8/9
32	14/5
33	12/10
34	13/3
35	9/–
35A5	13/–
35A5LT	13/–
35Z5	13/–
35Z5LT	13/–
36	10/5
37	9/11
38	10/7
39/44	10/7
41	9/4
42	9/5
43	10/11
45	7/10
46	12/4
47	11/3
48	21/–
49	11/1

Type.	Price.
50	£1/3/–
53	15/11
55	11/7
56	7/4
57	9/7
58	9/7
59	16/–
71A	10/3
75	9/2
76	7/6
77	10/1
78	9/8
79	13/3
80	6/10
81	£1/0/9
82	12/7
83	11/3
83V	17/–
84/6Z4	10/2
85	9/11
89	10/4
112A	9/6
302	13/6

G. TYPES

OA4G	17/6
OZ4G	12/6
1A5G	14/5
1A7G	14/2
1C5G	14/4
1C7G	15/6
1D5G-P	12/–
1D7G	15/6
1E5G-P	12/6
1E7G-V	18/6
1F5G	14/9
1F7G-V	13/6
1G4G	11/6
1G5G	13/–
1G6G	11/6
1H4G	8/2
1H5G	13/10
1H6G	11/7
1J6G	10/–
1K5G	11/6
1K7G	12/6
1L5G	12/6
1M5G	12/–
1N5G	13/2
5U4G	8/6
5V4G	15/10
5X4G	10/1
5Y3G	6/9
5Y4G	7/4
6AC5G	12/11
6AD7G	12/–
6AEG	12/6
6AFG	10/–
6A8G	10/10
6B4G	10/–
6B6G	11/6
6B8G	12/11
6C5G	11/10
6C8G	13/8
6D8G	13/8
6F5G	9/10
6F6G	9/8
6F8G	13/3
6G6G	13/11
6G8G	12/6
6H6G	9/11
6J5G	9/3
6J7G	10/3
6J8G	13/10
6K5G	11/1
6K6G	9/8
6K7G	9/11
6K8G	13/7
6L5G	10/1
6L6G	15/11
6L7G	13/3
6N6G	£1/3/10
6N7G	12/9
6P5G	9/4
6Q7G	9/–
6R7G	11/5
6S7G	15/1
6T7G	13/8
6U7G	10/2
6V6G	11/–
6W7G	12/6
6X5G	11/6
6Y6G	16/9
6Z7G	16/1
6ZY5G	14/2
25A6G	10/6
25A7G	13/6
25B6G	12/6
25L6G	10/8
25Z6G	10/–

G.T. TYPES

Type.	Price.
1A5GT	14/6
1A7GT	14/6
1H5GT	14/6
1D8GT	£1/2/6
1N5GT	14/–
1P5GT	15/–
1Q5GT	15/–
1T5GT	
5W4GT	10/–
6AE5GT	12/6
6A8GT	10/–
6F5GT	9/6
6J5GT	9/6
6J7GT	9/6
6K6GT	9/6
6K7GT	9/6
6Q7GT	9/6
6V6GT	10/–
6X5GT	10/6
12A8GT	10/–
12F5GT	10/–
12J5GT	9/6
12J7GT	10/–
12K7GT	9/6
12Q7GT	9/6
25A7GT	12/6
25B8GT	13/6
25L6GT	10/–
25Z6GT	9/6
35L6GT	10/–
35Z4GT	9/6
35Z5GT	9/6
45Z5GT	9/6
50L6GT	11/6
70L7GT	15/6
117N7GT	
117Z6GT	15/–
25AC5GT	12/6

PRICES ARE SUBJECT TO ALTERATION

All prices in this book must be regarded as an indication only—all orders will be executed at ruling prices.

THE ELECTRIC LAMPHOUSE LIMITED,

11 MANNERS STREET, WELLINGTON, C.1.

PHILIPS AND MULLARD VALVES

METAL CLAD "E" SERIES (6.3 VOLT A.C.) "P" BASE.

EAB1	12/6	EH2	15/11
EBC3	12/9	EK2	15/5
EBF1	13/–	EK3	16/6
EBF2	12/6	EL2	12/3
EBL1	15/2	EL3	12/9
ECH3	16/6	EM1	14/7
EF5	13/–	EM4	14/7
EF6	12/9	EZ2	9/10
EF8	13/–	EZ3	10/8
EF9	13/–		

METAL CLAD "E" SERIES, OCTAL BASE.

EBC33	13/–	ECH35	16/6
EBF32	13/–	EF39	13/–
EBL31	15/2	EL33	13/–

METAL CLAD "A" SERIES (4 VOLT A.C.) "P" BASE.

ABC1	12/9	AL3/4	12/3
ABL1	14/4	AM1	13/10
AF3	12/9	AZ1	10/8
AH1	15/5	AZ3	10/8
AK2	15/5	AZ31	10/8
AL2	14/10		

STANDARD D.C. TYPES.

A409	14/4	A615	13/10
A415	15/8	A642	16/6
A425	13/10	B405	14/4
A442	16/6	B406	14/4
A609	13/10	B605	14/4

METAL CLAD SERIES (4 VOLT A.C.)

AB1	10/1	E438	14/7
AB2	10/1	E442	15/5
ABC1	12/9	E443H	15/11
ABL1	14/4	E444	13/10
AF2	12/3	E446	13/3
AF6	12/9	E447	14/4
AK1	15/5	E452T	14/4
AK2	15/5	E454	12/3
AL4	12/3	E463	12/11
B443	18/4	E499	13/10
C443	17/3	506	12/9
E409	13/3	1561	12/9
E424	14/4		

METAL CLAD "C" SERIES (200 mA. A.C.-D.C.) "P" BASE.

CB1	10/4	CL2	14/10
CBC1	13/10	CL4	14/4
CC1	13/3	CY2	11/8
CF1	14/7	CCH35	16/6
CF2	14/7	CL33	13/–
CF3	14/10	CY31	13/–
CK1	14/4		

METAL CLAD "K" SERIES (2 VOLT BATTERY) "P" BASE.

KBC1	14/4	KF1	13/3
KC3	11/8	KF2	13/10
KF3	14/7	B217	10/1
KK2	16/2	B240	14/4
KDD1	14/4	C243	15/5
KL4	14/10		

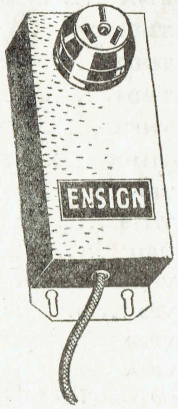
LISSEN VALVES

B2	15/–	SG2V	19/6
P22O	12/6	AC/TH1	15/–
L2D	17/6	R2	15/–
PT2A	19/6		

MULLARD TYPES

ACO44	16/6	S4VA	12/–
CBL1	13/–	TDD13C	13/10
CY1	13/–	TDD2A	14/4
DW4/350	12/9	TDD4	12/9
DW4/500	12/9	TH21C	13/–
EB4	12/6	TH30C	18/4
ECH2	16/6	TH4	13/–
EM3	12/–	TH4B	13/–
FC2A	16/6	UR1C	12/3
FC4	15/5	VP13C	14/7
Pen.A4	12/3	VP2	14/7
Pen.36C	14/4	VP2B	13/10
Pen.4DD	14/4	VP4A	12/3
Pen.4VA	12/11	VP4B	12/9
Pen.428	14/3	1561	12/9
PM1HF	12/3	1821	12/9
PM12M	12/3	1W4/500 (as 350)	11/8
PM22A	14/10	2D4A	10/1
PM2DX	10/1	2D4B	10/6
PM2HL	11/8	354V	14/9
SP13C	12/–		

with ENSIGN LINE FILTERS



Besides being picked up by the aerial system, man-made static can also come over the A.C. power mains.

We must decide whether the man-made static, which is proving so troublesome, is being picked up by the aerial or is coming over the power lines or both. A good test is to tune the set to a point where the noise is particularly bad and turn the volume control well up. Now remove the aerial wire and attach it to the earth terminal, but do not remove the earth wire. The effect will be to reduce the noise level, but if the man-made static continues to be very severe you will at once know that at least portion of the interference is coming over the A.C. power mains, and you will at least need an Ensign Line Filter before you can overcome the trouble. On the other hand, if the noise is entirely eliminated you will know that the noise is being picked up by the aerial and some form of noise-reducing aerial will be required.

Designed for use with electrically operated radio receivers. Simply fits between the receiver and the wall plug. It will definitely stop all man-made static entering through either A.C. or D.C. Mains. Particularly successful in D.C. and on ships with D.C. generators.

Cat. No. SA298 ..... **19/6**

THE LAMPHOUSE, 11 Manners Street, Wellington, C.1.

Join the Radio Hobbies Club

WHAT MEMBERS SAY.

"I joined in 1936, and have always been pleased with the 'Radiogram' and cannot understand how such a fine little book can be produced at the price. The recent issues have been very instructive. "I would like more about new circuits and valves, etc., but I know how this is impossible just now.—Rahob 2404."

* * *

"When I see anything about Generators in the 'Radiogram,' that is what I dive for.—Rahob 9373, REPOROA."

* * *

"I say there is no other Club in New Zealand as instructive as the Radio Hobbies Club. I wish the R.H.C. every success in the future.—Rahob 10643, PUNIHO."

* * *

"Congratulations on the wartime 'Radiogram,' it's certainly a top-hole magazine, packed full of interest.—Rahob 9308, EDENDALE."

* * *

"The 'Radiogram' is the best Radio magazine that can be bought for the price. No other Club in Australasia includes so many benefits, such as Technical Inquiry Service, DX advice, penfriends, and all the others.—Rahob 8411, WANGANUI."

* * *

"Your magazine has helped me make friends with other Rahobs. One is working with me, and another corresponds with me up North. So you see the Club is not only instructional but helps to promote friendship as well.—Rahob 10597, 'AERADIO'."

* * *

"From my point of view the articles in the Club paper, the 'Radiogram,' seem to be the very things I want to know about.—Rahob 8135."

* * *

"I have been especially interested in the 'Radiogram' features.—Rahob 9168."

"In passing I might add that I have a much-travelled copy of the 1939-40 Lamphouse Annual. It has been to India and Egypt, and back here when I returned six months ago. I might add that it gave me many interesting and happy hours.—R. A. MacP."

* * *

"Please find enclosed postal note for 6/- to cover my subscription for the R.H.C. for 1944, renewal for which falls due on the 2nd prox. Although the farm, a bit of swot now and again, and photography keep me pretty busy, I shall always do what I can to pull my weight as a Club member, and take this opportunity of wishing it every success for this year, and also of thanking those in control for the help I have received during the past 12 months.—Rahob 6973."

* * *

"Although I knew next to nothing about Radio three or four years ago, thanks to the 'Radiogram' and the Lamphouse Annuals, etc., I now understand the inside of a Radio fairly well."—Rahob 6697."

* * *

"In my opinion the 'Radiogram' is the best magazine of its kind on the market, and well worth the money.—Rahob 7323."

* * *

"Hawera, 8/4/44.

"During the last year my knowledge of Radio has increased vastly.—Rahob 8343."

* * *

"I must say I appreciate the Lamphouse Annual and the 'Radiogram." I find these publications very useful.—T.S."

* * *

"I always look forward to it every month and enjoy reading all the features. Best luck to the Club.—Rahob 6428."

You too can learn, make friends, and enjoy the many benefits of membership.

Subscription Rates:
New Zealand 6/- p.a.; Australia, 7/6 p.a.

Turn to Page 147 for full particulars.

USING HEADPHONES FOR QUALITY REPRODUCTION

(By RAHOB 4338.)

It often happens that it is desired to use headphones with an A.C. set for one reason or another, and to do this there are several possible means of connection, depending upon the use for which they are required. As an example, when required for listening to Morse, fidelity is not important, but for ordinary broadcast programmes fidelity definitely is of importance.

Let us consider the different methods of connection in order of merit.

One of the commonest methods is to attach the phones through a fairly large condenser (.1 or .25) between the plate of the output tube and earth, as in Fig. 1. In this case the speaker is usually left going, although it can be turned off by switch X.

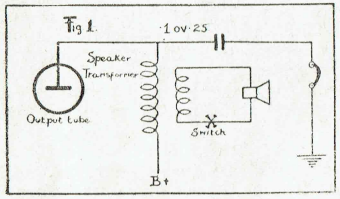


Fig. 1.

This system gives poor fidelity because the reaction of the condenser changes with the different frequencies; i.e., at 50 cycles its impedance will be approximately 20 times that at 1,000 cycles. As a result there is a considerable low frequency loss. If only speech or Morse is to be received this does not particularly matter, however.

Where less power is required, the phones may be inserted before the output stage by means of a closed circuit jack, as in Fig. 2. For local stations and quite

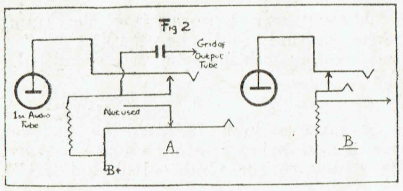


Fig. 2.

a lot of distant ones there will be plenty of power available for headphones, and the quality will be quite good. Either a double or single circuit jack may be used, as shown, although the former will give slightly better results. The connections for both types are clearly shown in the diagrams.

A point to notice is that the insertion of the plug will automatically connect the phones and cut out the speaker, even though the output valve is left running. Under no circumstances should it be pulled out, as damage to the set may result if this is done.

A third method which will give excellent results is shown in Fig. 3. A speaker transformer matched to the output tube (as it always should be) is connected in the usual way, but instead of terminating in a voice coil a resistor of the same value is placed across the secondary. A pair of phones with an impedance of at least 10 times that of the resistor are connected across it as shown. Naturally a slight mismatch will occur, but it is negligible. The only disadvantage is that nine-tenths of the power is lost in the resistor, but with A.C. sets there is usually plenty to spare.

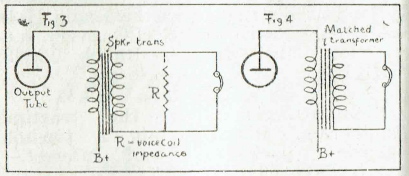


Fig. 3. **Fig. 4.**

The fourth and best method is to use an output transformer with a primary to match the output tube and a secondary to match the impedance of the phones.

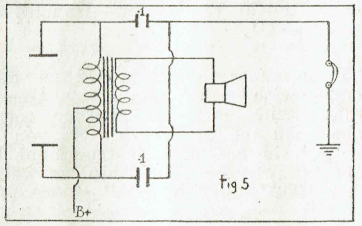


Fig. 5.

In this way best quality reproduction will be obtained. See Fig. 4.

If the set has push-pull output all the above can easily be applied except that in the first case two condensers are used, one from each plate, as shown in Fig. 5.

It will be noticed that most of the above systems are permanent adaptions for phone work. If it is desired to operate the speaker when phones are not wanted, suitable switching devices can be fixed without any trouble.

In conclusion, it is hardly necessary to add that a good pair of headphones should be used, not only for the sake of quality, but cheap phones will definitely deteriorate often after only a few months whereas others will last almost indefinitely.—Rahob 4338.

RAHOB AUSTRALASIAN BROADCAST LOG FOR 1944

Compiled by ARTHUR T. CUSHEN, 105 Princes Street, Invercargill, Short Wave Editor of the New Zealand DX Club's Bulletin, "N.Z. DX-TRA."

Location and Call.	Kilocycles.	Power in Watts.
Cumnock, N.S.W.—2CR	550	10,000
Minding, W.A.—6WA	560	10,000
Wellington, N.Z.—2YA	570	60,000
Horsham, Vic.—3WV	580	10,000
Hobart, Tas.—7ZL	600	2,000
Sydney, N.S.W.—2FC	610	10,000
Melbourne, Vic.—3AR	620	10,000
Townsville, Q.—4QN	630	7,000
Crystal Brook, S.A.—5CK	640	7,500
Auckland, N.Z.—1YA	650	10,000
Dubbo, N.S.W.—2DU	660	200
Burnie, Tas.—7BU	660	200
Corowa, N.S.W.—2CO	670	7,500
Lochinvar, N.S.W.—2HR	680	300
Atherton, Q.—4AT	680	500
Queenstown, Tas.—7QT	680	300
Invercargill, N.Z.—4YZ	680	5,000
Perth, W.A.—6WF	690	5,000
Lawrence, N.S.W.—2NR	700	7,500
Kelso, Tas.—7NT	710	7,500
Christchurch, N.Z.—3YA	720	10,000
Kalgoorlie, W.A.—6GF	720	2,000
A.E.F. Radio—Guadalcanar	730	—
Adelaide, S.A.—5CL	730	4,000
Sydney, N.S.W.—2BL	740	10,000
Napier, N.Z.—2YH	750	5,000
Dalby, Q.—4QS	760	10,000
Melbourne, Vic.—3LO	770	10 000
Katoomba, N.S.W.—2KA	780	2 000
Townsville, Q.—4TO	780	200
Dunedin, N.Z.—4YA	790	10,000
Broken Hill, N.S.W.—2BH	790	200
Perth, W.A.—6WN	790	500
Brisbane, Q.—4QG	800	2,500
New Plymouth, N.Z.—2YB	810	100
Murray Heights, S.A.—5RM	810	2 000
Newcastle, N.S.W.—2NA	820	10,000
Sale, Vic.—3G1	830	7,000
Wellington, N.Z.—2YC	840	5,000
Canberra, F.T.—2CY	850	10,000
Toowoomba, Q.—4GR	860	500
Hobart, Tas.—7HO	860	500
Sydney N.S.W.—2GB	870	1,000
Auckland, N.Z.—1YX	880	150
Warragul, Vic.—3UL	880	200
Warwick, Q.—4WK	880	100
Perth, W.A.—6PR	880	500
Adelaide, S.A.—5AN	890	500
Lismore, N.S.W.—2LM	900	500
Devonport, Tas.—7AD	900	300
Rockhampton, Q.—4RK	910	2,000
Suva, Fiji—ZJV	920	400
Nelson, N.Z.—2YN	920	30
Cooma, N.S.W.—2XL	920	200
Charlesville, Q.—4VL	920	200
Melbourne, Vic.—3UZ	930	600
Greymouth, N.Z.—3ZR	940	800
Brisbane, Q.—4QR	940	500
Sydney, N.S.W.—2UE	950	1,000
Adelaide, S.A.—5DN	960	500
"All Services' Radio"—Noumea	965	1,000
Bendigo, Vic.—3BO	970	500
Ayr, Q.—4AY	970	500
Kempsey, N.S.W.—2KM	980	100
Gisborne, N.Z.—2ZJ	980	25
Northam, W.A.—6AM	980	2,000
Orange, N.S.W.—2GZ	990	2,000
Wellington, N.Z.—2YD	990	250
Cairns, Q.—4CA	1,000	300
Maryborough, Q.—4MB	1,000	200
Launceston, Tas.—7EX	1,000	500
Hamilton, Vic.—3HA	1,010	750
Dunedin, N.Z.—4ZD	1,010	100
Sydney, N.S.W.—2KY	1,020	1,000
Melbourne, Vic.—3DB	1,030	500
Crystal Brook, S.A.—5PI	1,040	2,000
Canberra, F.T.—2CA	1,050	2,000
Kingaroy, Q.—4SB	1,060	2,000
Auckland, N.Z.—1ZB	1,070	1,000
Griffith, N.S.W.—2RG	1,070	200
Katanning, W.A.—6WB	1,070	2,000
Lithgow, N.S.W.—2LT	1,080	100
Rockhampton, Q.—4RO	1,080	200
Hobart, Tas.—7HT	1,080	500
Lubeck, Vic.—3LK	1,090	1,000
Longreach, Q.—4LG	1,100	300
Merridin, W.A.—6MD	1,100	500
Launceston, Tas.—7LA	1,100	500
Sydney, N.S.W.—2UW	1,110	750
Brisbane, Q.—4BC	1,120	1.000
Wellington, N.Z.—2ZB	1,130	1,000
Colac, Vic.—3CS	1,130	200
Perth W.A.—6PM	1,130	500
Armidale, N.S.W.—2AD	1,130	200
Dunedin, N.Z.—4YO	1,140	150
Wagga, N.S.W.—2WG	1,150	2,000
Hobart, Tas.—7ZR	1,160	500
Inverell, N.S.W.—2NZ	1,170	2,000
Gisborne, N.Z.—2ZM	1,180	100
Melbourne, Vic.—3KZ	1,180	600
Sydney, N.S.W.—2CH	1,190	1,000
Adelaide, S.A.—5KA	1,200	500
Christchurch, N.Z.—3YL	1,200	300
Grafton, N.S.W.—2GF	1,210	200
Warrnambool, Vic.—3YB	1,210	200
Kalgoorlie, W.A.—6KG	1.210	500
Oakey, Q.—4AK	1,220	2,000
Newcastle, N.S.W.—2NC	1,230	2,000
Sale, Vic.—3TR	1,240	1,000
Perth, W.A.—6IX	1,240	500
Allied Radio, New Guinea. —9PA	1,250	250
Auckland, N.Z.—1ZM	1,250	1,000
Shepparton, Vic.—3SR	1,260	2 000
Sydney, N.S.W.—2SM	1,270	1,000
Melbourne, Vic.—3AW	1,280	600
Brisbane, Q.—4BK	1,290	500
Tamworth, N.S.W.—2TM	1,300	2,000
Dunedin, N.Z.—4ZB	1,310	1,000
Adelaide, S.A.—5AD	1,310	500
Ballarat, Vic.—3BA	1 320	500
Perth, W.A.—6KY	1,320	500
Swan Hill, Vic.—3SH	1,330	200
Bundaberg, Q.—4BU	1,330	500
Young, N.S.W.—2LF	1,340	300
Dardanup, W.A.—6TZ	1,340	1,000
Geelong, Vic.—3GL	1,350	500
Gympie, Q.—4GY	1,350	200
Mildura, Vic.—3MA	1,360	200
Port Moresby, Papua—4PM	1,360	100
Gunnedah, N.S.W.—2MO	1,370	100
Mt. Gambier, S.A.—5SE	1,370	200
Geraldton, W.A.—6GE	1,370	500
Brisbane, Q.—4BH	1,380	1,000
Goulburn, N.S.W.—2GN	1,390	200
Mackay, Q.—4MK	1,390	100
Palmerston North, N.Z.—2ZA	1,400	1,000
Parkes, N.S.W.—2PK	1,400	200
Port Augusta, S.A.—5AU	1,400	200
Newcastle, N.S.W.—2KO	1,410	500
Melbourne, Vic.—3XY	1,420	600
Christchurch, N.Z.—3ZB	1,430	1,000
Wollongong, N.S.W.—2WL	1,430	500
Deniliquin, N.S.W.—2QN	1.440	200
Ipswich, Q.—4IP	1,440	200
Derby, Tas.—7DY	1,450	200
Cessnock, N.S.W.—2CK	1,460	300
Murray Heights S.A.—5MU	1,460	200
Murwillumbah, N.S.W.—2MW	1.470	200
Bendigo, Vic.—3CV	1,470	500
Albury, N.S.W.—2AY	1,480	200
Bega, N.S.W.—2BE	1,490	100
Roma, Q.—4ZR	1,490	200
Bathurst, N.S.W.—2BS	1,500	100
Melbourne, Vic.—3AK	1,500	200

NORTH AMERICAN BROADCAST STATIONS

Complete list of stations in United States and Canada, with main Mexican and Cuban ones, now in operation, giving call, location, power and time belt. Compiled by Arthur T. Cushen, 105 Princes Street, Invercargill, DX Adviser to the Radio Hobbies Club. All American stations now observe Daylight Saving, or War Time, and this means that at midnight Eastern War Time it is 4 p.m. N.Z.D.S.T.; midnight Central War Time, 5 p.m. N.Z.D.S.T.; midnight Mountain (or Midwest, as it is called in Canada) 6 p.m. N.Z.D.S.T. and midnight Pacific War Time, 7 p.m. N.Z.D.S.T., all these being the following day in New Zealand. A Atlantic Time; E Eastern War Time; C Central War time; M Mountain War Time; P Pacific War Time.

Power shown is that used in the Evening Broadcasts.

(Stations marked * observe standard time.)

Call and Location.	Power in Watts.	Zone.
540 Kilocycles—		
CBK—Watrous, Sask.	50,000	M
550 Kilocycles—		
CFNB—Fredericton, N.B.	1,000	E
KFYR—Bismarck, N.D.	5,000	C
KOAC—Corvallis, Ore.	1,000	P
KOY—Phoenix, Ariz.	1,000	M
KSD—St. Louis, Mo.	1,000	C
KTSA—San Antonio, Tex.	1,000	C
WDEV—Waterbury, Vt.	1,000	E
WGR—Buffalo, N.Y.	1,000	E
WKRC—Cincinnati, Ohio	1,000	E
WSVA—Harrisonburg, Va.	1,000	E
560 Kilocycles—		
CJKL—Kirkland Lake, Ont.	1,000	E
KFDM—Beaumont, Tex.	1,000	C
KLZ—Denver, Colo.	5,000	M
KPQ—Wenatchee, Wash	1,000	P
KSFO—San Francisco, Cal.	5,000	P
KWTO—Springfield, Mo	5,000	C
WFIL—Philadelphia, Pa.	1,000	E
WGAN—Portland, Me.	5,000	E
WIND—Gary, Ind.	5,000	C
WIS—Columbus, S.C.	5,000	E
WQAM—Miami, Fla.	5,000	E
570 Kilocycles—		
CMHI—Santa Clara, Cuba	15,000	E
KGKO—Fort Worth, Tex.	5,000	C
KMTR—Los Angeles, Cal.	1,000	P
KUTA—Salt Lake City, Ut.	5,000	M
KVI—Tacoma, Wash.	5,000	P
WKBN—Youngstown, Ohio	5,000	E
WMAM—Marinette, Wis.	250	C
WMCA—New York, N.Y.	5,000	E
WNAX—Yankton, S. Dak.	5,000	C
WSYR—Syracuse, N.Y.	5,000	E
WWNC—Asheville, N.C.	1,000	E
580 Kilocycles—		
CJFX—Antigonish, N.S.	1,000	A
CKCL—Toronto, Ont.	1,000	E
CKPR—Ft. William, Ont.	1,000	E
CKUA—Edmonton, Alta.	1,000	M
KMJ—Fresno, Cal	5,000	P
KSAC—Manhattan, Kansas	500	C
WCHS—Charleston, W., Va.	5,000	E
WDBO—Orlando, Fla.	5,000	E
WIAC—Hato Rey, P. Rico	5,000	A
WIBW—Topeka, Kansas	5,000	C
WILL—Urbana, Ill.	5,000	C
WTAG—Worcester, Mass	5,000	E
590 Kilocycles—		
CMCY—Havana, Cuba	15,000	E
KGMB—Honolulu, Hawaii	5,000	—
KHQ—Spokane, Wash.	5,000	P
KTBC—Austin, Texas	1,000	C
WAGA—Atlanta, Ga.	5,000	E
WEEI—Boston, Mass.	5,000	E
WKZO—Kalamazoo, Mich.	5,000	E
WMBS—Uniontown, Pa.	1,000	E
WOW—Omaha, Nebr,	5,000	C

Call and Location.	Power in Watts.	Zone.
600 Kilocycles—		
CFCH—North Bay, Ont.	1,000	E
CFCF—Montreal, Que.	500	E
CFQC—Saskatoon, Sask	1,000	M
CJOR—Vancouver, B.C.	1,000	P
KFSD—San Diego, Cal.	1,000	P
KROD—El Paso, Texas	500	M
KSJB—Jamestown, N.D.	100	C
WCAO—Baltimore, Md.	5,000	E
WICC—Bridgeport, Conn.	5,000	E
WMT—Cedar Rapids, Iowa	5,000	C
WREC—Memphis, Tenn.	5,000	C
WSJS—Winston Salem, N.C.	5,000	E
610 Kilocycles—		
CHNC—New Carlisle, Que.	1,000	E
CJAT—Trail, B.C.	1,000	P
KDAL—Duluth, Minn.	1,000	C
KFRC—San Francisco, Cal.	5,000	P
WAYS—Charlotte, N.C.	1,000	E
WCLE—Cleveland, Ohio	500	E
WDAF—Kansas City, Mo.	5,000	C
WIOD—Miami, Fla.	5,000	E
WIP—Philadelphia, Pa.	5,000	E
WMUR—Manchester, N.H.	1,000	E
WSGN—Birmingham, Ala	1,000	C
620 Kilocycles—		
CKCK—Regina, Sask.	1,000	M
KGW—Portland, Ore.	5,000	P
KTAR—Phoenix, Ariz.	5,000	M
KWFT—Wichita Falls, Tex.	1,000	C
WAGE—Salina, N.Y.	1,000	E
WCAX—Burlington, Vt.	1,000	E
WHJB—Greensburg, Pa.	250	E
WKAQ—San Juan, P.R.	5,000	A
WLBZ—Bangor, Me	5,000	E
WROL—Knoxville, Tenn.	500	C
WSUN—St. Petersburg, Fla.	5,000	E
WTMJ—Milwaukee, Mis	5,000	C
630 Kilocycles—		
CFCO—Chatham, Ont.	100	E
CFCY—Charlottetown, P.E.I.	1,000	A
CKRC—Winnipeg, Man.	1,000	C
CKOV—Kelowna, B.C.	1,000	P
CMZ—Havana, Cuba	15,000	E
KGFX—Pierre, S.D.	200	C
KOH—Reno, Nev.	1,000	P
KVOD—Denver, Colo.	5,000	M
KXOK—St. Louis, Mo.	5,000	C
WMAL—Washington, D.C.	5,000	E
WPRO—Providence, R.I.	5,000	E
640 Kilocycles—		
KFI—Los Angeles, Cal.	50,000	P
WHKC—Columbus, Ohio	500	E
WNAD—Norman, Okla	1,000	C
WOI—Ames, Iowa	5,000	C
650 Kilocycles—		
WSM—Nashville, Tenn.	50,000	C

Call and Location.	Power in Watts.	Zone.
660 Kilocycles—		
KFAR—Fairbanks, Alaska	10,000	—
KOWH—Omaha, Nebr.	500	C
KSKY—Dallas, Texas	1,000	C
WEAF—New York, N.Y.	50,000	E
670 Kilocycles—		
WMAQ—Chicago, Ill.	50,000	C
680 Kilocycles		
KFEQ—St. Joseph, Mo.	5,000	C
KPO—San Francisco, Cal.	50,000	P
WLAW—Lawrence, Mass.	5,000	E
WPTF—Raleigh, N.C.	50,000	E
WISR—Butler, Pa.	250	E
690 Kilocycles—		
CBF—Montreal, Que.	50,000	E
KGGF—Coffeyville, Kans.	500	C
CMQ—Havana, Cuba	25,000	E
XEAC—Tijuana, Mex.	5,000	P
XEN—Mexico City, Mex.	5,000	C
700 Kilocycles—		
WLW—Cincinnati, Ohio	50,000	C
710 Kilocycles—		
KIRO—Seattle, Wash.	50,000	P
KMPC—Beverly Hills, Cal.	10,000	P
WFTL—Ft. Lauderdale, Fla.	10,000	E
WOR—New York, N.Y.	50,000	E
720 Kilocycles—		
WGN—Chicago, Ill.	50,000	C
730—Kilocycles—		
CKAC—Montreal, Que.	5,000	E
740 Kilocycles—		
CBL—Toronto, Ont.	50,000	E
KQW—San Jose, Cal.	5,000	P
KTRH—Houston, Texas	50,000	C
750 Kilocycles—		
KMMJ—Grand Island, Nebr.	1,000	C
KXL—Portland, Ore.	10,000	P
WHEB—South Portsmouth, N.H.	1,000	E
WSB—Atlanta, Ga.	50,000	E
760 Kilocycles—		
KGU—Honolulu, Hawaii	2,500	—
WJR—Detroit, Mich.	50,000	E
770 Kilocycles—		
KOB—Albuquerque, N.M.	50,000	M
KXA—Seattle, Wash.	1,000	P
WCAL—Northfield, Minn.	5,000	C
WEW—St. Louis, Minn.	1,000	C
WJZ—New York, N.Y.	50,000	E
WLB—Minneapolis, Minn.	5,000	C.
780 Kilocycles—		
KFAB—Lincoln, Nebr.	10,000	C
WBBM—Chicago, Ill.	50,000	C
790 Kilocycles—		
CKSO—Sudbury, Ont.	1,000	E
KECA—Los Angeles, Calif.	5,000	P
KFQD—Ancharoge, Alaska	1,000	—
KGHL—Billings, Mont.	5,000	M
KVAS—Bellingham, Wash.	1,000	P
WEAN—Providence, R.I.	5,000	E
WMC—Memphis, Tenn.	5,000	C
WPIC—Sharon, Penn.	1,000	E
WTAR—Norfolk, Va.	5,000	E
WWNY—Watertown, N.Y.	1,000	E
800 Kilocycles—		
CHAB—Moose Jaw, Sask.	1,000	M
CHRC—Quebec, Que.	250	E
CKLW—Windsor, Ont.	5,000	E
XELO—Ciudad Juarex, Mex.	150,000	C

Call and Location.	Power in Watts.	Zone.
810 Kilocycles—		
KGO—San Francisco, Calif.	7,500	P
KOAM—Pittsburg, Kansas	1,000	C
WGY—Schenectady, N.Y.	50,000	E
820 Kilocycles—		
WAIT—Chicago, Ill.	5,000	C
WBAP—Fort Worth, Tex.	50,000	C
WFAA—Dallas, Texas	50,000	C
WOSU—Columbus, Ohio	5,000	E
830 Kilocycles—		
WCCO—Minneapolis, Minn.	50,000	C
WNYC—New York, N.Y.	1,000	E
840 Kilocycles—		
WHAS—Louisville, Ky.	50,000	C
850 Kilocycles—		
KFUO—Clayton, Mo.	5,000	C
KOA—Denver, Colo.	50,000	M
WEEU—Reading, Pa.	1,000	E
WHDH—Boston, Mass.	5,000	E
WJW—Akron, Ohio	5,000	E
WRUF—Gainesville, Fla.	5,000	E
860 Kilocycles—		
CFRB—Toronto, Ont.	10,000	E
XEMO—Tijuana, Mex.	5.000	P
KTRB—Modesto, Calif.	1,000	P
WSON—Henderson, Ky.	250	E
WJW—Cleveland, Ohio	5,000	E
870 Kilocycles—		
KIEV—Glendale, Calif.	250	P
WHCU—Ithica, N.Y	1,000	E
WKAR—East Lansing, Mich.	5,000	E
WWL—New Orleans, La.	50,000	C
880 Kilocycles—		
WABC—New York, N.Y.	50,000	E
WHB—Kansas City, Mo.	1,000	C
890 Kilocycles—		
WENR—Chicago, Ill.	50,000	C
WLS—Chicago, Ill.	50,000	C
900 Kilocycles—		
CHML—Hamilton, Ont.	1,000	E
CJBR—Rimouski, Que.	1,000	E
CKB1—Prince Albert, Sask.	1,000	M
XEW—Mexico City, Mex.	100,000	C
KLCN—Blytheville, Ark.	1,000	C
WSEA—York, Pa.	1,000	E
910 Kilocycles—		
CBO—Ottawa, Ont.	1,000	E
CFJC—Kamloops, B.C.	1,000	P
KFKA—Greeley, Col.	1,000	M
KLX—Oakland, Cal.	1,000	P
KPOF—Denver, Col.	1,000	M
KRRV—Sherman, Tex.	1,000	C
KVAN—Vancouver, Wash.	500	P
WABI—Bangor, Me.	5,000	E
WCOC—Meridian, Miss.	1,000	C
WFDF—Flint, Mich.	1,000	E
WGBI—Scranton, Pa.	500	E
WJHL—Johnson City, Tenn.	1,000	C
WQAN—Scranton, Pa.	500	E
WRNL—Richmond, Va.	5,000	E
WSUI—Iowa City, Iowa	5,000	C
920 Kilocycles—		
CKNX—Wingham, Ont.	1,000	E
KARK—Little Rock, Ark.	5,000	C
KFNF—Shenandoah, Iowa	500	C
KFPY—Spokane, Wash.	5,000	P
KFXJ—Grand Junction, Colo	500	M
KUSD—Vermillion, S. Dak.	1,500	C
WBAA—W. Lafayette, Ind.	1,000	C
WBBB—Burlington, N.C.	1,000	E
WGST—Atlanta, Ga.	1,000	E
WJAR—Providence, R.I.	5,000	E

Call and Location.	Power in Watts.	Zone.
WMMN—Pairmont, W. Va.	5,000	E
WTTM—Trenton, N.J.	1,000	E
930 Kilocycles—		
CJCA—Edmonton, Alb.	1,000	M
KHJ—Lost Angeles, Cal.	5,000	P
KSEI—Pocatello, Idaho	250	M
KTKN—Ketchikan, Alaska	1,000	—
WBEN—Buffalo, New York	5,000	E
WFMD—Frederick, Md.	500	E
WJAX—Jacksonville, Fla	1,000	E
WKY—Oklahoma City, Okla.	5,000	C
WLBL—Stevens Pt., Wisc.	5,000	C
WPAT—Patterson, N.J.	1,000	E
WRRF—Washington, N.C.	1,000	E
WSAZ—Huntington, W.Va.	1,000	C
WTAD—Quincy, Ill.	1,000	C
940 Kilocycles—		
CBM—Montreal, Que.	5,000	E
XEDP—Mexico City, Mex.	150,000	C
XEQ—Mexico City	150,000	C
KTKC—Visalia, Calif.	5,000	P
WMAZ—Macon, Ga.	5,000	E
950 Kilocycles—		
CKNB—Campbelltown, N.B.	1,000	E
KFEL—Denver, Colo.	5,000	M
KOMO—Seattle, Wash.	5,000	P
KPRC—Houston, Texas	5,000	C
WAAF—Chicago, Ill.	1,000	C
WORL—Boston, Mass.	1,000	E
WPEN—Philadelphia, Pa.	5,000	E
WSPA—Spartanburg, S.C.	1,000	E
WWJ—Detroit, Mich.	5,000	E
XEGM—Tijuana, Mex.	1,000	P
960 Kilocycles—		
CFAC—Calgary, Alta.	1,000	M
CHNS—Halifax, N.S.	1,000	A
CKWS—Kingston, Ont.	1,000	E
KMA—Shenandoah, Iowa	5,000	C
KROW—Oakland, Cal.	1,000	P
WBRC—Birmingham, Ala.	5,000	C
WDBJ—Roanake, Va.	5,000	E
WELI—New Haven, Conn.	1,000	E
WSBT—South Bend, Ind.	1,000	C
970 Kilocycles—		
KOIN—Portland, Ore.	5,000	P
WAAT—Newark N.J.	1,000	E
WAVE—Louisville, Ky.	5,000	C
WCSH—Portland, Me.	5,000	E
WDAY—Fargo, N.D.	5,000	C
WFLA—Tampa, Fla.	1,000	E
WHA—Madison, Wis.	5,000	C
WICA—Ashtabula, Ohio	1,000	E
980 Kilocycles—		
CBV—Quebec, Que.	1,000	E
CKRM—Regina, Sask.	1,000	M
CKWX—Vancouver, B.C.	1,000	P
KFWB—Los Angeles, Cal.	5,000	P
KMBC—Kansas City, Mo.	5,000	C
WGRG—Greensboro, N.C.	1,000	E
WRC—Washington, D.C.	5,000	E
WSIX—Nashville, Tenn.	5,000	C
WTRY—Troy, N.Y.	1,000	E
990 Kilocycles—		
CKY—Winnipeg, Man.	15,000	C
WIBG—Glenside, Pa.	1,000	E
WNOX—Knoxville, Tenn.	10,000	C
WPRA—Mayaguez, P. Rico	1,000	A
XECL—Mexicali, B.C.	5,000	P
1000 Kilocycles—		
KJR—Seattle, Wash.	5,000	P
WCFL—Chicago, Ill.	10,000	C
WQAM—Miami, Fla.	1,000	E
XEOY—Mexico City, Mex.	10,000	C

Call and Location.	Power in Watts.	Zone.
1010 Kilocycles—		
CJBC—Toronto, Ont.	5,000	E
CFCN—Calgary, Alta.	10,000	M
CMX—Havana, Cuba	25,000	E
KLRA—Little Rock, Ark.	50,000	C
KWBU—Corpus Christi, Texas	50,000	C
WINS—New York, N.Y.	10,000	E
1020 Kilocycles—		
KDKA—Pittsburgh, Pa.	50,000	E
KFVD—Los Angeles, Cal.	1,000	P
1030 Kilocycles—		
WBZ—Boston, Mass.	50,000	E
WBZA—Boston, Mass.	1,000	E
1040 Kilocycles—		
WHO—Des Moines, Iowa	50,000	C
1050 Kilocycles—		
WDZ—Tuscola, Ill.	1,000	C
WHN—New York, N.Y.	50,000	E
XEG—Monterry, N.L.	150,000	C
1060 Kilocycles—		
CJOC—Lethbridge, Alta.	1,000	M
KYW—Philadelphia, Pa.	50,000	E
XEST—Mexico City, Mex.	50,000	C
1070 Kilocycles—		
CBA—Sackville, N.B.	50,000	E
KFBI—Wichita, Kansas	1,000	C
KNX—Los Angeles, Cal.	50,000	P
WAPI—Birmingham, Ala.	5,000	C
WIBC—Indianapolis, Ind.	1,000	C
1080 Kilocycles—		
KRLD—Dallas, Texas	50,000	C
KWJJ—Portland, Ore.	1,000	P
WCAZ—Carthage, Ill.	250	C
WTIC—Hartford, Conn.	50,000	E
1090 Kilocycles—		
XERB—Tijuana, Mex.	50,000	P
KEVR—Seattle, Wash.	250	P
KTHS—Hot Springs, Ark.	5,000	C
WBAL—Baltimore, Md.	50,000	E
WJAG—Norfolk, Nebr.	1,000	C
1100 Kilocycles—		
KJBS—San Francisco, Cal.	500	P
WTAM—Cleveland, Ohio	50,000	E
1110 Kilocycles—		
KPAS—Pasadena, Cal.	10,000	P
WBT—Charlotte, N.C.	50,000	E
WMBI—Chicago, Ill.	5,000	C
1120 Kilocycles—		
KMOX—St. Louis, Mo.	50,000	C
1130 Kilocycles—		
CBR—Vancouver, B.C.	5,000	P
KWKH—Shreveport, La.	50,000	C
WCAR—Pontiac, Mich.	1,000	E
WDGY—Minneapolis, Minn.	500	C
WNEW—New York, N.Y.	10,000	E
1140 Kilocycles—		
XENT—Neuvo Laredo, Mex.	50,000	C
KGDM—Stockton, Calif.	5,000	P
KSOO—Sioux Falls, S.D.	5,000	C
WRVA—Richmond, Va.	50,000	E
1150 Kilocycles—		
CHSJ—St. John, N.B.	1,000	E
CKOC—Hamilton, Ont.	500	E
CKX—Brandon, Man.	1,000	C
KFSG—Los Angeles, Cal.	1,000	P
KRKD—Los Angeles, Cal.	1,000	P
KRSC—Seattle, Wash.	1,000	P
KSAL—Salina, Kansas	1,000	C
KSWO—Lawton, Oklo.	250	C
WAPO—Chattanooga, Tenn.	1,000	C
WCOP—Boston, Mass.	500	E

Call and Location.	Power in Watts.	Zone.
WDEL—Wilmington, Del.	5,000	E
WISN—Milwaukee, Wis.	5,000	C
WJBO—Baton Rouge, La.	5,000	C
WKPA—New Kensington, Pa.	250	C
WTAW—College Station, Texas	1,000	C
1160 Kilocycles—		
KSL—Salt Lake City Utah	50,000	M
WJJD—Chicago, Ill.	20,000	C
1170 Kilocycles—		
KVOO—Tulsa, Okla.	50,000	C
WWVA—Wheeling, W.Va.	50,000	E
1180 Kilocycles—		
WHAM—Rochester, N.Y.	50,000	E
WLDS—Jacksonville, Ill.	250	C
1190 Kilocycles—		
KEX—Portland, Ore.	5,000	P
WLIB—Brooklyn, N.Y.	1,000	E
WOWO—Fort Wayne, Ind.	10,000	C
1200 Kilocycles—		
WOAI—San Antonia, Texas	50,000	C
1210 Kilocycles—		
WCAU—Philadelphia, Pa.	50,000	E
1220 Kilocycles—		
XEB—Mexico City, Mex.	20,000	C
WGAR—Cleveland, Ohio	5,000	E
WGNY—Newburgh, N.Y.	1,000	E
WVCX—SitkaJ, Alaska	15	—
CKCA—Kenora, Ont.	1,000	C
1230 Kilocycles—		
CFAR—Flin Flon, Man.	250	C
CHGB—St. Anne de la Pocatiere, Que.	250	E
CJCJ—Calgary, Atla.	100	M
CKVD—Val D'Or, Que.	100	E
KADA—Ada, Okla.	250	C
KAST—Astoria, Ore.	250	P
KBTM—Jonesboro, Ark.	250	C
KCMC—Texarkana, Texas	250	C
KELO—Sioux Falls, S.D.	250	C
KFDA—Amarillo, Texas	250	C
KFIO—Spokane, Wash.	250	P
KFJB—Marshalltown, Iowa	250	C
KFUN—Las Vegas, N.M	250	M
KFXD—Nampa, Idaho	250	M
KGDE—Fergus Falls, Minn.	250	C
KGEK—Stirling, Colo.	250	M
KGFJ—Los Angeles, Cal.	250	P
KGHI—Little Rock, Ark.	250	C
KHAS—Hastings, Nebr.	250	C
KHBC—Hilo, Hawaii	250	—
KMLB—Munroe, La.	250	C
KODL—The Dalles, Ore.	250	P
KOOS—Marshfield, Ore.	250	P
KPHO—Phoenix, Ariz.	250	M
KPOW—Powell, Wyo.	250	M
KRLH—Midland, Texas	250	C
KSUN—Lowell, Ariz.	250	M
KVCV—Reading, Cal.	250	P
KVEC—San Luis Obispo Cal.	250	P
KVNU—Logan, Utah	250	M
KWG—Stockton, Cal.	250	P
KWNO—Winona, Minn.	250	C
KYSM—Mankato, Minn.	250	C
WAIM—Anderson, S.C.	250	E
WAJR—Morgantown, W.Va.	250	E
WAYX—Waycrosse, Ga.	250	E
WBBZ—Ponca City, Okla.	250	C
WBHP—Huntsville, Ala.	250	C
WBLJ—Dalton, Ga.	250	C
WBOC—Salisbury, Md.	250	E

Call and Location.	Power in Watts.	Zone.
WBOW—Terre Haute, Ind.	250	C
WCAT—Rapid City, S.D.	250	M
WCBT—Roanoke, N.C.	250	E
WCED—DuBois, Penn.	250	E
WCLO—Janesville, Wis.	250	C
WCLS—Florence, S.C.	250	E
WCOL—Columbus, Ohio	250	E
WCPO—Cincinnati, Ohio	250	E
WDLP—Panama City, Fla.	250	E
WDSM—Superior, Wis.	250	C
WENY—Elmira, N.Y.	250	E
WESX—Marblehead, Mass.	250	E
WFAS—White Plains, N.Y.	250	E
WFTC—Kinston, N.C.	250	E
WHBC—Canton, Ohio	250	E
WHBY—Appleton, Wis.	250	C
WHOP—Hopkinsville, Ky.	250	C
WIBX—Utica, N.Y	250	E
WIL—St. Louis, Mo.	250	C
WISE—Asheville, N.C.	250	E
WITH—Baltimore, Md.	250	E
WJBC—Bloomington, Ill.	250	C
WJBW—New Orlean, La.	250	C
WJNO—West Palm Beach, Fla.	250	E
WJOB—Hammond, Ind.	250	C
WJRD—Tuscaloose, Ala.	250	C
WKBO—Harrisburg, Pa.	250	E
WLOF—Orlando, Fla.	250	E
WLOG—Logan, W.Va.	250	E
WLVA—Lynchburg, Va.	250	E
WMFR—High Point, N.C.	250	E
WMOB—Mobile, Ala.	250	C
WMPC—Lapeer, Mich.	250	E
WRBL—Columbus, Ca.	250	E
WSKB—McComb, Miss.	250	C
WSLS—Roanoke, Va.	250	E
WSOO—Sault St. Marie, Mich.	250	E
WTHT—Hartford, Conn.	250	E
WTOL—Toledo, Ohio	250	E
1240 Kilocycles—		
CFPR—Prince Rupert, B.C.	50	P
CHLT—Sherbrooke, Ont.	250	E
CJCS—Stratford, Ont.	50	E
CJEM—Edmonton, N.B.	250	A
CKCH—Hull, Que.	250	E
CKLN—Nelson, B.C.	250	P
KALB—Alexandria, La.	250	C
KANS—Wichita, Kansas	250	C
KASA—Elk City, Okla.	250	C
KAVE—Carlsbad, N. Mex.	250	M
KBIZ—Ottumwa, Iowa	250	C
KDLR—Devil's Lake, N.D.	250	C
KDON—Monterey, Cal.	250	P
KFBC—Cheyenne, Wyo.	250	P
KFJI—Klamath Falls, Ore.	250	P
KFOR—Lincoln, Nebr.	250	C
KFXM—San Bernandino, Cal.	250	P
KGBS—Harlingen, Texas	250	C
KGY—Olympia, Wash.	250	P
KHBG—Okmulgee, Okla.	250	C
KICA—Clovis, N. Mex.	250	M
KICD—Spencer, Iowa	100	C
KIUL—Garden City, Kansas	250	M
KMAC—San Antonio, Texas	250	C
KOCA—Kilgore, Texas	250	C
KODY—North Platte, Nbr.	250	C
KOVO—Provo, Utah	250	M
KPFA—Helena, Mont.	250	M
KPPC—Pasadena, Calif.	250	P
KROY—Sacramento, Calif	250	P
KVSO—Ardmore, Okla.	250	C
KWAT—Watertown, S.D.	250	C
KWIL—Albany, Ore.	250	P
KWJB—Globe, Ariz.	250	M
KWLC—Decorah, Iowa	250	C
KWOS—Jefferson City, Mo.	250	C

Call and Location.	Power in Watts.	Zone.
KXOX—Sweetwater, Texas .	250	C
KYUM—Yuma, Ariz. ..	250	M
WAAC—Fort Myers, Fla. ..	250	E
WAJV—Akron, Ohio ..	250	E
WARC—Rochester, N.Y. ..	250	E
WATN—Watertown, N.Y. .	250	E
WBAX—Wilkes-Barre, Pa.	100	E
WBBL—Richmond, Va. ..	250	E
WBIR—Knoxville, Tenn. ..	250	C
WBML—Macon, Ga. ..	250	E
WCOU—Lewiston, Me. ..	250	E
WCOV—Montgomery, Ala. .	250	C
WCRW—Chicago, Ill. ..	250	C
WEBQ—Harrisbury, Ill. .	250	C
WEDC—Chicago, Ill. ..	250	C
WFOY—St. Augustine, Fla.	250	E
WGAC—Augusta, Ga. ..	250	E
WGBB—Freeport, N.Y. ..	250	E
WGCM—Gulfport, Miss. ..	250	C
WGGA—Gainesville, Ga. ..	250	E
WGRM—Greenwood, Miss.	250	C
WHAI—Greenfield, Mass ..	250	E
WHBU—Anderson, Ind ..	250	C
WHIZ—Zanesville, Ohio ..	250	E
WIBU—Poynette, Wis. ..	250	C
WINN—Louisville, Ky. ..	250	C
WJBY—Gadsden, Ala. ..	250	C
WJEJ—Hagerstown, Md. ..	250	E
WJIM—Lansing, Mich. ..	250	E
WJLS—Beckles, W. Va. ..	250	E
WJMC—Rice Lake, Wis. ..	250	C
WJRM—Elkins, W. Va. ..	250	E
WJTN—Jamestown, N.Y. ..	250	E
WKOK—Sunbury, Pa. ..	250	E
WLAG—La Grange, Ga. ..	250	C
WLOK—Lima, Ohio ..	250	E
WMFG—Hibbing, Minn. ..	250	C
WOCB—Hyannis, Mass. ..	250	E
WOMT—Manitowoc, Wis. .	250	C
WPAX—Thomasville, Ga. ..	250	E
WRAL—Raleigh, N.C. ..	250	E
WSBC—Chicago, Ill. ..	250	C
WSLS—Roanoke, Va. ..	250	E
WSNJ—Bridgetown, N.J. ..	250	E
WSNY—Schenectady, N.Y.	250	E
WSOC—Charlotte, N.C. ..	250	E
WTAX—Springfield, Ill. ..	250	C
1250 Kilocycles—		
KFKU—Lawrence, Kansas .	1,000	C
KPAC—Port Arthur, Texas	1,000	C
KTMS—Santa Barbara, Cal.	1,000	P
KTW—Seattle, Wash. ..	1,000	P
KWSC—Pullman, Wash. ..	5,000	P
WCAE—Pittsburgh, Pa. ..	5,000	E
WDAE—Tampa, Fla. ..	5,000	E
WREN—Lawrence, Kansas .	1,000	C
WTMA—Charleston, S.C. ..	1,000	E
1260 Kilocycles—		
CFRN—Edmonton, Alta. ..	1,000	M
KFGQ—Boone, Iowa ..	250	C
KGBX—Springfield, Mo. ..	5,000	C
KGGM—Albuquerque, N. ..	1,000	M
KYA—San Francisco, Cal. .	1,000	P
WFBM—Indianapolis, Ind. .	5,000	C
WNAC—Boston, Mass. ..	5,000	E
WOL—Washington, D.C. ..	1,000	E
1270 Kilocycles—		
CJCB—Sydney, N.S. ..	1,000	A
KFJZ—Fort Worth, Texas .	5,000	C
KGCU—Mandan, N.D. ..	500	M
KTFI—Twin Falls, Idaho ..	1,000	M
WHBF—Rock Island, Ill. .	5,000	C
WPDQ—Jacksonville, Fla. .	5,000	E
WSPR—Springfield, Mass. .	500	E
WXYZ—Detroit, Mich. ..	5,000	E
1280 Kilocycles—		
KFOX—Long Beach, Calif. .	1,000	P
KIT—Yakima, Wash. ..	1,000	P
WDSU—New Orleans, La. .	1,000	C
WGBF—Evansville, Ind. ..	1,000	C
WHBI—Newark, N.J. ..	1,000	E
WKST—New Castle, Pa. ..	1,000	E
WMRO—Aurora, Ill.	250	C
WOV—New York, N.Y. ..	5,000	E
WTCN—Minneapolis, Minn.	1,000	C
1290 Kilocycles—		
KGVO—Missoula, Mont. ..	1,000	M
KHSL—Chico, Calif. ..	1,000	P
KOIL—Omaha, Nebr. ..	5,000	C
KRGV—Weslaco, Texas ..	1,000	C
KUOA—Siloam Springs, Ark.	5,000	C
KVOA—Tucson, Ariz. ..	1,000	M*
WFVA—Fredericksburg, Va.	250	E
WHIO—Dayton, Ohio ..	5,000	E
WHKY—Hickory, N.C. ..	1,000	E
WHLD—Niagara Falls, N.Y.	1,000	E
WKNE—Keene, N.H. ..	5,000	E
WNBF—Binghamton, N.Y. .	5,000	E
WTOC—Savannah, Ga. ..	5,000	E
1300 Kilocycles—		
KGLO—Mason City, Iowa .	5,000	C
KOL—Seattle, Wash. ..	5,000	P
KVOR—Colorado Springs Colo.	1,000	M
WFBR—Baltimore, Md. ..	5,000	E
WJDX—Jackson, Miss. ..	1,000	C
WOOD—Grand Rapids, Mich.	5,000	E
1310 Kilocycles—		
CKCO—Ottawa, Ont. ..	1,000	E
KFBB—Great Falls, Mont. .	5,000	M
KLS—Oakland, Calif. ..	1,000	P
WCAM—Camden, N.J. ..	500	E
WCAP—Ashbury Park, N.J.	500	E
WDOD—Chattanooga, Tenn.	5,000	C
WIBA—Madison, Wisc. ..	5,000	C
WISH—Indianapolis, Ind. ..	1,000	C
WORC—Worcester, Mass. .	1,000	E
WRR—Dallas, Texas ..	5,000	C
WTNJ—Trenton, N.J. ..	500	E
1320 Kilocycles—		
KDYL—Salt Lake City, Utah	5,000	M
KXYZ—Houston, Texas ..	5,000	C
WATR—Waterbury, Conn. .	1,000	E
WEBC—Duluth, Minn. ..	5,000	C
WJAS—Pittsburgh, Pa. ..	5,000	E
WJHP—Jacksonville, Fla. .	250	E
WNBZ—Saranac Lake, N.Y.	100	E
WNEL—San Juan, P. Rico	5,000	A
1330 Kilocycles—		
KALE—Portland, Ore. ..	5,000	P
KFAC—Los Angeles, Cal. .	1,000	P
KFH—Wichita, Kansas ..	5,000	C
WBBR—Brooklyn, N.Y. ..	1,000	E
WEVD—New York, N.Y. ..	5,000	E
WFBC—Greenville, S.C. ..	5,000	E
WFIN—Findlay, Ohio ..	1,000	E
WHAZ—Troy, N.Y. ..	1,000	E
WHBL—Sheboygan, Wisc. .	250	C
WLOL—Minneapolis, Minn.	1,000	C
1340 Kilocycles—		
CHAD—Amos, Que. ..	250	E
CHOV—Pembroke, Ont. ..	250	E
CHWK—Chilliwack, B.C. ..	100	P
CJLS—Yarmouth, N.S. ..	100	A
CKCV—Quebec, Que. ..	100	E
KAND—Corsicana, Texas ..	250	C
KBND—Bend, Ore. ..	250	P
KCKN—Kansas City, Kansas	250	C

Call and Location.	Power in Watts.	Zone.
KCRJ—Jerome, Ariz. ..	250	M
KFRE—Fresno, Cal. ..	250	P
KFYO—Lubbock, Texas ..	250	C
KGEZ—Kalispell, Mont. .	250	C
KGFW—Kearney, Nebr. ..	250	C
KHMO—Hannibal, Mont. ..	250	C
KHUB—Watsonville, Calif.	250	P
KMYR—Denver, Col. ..	250	M
KOCY—Oklahoma City, Okla.	250	C
KOME—Tulsa, Okla. ..	250	C
KPDN—Pampa, Texas ..	250	C
KRBA—Lurkin, Texas ..	250	C
KRJF—Miles City, Mont. ..	250	M
KRMD—Shreveport, La. ..	250	C
KROC—Rochester, Minn ..	250	C
KROS—Clinton, Iowa ..	250	C
KSUB—Cedar City, Utah .	250	M
KUIN—Grant's Pass, Ore. .	250	P
KVIC—Victoria, Texas ..	250	C
KVOL—Lafayette, La. ..	250	C
KVOX—Moorhead, Minn. ..	250	C
KVSF—Santa Fe, N.M. ..	250	M
KWFC—Hot Springs, Ark. .	250	C
KWLM—Willmar, Minn. ..	250	C
KWOC—Poplar Bluff, Mo. .	250	C
KXRO—Aberdeen, Wash. .	250	P
WAIR—Winston-Salem, N.C.	250	E
WALL—Middletown, N.Y. .	250	E
WAML—Laurel, Miss. ..	250	C
WBRE—Wilkes-Barre, Pa. .	250	E
WBRK—Pittsfield, Mass. ..	250	E
WBRW—Welch, W.V. ..	250	E
WCBI—Columbus, Miss. ..	250	C
WCLS—Joliet, Ill.	250	C
WCMI—Ashland, Ky. ..	250	C
WDAK—Columbus, Ga. ..	250	C
WDMJ—Marquette, Mich. .	250	C
WEBR—Buffalo, New York	250	E
WEIM—Fitchburg, Mass. .	250	E
WEMP—Milwaukee, Wis. ..	250	C
WEXL—Royal Oak, Mich .	250	E
WFBG—Altoona, Pa. ..	250	E
WFHR—Wisconsin Rapids, Wis.	250	C
WFIG—Sunter, S.C. ..	250	E
WGAA—Cedartown, Go. ..	250	E
WGAU—Athens, Ga. ..	250	E
WGH—Newport News, Va.	250	E
WGTM—Wilson, N.C. ..	250	E
WHAT—Philadelphia, Pa. .	250	E
WINX—Washington, D.C. .	250	E
WIZE—Springfield, Ohio ..	250	E
WJMA—Covington, Va. ..	250	E
WJPF—Herrin, Ill. ..	250	C
WJPR—Greenville, Miss. ..	250	C
WLAK—Lakeland, Fla. ..	250	E
WLAV—Grand Rapids, Mich.	250	E
WLBC—Municie, Ind. ..	250	C
WLBJ—Bowling Green, Ky.	250	C
WLNH—Laconia, N.H. ..	250	E
WMBO—Auburn, N.Y. ..	250	E
WMFF—Plattsburg, N.Y. ..	250	E
WNBH—New Bedford, Mass.	250	E
WRAW—Reading, Pa. ..	250	E
WSAJ—Grove City, Pa. ..	250	E
WSAV—Savannah, Ga. ..	250	E
WSOY—Decatur, Ill. ..	250	C
WSTV—Steuhenville, Ohio	250	E
WTAL—Tallahassee, Fla. ..	250	E
WTEL—Philadelphia, Pa. ..	250	E
WTRC—Elkhart, Ind. ..	250	C
WWPG—Palm Beach, Fla. .	250	E
1350 Kilocycles—		
CFCP—Grand Prairie, Alta.	1,000	M
KGHF—Pueblo, Colo. ..	500	M
KID—Idaho Falls, Idaho .	500	M
KRNT—Des Moines, Iowa ..	5,000	C
KSRO—Santa Rosa, Calif. .	1,000	P
WADC—Akson, Ohio ..	5,000	E
WORK—York, Pa.	1,000	E
WSMB—New Orleans, La. ..	5,000	C
1360 Kilocycles—		
KGB—San Diego, Calif. ..	1,000	P
KMO—Tacoma, Wash. ..	5,000	P
KRIS—Corpus Christi, Texas	1,000	C
KSCJ—Sioux City, Iowa ..	5,000	C
WDRC—Hartford, Conn. ..	5,000	E
WKAT—Miami Beach, Fla.	1,000	E
WSAI—Cincinnati, Ohio ..	5,000	E
WTAQ—Green Bay, Wis. ..	5,000	C
1370 Kilocycles—		
KDTH—Dubuque, Iowa ..	1,000	C
KFRO—Longview, Texas ..	1,000	C
KGIR—Butte, Mont. ..	5,000	M
KGNO—Dodge City, Kansas	250	C
WCOA—Pensacola, Fla. ..	500	C
WFEA—Manchester, N.H. .	5,000	E
WPAB—Ponce, Puerto Rico .	1,000	A
WSAY—Rochester, N.Y. ..	1,000	E
WSPD—Toledo, Ohio ..	5,000	E
1380 Kilocycles—		
CKPC—Brantford, Ont. ..	100	E
KBWD—Broonwood, Texas	500	C
KIDO—Boise, Idaho ..	1,000	M
KTSM—El Paso, Texas . ..	500	M
KWK—St. Louis, Mo. ..	1,000	C
WAWZ—Zarephath, N.J. .	1,000	E
WBNX—New York, N.Y. ..	5,000	E
WBMG—Richmond, Va. ..	5,000	E
WSYB—Rutland, Vt.	1,000	E
WTSP—St. Petersburg, Fla.	500	E
1390 Kilocycles—		
KCRC—Enid, Okla. ..	1,000	C
KGER—Long Beach, Calif. .	5,000	P
KLPM—Minot, N.D. ..	1,000	C
KSLM—Salem, Ore. ..	1,000	P
WCSC—Charleston, S.C. ..	1,000	E
WFBL—Syracuse, N.Y. ..	5,000	E
WGES—Chicago, Ill. ..	5,000	C
WQBC—Vicksburg, Miss. ..	1,000	C
WTJS—Jackson, Tenn. ..	1,000	E
1400 Kilocycles—		
CFOS—Owen Sound, Ont. ..	250	E
CKCW—Moncton, N.B. ..	250	E
CKRN—Rouyn, Que. ..	250	E
KELD—El Dorado, Ark. ..	250	C
KENO—Las Vegas, Nevada	250	P
KFPW—Pt. Smith, Ark. ..	250	C
KFRU—Columbia, Mo. ..	250	C
KFVS—Cape Girardeau, Mo.	250	C
KGFL—Roswell, N.M. ..	250	M
KGKL—San Angelo, Texas .	250	C
KIUN—Pecos, Texas ..	250	C
KIUP—Durango, Colo. ..	250	M
KLUE—Galveston, Texas .	250	C
KOBH—Rapid City, S.D. ..	250	M
KOKO—La Junta, Colo. ..	250	M
KONO—San Antonio, Texas	250	C
KORN—Fremont, Nebr. ..	250	C
KRE—Berkeley, Calif. ..	250	P
KRKO—Everett, Wash. ..	250	P
KRLC—Lewiston, Idaho ..	250	P
KTEM—Temple, Texas ..	250	C
KTNM—Tucumcari, N.M. ..	250	M
KTOK—Oklahoma, Okla. ..	250	C
KTSW—Emporia, Kansas ..	250	C

Call and Location.	Power in Watts.	Zone.
KTTS—Springfield, Mo.	250	C
KTUC—Tucson, Ariz.	250	M
KVFD—Fort Dodge, Iowa	250	C
KVGB—Great Bend, Kansas	250	C
KVOP—Plainview, Texas	250	C
KVRS—Rock Springs, Wyo.	250	M
KWLK—Longview, Wash.	250	P
KWON—Bartlesville, Okla	250	C
KWYO—Sheridan, Wyo.	250	M
WABY—Albany, N.Y.	250	E
WAGF—Dothan, Ala.	250	C
WARM—Scranton, Pa.	250	E
WATL—Atlanta, Ga.	250	E
WATW—Ashland, Wis.	250	C
WBLK—Clarksburg, W. Va.	250	E
WBNY—Buffalo, N.Y.	250	E
WBTH—Williamson, W. Va.	250	E
WBTM—Danville, Va.	250	E
WCBM—Baltimore, Md.	250	E
WCNC—Elizabeth City, N.C.	250	E
WCOS—Columbia, S.C.	250	E
WDAS—Philadelphia, Pa.	250	E
WDEF—Chattanooga, Tenn.	250	C
WDWS—Champagne, Ill.	250	C
WELL—Battle Creek, Mich.	250	E
WEOA—Evansville, Ind.	250	C
WEST—Easton, Pa.	250	E
WFOR—Hattiesburg, Miss.	250	C
WGBR—Goldsboro, N.C.	250	E
WGIL—Galesburg, Ill.	250	C
WGRC—Louisville, Ky.	250	C
WHBQ—Memphis, Tenn.	250	C
WHDF—Calumet, Mich.	250	E
WHLB—Virginia, Minn	250	C
WHUB—Cookeville, Tenn.	250	C
WHYN—Holyoke, Miss.	250	E
WINC—Winchester, Va.	250	E
WJAC—Johnstown, Pa.	250	E
WJHO—Opelika, Ala.	250	C
WJLB—Detroit, Mich.	250	E
WJLD—Bessemer, Ala.	250	C
WJZM—Clarkeville, Tenn.	250	C
WKMO—Kokomo, Ind.	250	C
WKPT—Kingsport, Tenn.	250	C
WKWK—Wheeling, W. Va.	250	E
WLLH—Lowell, Mass.	250	E
WMAN—Mansfield, Ohio	250	E
WMBR—Jacksonville, Fla.	250	E
WMFD—Wilmington, N.C.	250	E
WMGA—Moultrie, Ga.	250	E
WMIN—St. Paul, Min	250	C
WMSL—Decatur, Ala.	250	C
WORD—Spartanburg, S.C.	250	E
WPAY—Portsmouth, Ohio	250	E
WRAK—Williamsport, Pa.	250	E
WRDO—Augusta, Me.	250	E
WRJN—Racine, Wis.	250	C
WRRN—Warren, Ohio	250	E
WSAM—Saginaw, Mich.	250	E
WSAU—Wauaau, Wis.	250	C
WSLB—Ogdensburg, N.Y.	250	E
WSVS—Buffalo, N.Y.	250	E
WTCM—Traverse City, Mich.	250	E
1410 Kilocycles—		
CKMO—Vancouver, B.C.	100	P
KERN—Bakersfield, Cal.	1,000	P
KQV—Pittsburgh, Pa.	1,000	E
WALA—Mobile, Ala.	5,000	C
WEGO—Concord, N.C.	1,000	E
WING—Dayton, Ohio	5,000	E
WKBH—La Crosse, Wis.	1,000	C
WNBC—New Britain, Conn.	5,000	E
1420 Kilocycles—		
KABR—Aberdeen, S.D.	5,000	C
KUJ—Walla Walla, Wash.	1,000	P
WFCI—Pawtucket, R.I.	1,000	E
WHK—Cleveland, Ohio	5,000	E
WOC—Davenport, La.	5,000	C
WPRP—Ponce, Puerto Rico	250	A
WWSR—St. Albans, Vt.	1,000	E
1430 Kilocycles—		
CHEX—Peterborough, Ont.	1,000	E
KARM—Fresno, Calif.	5,000	P
KLO—Ogden, Utah	5,000	M
KTUL—Tulsa, Okla.	5,000	C
KWKW—Pasadena, Calif.	1,000	P
WBYN—Brooklyn, N.Y.	500	E
WIRE—Indianapolis, Ind.	5,000	C
1440 Kilocycles—		
KFJM—Grand Forks, N.D.	500	C
KGNC—Amarillo, Texas	1,000	C
KILO—Grand Forks, N.D.	500	C
KMED—Medford, Ore.	1,000	P
KPRO—Riverside, Calif.	1,000	P
WAAB—Worcester, Mass.	5,000	E
WBCM—Bay City, Mich.	500	E
WHIS—Bluefield, W. Va.	500	E
WROK—Rockford, Ill.	500	C
WSFA—Montgomery, Ala.	500	C
1450 Kilocycles—		
CFBR—Prescott, Ont.	100	E
CHLN—Three Rivers, Ont.	100	E
CHPS—Parry Sound, Ont.	250	E
KABC—San Antonia, Texas	250	C
KATE—Albert Lea, Minn.	250	C
KBPS—Portland, Ore.	250	P
KDNT—Denton, Texas	250	C
KEUB—Price, Utah	250	M
KFAM—St. Cloud, Minn.	250	C
KFIZ—Fond du Lac, Wis.	250	C
KFMB—San Diego, Calif.	250	P
KGFF—Shawnee, Okla.	250	C
KGIW—Alamosa, Colo.	250	M
KGLU—Safford, Ariz.	250	M
KLBM—La Grande, Ore.	250	P
KMYC—Marysville, Calif.	250	P
KNET—Palestine, Texas	250	C
KORE—Eugene, Ore	250	P
KRBC—Abilene, Texas	250	C
KRBM—Bozeman, Mont.	250	M
KRIC—Beaumont, Texas	250	M
KSAN—San Francisco, Calif.	250	P
KTRI—Sioux City, Iowa	250	C
KVAK—Atchison, Kansas	250	C
KWAL—Wallace, Idaho	250	P
KWBW—Hutchinson, Kansas	250	C
WACO—Waco, Texas	250	C
WAGM—Presque Isle, Me.	250	E
WAOV—Vincennes, Ind.	250	C
WARW—Clarksdale, Miss.	250	C
WASK—Lafayette, Ind.	250	C
WAZL—Hazleton, Pa.	250	E
WCBS—Springfield, Ill.	250	C
WCHV—Charlottesville, Ca.	250	E
WCRS—Greenwood, S.C.	250	E
WEED—Rocky Mount, N.C.	250	E
WFMJ—Youngstown, Ohio	250	E
WFNC—Fayetteville, N.C.	250	E
WFPG—Atlantic City, N.J.	250	E
WGL—Fort Wayne, Ind.	250	C
WGNC—Gastonia, N.C.	250	E
WGOV—Valdosta, N.C.	250	E
WGPC—Albany, Ga.	250	C
WHDL—Olean, N.Y.	250	E
WHFC—Cicero, Ill.	250	C
WHLN—Harlan, Ky.	250	E
WHLS—Post Huron, Mich.	250	E
WHIT—New Bern, N.C.,	250	E
WHMA—Anniston, Ala.	250	C
WIBM—Jackson, Mich.	250	E

Call and Location.	Power in Watts.	Zone.
WILM—Wilmington, Del.	250	E
WJMS—Ironwood, Mich.	250	E
WJPA—Washington, Pa.	250	E
WKEU—Griffin, Ga.	250	C
WKIP—Poughkeepsie, N.Y.	250	E
WLAP—Lexington, Ky.	250	C
WLAY—Muscle Shoals City Ala.	250	C
WLEU—Erie Pa.	250	E
WLPM—Suffolk, Va.	250	E
WMAS—Springfield, Mass.	250	E
WMBH—Joplin, Mo.	250	C
WMFJ—Daytona Beach, Fla.	250	E
WMVA—Martinsville, Va.	250	E
WNAB—Bridgeport, Conn.	250	E
WNOE—New Orleans, La.	250	C
WPAD—Paducah, Ky.	250	C
WPAR—Parkersburg, W. Va.	250	E
WRLC—Toccoa, Ga.	250	E
WSLI—Jackson, Miss.	250	C
WSPB—Sarasota, Fla.	250	E
WTBO—Cumberland, Md.	250	E
WWDC—Washington, D.C.	250	E
1460 Kilocycles—		
CJGX—Yorkton, Sask.	1,000	C
KEVE—Everett, Wash.	500	P
KINY—Juneau, Alaska	5,000	—
KSO—Des Moines, Iowa	5,000	C
WBNS—Columbus, Ohio	1,000	E
WHEC—Rochester, N.Y.	500	E
WHP—Harrisburg, Pa.	1,000	E
WMPS—Memphis, Tenn.	500	C
WOKO—Albany, N.Y.	500	E
XETU—Tampico, Mex.	1,000	C
1470 Kilocycles—		
CKGB—Timmins, Ont.	1,000	E
KDFN—Casper, Wyo.	1,000	P
KELA—Centralia, Wash.	1,000	P
WBIG—Greensboro, N.C.	5,000	E
WCBA—Allentown, Pa.	500	E
WMBD—Peoria, Ill.	1,000	C
WSAN—Allentown, Pa.	5,000	E
XEAU—Tijuana, B.C.	250	A
1480 Kilocycles—		
CJVI—Victoria, B.C.	500	P
CHGS—Summerside, P.E.I.	100	C
KCMO—Kansas City, Mo.	5,000	C
KGCX—Sydney, Mont.	1,000	M
KIEM—Eureka, Calif	1,000	P
KTBS—Shreveport, La.	1,000	C
WHBC—Canton, Ohio	1,000	E
WHOM—Jersey City, N.J.	500	E
WRDW—Augusta, Ga.	5,000	E
WSAR—Fall River, Mass.	1,000	E
1490 Kilocycles—		
CFRC—Kingston, Ont.	100	E
CHLP—Montreal, Que.	100	E
CJIC—Sault Ste, Marie, Ont.	250	E
CJMH—Medicine Hat, Alb.	100	M
CKCS—Kitchener, Ont.	250	E
KBIX—Muskogee, Okla.	250	C
KBRK—Baker, Ore.	250	P
KBON—Omaha, Nebr.	250	C
KBST—Big Springs, Texas	250	C
KBUR—Burlington, Iowa	250	C
KDB—Santa Barbara, Calif.	250	P
KDRO—Sedalia, Mo.	250	C
KEEW—Brownsville, Texas	250	C
KEYS—Corpus Christi, Texas	250	C
KFFA—Helena, Ark	250	C
KGKB—Tyler, Texas	250	C
KGKY—Scottsbluff, Nebr.	250	M
KNEL—Brady, Texas	250	C
KNOW—Austin, Texas	250	C
KOTN—Pine Bluff, Ark.	250	C
KOVC—Valley City, N.D.	250	C
KPAB—Laredo, Texas	250	C
KPLT—Paris, Texas	250	C
KRNR—Roseburg, Ore.	250	P
KSAM—Huntsville, Texas	250	C
KTBI—Tacoma, Wash.	250	P
KTOH—Lihue, Hawaii	250	—
KVOE—Santa Ana, Calif.	250	P
KVWC—Vernon, Texas	250	C
KWEW—Hobbs, N.M.	250	M
KYCA—Prescott, Ariz	250	M
KYOS—Merced, Calif.	250	P
WBAB—Atlantic City, N.J.	250	E
WBTA—Batavia, N.Y.	250	E
WDAN—Danvill, Ill.	250	C
WDBC—Escanaba, Mich.	250	E
WDNC—Durham, N.C.	250	E
WERC—Erie, Pa.	250	E
WGAL—Lancaster, Pa.	250	E
WGKV—Charleston, W. Va.	250	E
WGTC—Greenville, N.C.	250	E
WHBB—Selma, Ala.	250	C
WIGM—Medford, Wis.	250	C
WJBK—Detroit, Mich.	250	E
WKBB—Dubuque, Iowa	250	C
WKBV—Richmond, Ind.	250	C
WKBZ—Muskegon, Mich	250	E
WKNY—Kingston, N.Y.	250	E
WKRO—Cairo, Ill.	250	C
WMIS—Natchez, Miss.	250	C
WMJM—Cordele, Ga.	250	E
WMOG—Brunswick, Ga.	250	E
WMRC—Greenville, S.C.	250	E
WMRF—Lewistown, Pa.	250	E
WMRN—Marion, Ohio	250	E
WNLC—New London, Conn.	250	E
WOLF—Syracuse, N.Y.	250	E
WOMI—Owensboro, Ky.	250	C
WOPI—Bristol, Tenn.	250	C
WOSH—Oshkosh, Wis.	250	C
WRGA—Rome, Ga.	250	C
WSAP—Portsmouth, Va.	250	E
WSLS—Roanoke, N.C.	250	E
WSTP—Salisbury, N.C.	250	E
WTMC—Ocala, Fla.	250	E
WTMV—E. St. Louis, Ill.	250	C
WWSW—Pittsburgh, Pa.	250	E
1500 Kilocycles—		
KSTP—St. Paul, Minn.	50,000	C
WTOP—Washington, D.C.	50,000	E
1510 Kilocycles—		
KGA—Spokane, Wash.	10,000	P
WLAC—Nashville, Tenn.	50,000	C
WMEX—Boston, Mass.	5,000	E
1520 Kilocycles—		
KOMA—Oklahoma City, Okla.	5,000	C
WKBW—Buffalo, N.Y.	50,000	E
1530 Kilocycles—		
KFBK—Sacramento, Calif	10,000	P
WCKY—Cincinnati, Ohio	50,000	E
1540 Kilocycles—		
KXEL—Waterloo, Iowa	50,000	C
1550 Kilocycles—		
CKTB—St. Catherine, Ont.	1,000	E
XEBG—Tijuana, Mex.	1,000	P
1560 Kilocycles—		
KPMC—Bakersfield, Calif	1,000	P
WQXR—New York, N.Y.	10,000	E
1570 Kilocycles—		
CFPL—London, Ont.	1,000	E
1580 Kilocycles—		
CBJ—Chicoutini, Que.	1,000	E
1590 Kilocycles—		
WAKR—Akron, Ohio	5,000	E
WALB—Albany, Ga.	1,000	E
WBRY—Waterbury, Conn.	1,000	E
XEMC—Mexico City, Mex.	5,000	C
1600 Kilocycles—		
WWRL—Woodside, N.Y.	250	E

RAHOB WORLD SHORT-WAVE LOG

Compiled by Arthur T. Cushen, 105 Princes Street, Invercargill, Short wave Editor, "N.Z.DX-TRA," Bulletin of the New Zealand DX Club. This log contains the principal short wave stations audible when going to press. New and alterations to station schedules appear each month in "Girdling the Globe," the DX page of the "Radiogram."

ALL TIMES NEW ZEALAND DAYLIGHT SAVING TIME.

Location and Call.	Mega-cycles.	Metres.	Power in Watts.	Schedules and Items of Interest.
London, England—GRZ ..	21.640	13.86	50,000	News at 11 p.m.
Berne, Switzerland—HBH .	18.480	16.23	50,000	7.30-9 p.m., Tuesday, Saturday.
Batavia (Joakata)—JBC ..	18.135	16.54		News, 1, 5, 7.10, 10.30 p.m, midnight.
London, England—GVO ..	18.080	16.59	50,000	Used to the Middle East.
London, England—GRP ..	17.870	16.79	50,000	News, 11 p.m.
Berlin, Germany—DJH ..	17.845	16.81	50,000	News, 9.30 p.m. and Midnight.
New York, U.S.A.—WCRC	17.830	16.83	50,000	News at 1 p.m.
London, England—GSV ..	17.810	16.74	50,000	Turkish, 9.30 p.m.
Cincinnati, U.S.A.—WLWO	17.800	16.85	75,000	News, 6 a.m.
Sydney—Aust.—VLI-8 ..	17.800	16.85	16,000	News at 9.30 p.m. to England.
London, England—GSG ..	17,790	16.86	50,000	News, 11 p.m.
New York, U.S.A.—WNBI	17.780	16.87	50,000	Heard from 1 a.m.
Berlin, Germany—DJE ..	17.760	16.89	50,000	Great signal, news midnight.
San Francisco—KROJ ..	17.760	16.89		Opens at 1 p.m. with news.
London, England—GVQ ..	17.730	16.92	50,000	Being heard 1 a.m.
London, England—GRA ..	17.710	16.94	50,000	News, 8 p.m.
London, England—GVP ..	17,700	16.95	50,000	Heard at 11 p.m.
Brazzaville, Africa—FZI ..	15.595	19.25	50,000	Heard at 11.30 p.m.
Leopoldville, Africa ..	15.530	19.30		News at 11 p.m.
London, England—GRD ..	15.450	19.42	50,000	Used in Pacific service.
London, England—GWE ..	15.440	19.44	50,000	Last portion, Pacific service.
London, England—GWD ..	15.420	19.46	50,000	News, 3 a.m.
London, England—GRE ..	15.390	19.49	50,000	Opens 10.45 p.m.; news 11 p.m.
San Francisco, U.S.A.—KWU	15.350	19.53		Opens at 8.30 a.m.
Boston, U.S.A.—WRUW ..	15.350	19.53	50,000	Opens 2.15 a.m.
Berlin, Germany—DJR ..	15.340	19.56	50,000	News, 5.30, 7 p.m., midnight.
Schenectady, U.S.A.—WGEA	15,330	19.57	100,000	11 a.m.-4 p.m. to Latin America.
San Francisco, Cal.—KGEI	15.330	19.570	50,000	Closes at 11 a.m.
Sydney, Australia—VLI-3	15.315	19.59	16,000	To Asia, news, 10.30 p.m.
Tokio, Japan	15.310	19.60	50,000	News at 8.40 p.m.
London, England—GSP ..	15.310	19.60	50,000	Used in Pacific service.
San Francisco, U.S.A.—KWID	15.290	19.62	100,000	10 a.m.-4.45 p.m.
Delhi, India—VUD2 ..	15.290	19.62	10,000	News, 3.30 p.m. and 5 p.m.
Berlin, Germany—DJQ ..	15.280	19.63	50,000	News, 5.30 and 7 p.m.
New York, U.S.A.—WCBX	15.270	19.64	50,000	News, 10 p.m., etc.
London, England—GSI ..	15.260	19.66	50,000	African service.
Cincinnati, U.S.A.—WLWK	15.250	19.67	75,000	12.30-9.15 a.m. to Europe.
Melbourne, Aust.—VLG-6	15.230	19.70	10,000	National programmes.
Moscow, U.S.S.R.—RV96 ..	15.230	19.70	50,000	News at 9.15 a.m.
Boston, Mass., U.S.A.—WBOS	15.210	19.72	50,000	Opens 2 a.m. with news.
Berlin, Germany—DJB ..	15.200	19.72	50,000	News at 1.30 a.m.
Ankara, Turkey—TAQ ..	15.195	19.74	20,000	Fair signal at 12.30 a.m.
New York, U.S.A.—WOOC	15.190	19.75	50,000	Closes at 6.45 a.m., see 9.65 mcs.
San. Fran., U.S.A.—KROJ	15.190	19.75	50,000	Opens at 8 a.m.
London, England—GSO ..	15.180	19.76	50,000	Foreign service at 1 a.m.
Guatamala City—TGWA ..	15.170	19.78	10,000	Mondays only at 9.30 a.m.
Melbourne, Aust.—VLG-7	15.160	19.79	10,000	National programme.
Tokio, Japan—JZK	15.160	19.79	50,000	News, 5, 6, 7 p.m.
New York, U.S.A.—WNBI	15.150	19.81	50,000	Heard before noon.
London, England—GSF ..	15.140	19.82	50,000	Pacific service.
San Fran., U.S.A.—KGEI	15.130	19.830	50,000	5.15-6.15 a.m.
Tokio, Japan —JLG4 ..	15.105	19.86	50,000	News, 11 a.m., 5, 6, 7 p.m.
Vatican City—HVJ ..	15.090	19.87	15,000	B.O.W. session in evening.
Berlin, Germany—DJL ..	15.110	19.85	50,000	News, 12.30 and 1.30 a.m.
London, England—GWC ..	15.070	19.91	50,000	Pacific Service.
London, England—GWG ..	15.060	19.92	50,000	Fair at midnight.
Macao, Portuguese China..	15.045	19.94	—	Opens 11.30 p.m., news 11.45 p.m.
Washington, U.S.A.—WWV	15,000	20.00	10,000	Frequency check station.
Berne, Switzerland—HER..	12.960	23.13	25,000	8–9.30 p.m., Tuesdays.
New York, U.S.A. WKRD	12.960	23.13		News, 7 a.m.
Quito, Ecuador—HCJB ..	12.455	24.09	10,000	Religious session, 2 p.m.
Batavia (Joakata)—JANX	12.270	24.45		10 p.m.-1 a.m. in English.
Moscow, U.S.S.R.	12.260	24.47		Good Signal 11 p.m.
Reykjavik, Iceland—TFJ .	12.230	24.54		5.15-5.30 p.m.
Radio France—Algiers ..	12.120	24.75		7-9.30 a.m.
London, England—GRF ..	12,090	24.80	50,000	Latin American transmission.
Shanghai (French)—FFZ..	12.060	24.88	400	News at midnight.
Kuibyshev, U.S.S.R. ..	12.060	24.88	50,000	News, 12.30 a.m.
London, England—GRV ..	12.040	24.92	50,000	Latin American session, 1 p.m.
Shanghai (Italian)—XIRS	11.990	25.02		News 11 p.m.
Santiago, Chile—CB1180 ..	11.975	25.04	5,000	Good signal till closing 4 p.m.

Location and Call.	Mega-cycles.	Metres.	Power in Watts.	Schedules and Items of Interest.
Brazzaville, Fighting French Africa—FZI	11.970	25.05	15,000	News, 7.45 a.m., 3.45 p.m.
Indian Independence Radio	11.970	25.05		News at 1 a.m.
London, England—GVY ..	11.960	25.09	50,000	Opens 10 p.m., News 11 p.m.
London, England—GVX ..	11.930	25.15	50,000	European transmission, 10 p.m.
San Francisco, U.S.A.—KWIX	11.900	25,21	100,000	5 p.m.–1 a.m., great signal.
San Jose, Costa Rica—TIJMP	11.900	25.21		Midnight-1.30 a.m., signs 5 p.m.
Chungking, China, XGOY	11.900	25.21	35.000	News directed to N.Z. 10 p.m.
Tokio, Japan—JVU-3 ..	11.890	25.23	50,000	News, 6 and 7 p.m.
New York, U.S.A.—WRCA	11.890	25.23	50,000	News, 7, 8 a.m., opens 9 p.m.
Paris, France—DXL7 ..	11.885	25.23	50,000	Berlin relay, news, 2, 3, 5.30 p.m.
Melbourne, Aust.—VLR-3	11.880	25.25	2,000	News, 2.30, 3.30, 5 p.m.
Sante Fe, Argentina—LRR	11,880	25.25	10,000	Special tests, 8 p.m.
Sydney, Aust.—VLI-2 ..	11.870	25.27	16,000	To Britain, 6.55 p.m.; news, 7 p.m.
Boston, U.S.A.—WBOS ..	11.870	25.27	50,000	News on the hour, 7, 8, 9 a.m.
Delhi, India—VUD	11.870	25.27	10,000	News 9.45 p.m. and midnight.
New York, U.S.A.—WOOW	11.870	25.27	50,000	Closes at 7 a.m.
Algiers, Algeria—AFHQ ..	11.860	25.29		News 10 and 11 p.m.
Shanghai, China—XMHA	11.860	25.29		News at 9.30 p.m.
London, England—GSE ..	11.860	25.29	50,000	European transmission, 7 p.m.
Berlin, Germany—DJP ..	11.855	25.31	50,000	News at midnight.
Shonan (Singapore) ..	11.848	25.33		10-11 p.m., News and POW.
Schenectady, N.Y., U.S.A.—WGEO	11.847½	25.33	50,000	News, 10 p.m.
Melbourne. Aust. VLG-4 ..	11.840	25.35	10,000	To S.E. Asia, 10.15 p.m., news 10.30
London, England—GWQ ..	11.840	25.33	50,000	9 p.m.-2.30 a.m.
New York, U.S.A.—WCRC	11.830	25.36	50,000	Opens 10 p.m.; News, 7, 8, 9 a.m.
Perth, W. Aust.—VLW3 ..	11.830	25.36	2,000	Good signal at 5 p.m.
London, England—GSN ..	11.820	25.38	50,000	News, 11 p.m.
London, England—GWH ..	11.800	25.42	50,000	Heard to Europe at 11 p.m.
Tokio, Japan—JZJ ..	11.800	25.42	50,000	News, 9 p.m., midnight.
Boston, U.S.A.—WRUA ..	11.790	25.45	50.000	Closes at 8.30 a.m., moves to 7.575
Delhi, India—VUD6 ..	11.790	25.45	10,000	News at 1 a.m. and 3.30 p.m.
San Francisco, U.S.A.—KGEI	11.790	25.45	100,000	News on the hour, sign 4.45 p.m.
London, England—GVU ..	11.780	25.47	50,000	English news to Japan, 9.30 p.m.
Panama City, Panama—HP5G	11.780	25.47		News 3.45 p.m., signs 4 p.m.
Hsinking, Manchukuo—MTCY	11.775	25.48	20,000	News, 8.30 p.m., closes 9 p.m.
Saigon, Indo-China ..	11.775	25.48	12,000	News, 10.30 p.m., 2.45 a.m.
Berlin, Germany—DJD ..	11.770	25.49	50.000	News. noon. 1, 2, 3 p.m.
Sao Paulo, Brazil—ZYB8..	11.765	25.50	25,000	1-4.30, 6-8.30 a.m.
Melbourne, Aust.—VLR8	11.760	25.51	2,000	National programmes.
London, England—GSD ..	11.750	25.53	50,000	Pacific service.
Santiago, Chile—CB1174 ..	11.740	25.55		Signs 4.30 p.m.
Santa Clara, Cuba—COCY	11.740	25.55		Signs with English, 6.15 p.m.
Vatican City—HVJ ..	11.740	25.55	15,000	Prisoner of War sessions.
London, England—GVV ..	11.730	25.58	50,000	General Overseas Service.
Boston, U.S.A.—WRUL ..	11.730	25.58	50,000	Closes 6 p.m.
Tokio, Japan—JVW3 ..	11.725	25.59		News, 11.50 p.m.
Leopoldville, Bel. Congo ..	11.720	25.60		Opens 6.30 a.m.
Bankok, Thailand—HSP5	11.715	25.60	10,000	News at midnight and 1.30 a.m.
Rio de Janeira, Brazil—PRL8	11.715	25.60	50,000	News, 8 a.m. and 2 p.m.
Melbourne, Aust.—VLG3 ..	11.710	25.62	10 000	To Britain, 7 p.m.
Cincinnati, U.S.A.—WLWO	11.710	25.62	75 000	News, 7, 8, 9 a.m., signs 9.15 a.m.
Berne, Switzerland—HER5	11.710	25.62	25,000	7.30-9 p.m., Tuesday, in Eng.
London, England—GVW	11.705	25.63	50,000	3.30-9 a.m., to Africa.
Tokio, Japan—JLG3 ..	11.705	25.63	50,000	Messages from P.O.W., 9 p.m.
Montreal, Canada—CBFY	11.705	25.63	7,500	Opens 11.30 p.m.
Stockholm, Sweden—SBP	11.705	25.63	12,500	News to U.S.A. 1 p.m.
Panama City, Panama—HP5A	11.700	25.64	500	Signs at 5 p.m.
London, England—GRG ..	11.680	25.68	50,000	North American service.
Shanghai (German)—XGRS	11.680	25.68	500	Herbert Moyle's News, 10.45 p.m.
Manila, Philippines—KIAN	11.620	25.82		News, 10.30 p.m.
Havana, Cuba—COK ..	11.620	25.82		Plenty of English, signs 4 p.m.
New York, U.S.A.—WCDA	11.145	26.92	50 000	News, 7 a.m., closes 8 a.m.
Boston, U.S.A.—WRUA ..	11,145	26.92	50,000	Heard at 11 p.m.
Lisbon, Portugal—CSW6	11.040	27.17	5.000	Opens at 5 a.m.
San Francisco, U.S.A.—KWV	10.840	27.68		Variety programme, 5 p.m.
Nairobi, Kenya—VQ7LO ..	10.730	27.96	600	2.45-7 a.m.
San Francisco, U.S.A.—KES3	10.620	28.25		News, 7 p.m.; relays KWID.
Berlin, Germany—DZD ..	10.543	28.45	50,000	News 2 and 3 p.m., to U.S.A.
Moscow, U.S.S.R. ..	10.440	28.73		News. midnight.
Berlin, Germany—DZC ..	10.290	29.15	50,000	News to troops in Africa. 7 a.m.
Peiping, China—XGAP ..	10.240	29.24		Native programme, 11 p.m.
Rio de Janiero—PSH ..	10.220	29.35	12,000	English session, 1-1.30 p.m.
Washington, U.S.A.—WWV	10,000	30.00	10,000	Frequency check.

Location and Call.	Mega-cycles.	Metres.	Power in Watts.	Schedules and Items of Interest.
Quito, Ecuador—HCJB	9.958	30.12	1,000	2-3 p.m. English; also 1.15 a.m.
"Radio Mediterranean"	9.920	30.17		News, 5.30 p.m., on till 7 p.m.
San Francisco, U.S.A.—KROJ	9.890	30.21		4 p.m.-1 a.m., good signal.
New York, U.S.A.—WKRD	9.897	30.33		News, 11 p.m.
Madrid, Spain—EAQ	9.860	30.43		News, 6.15 a.m., noon.
Moscow, U.S.S.R.	9.860	30.43		Great signal, news, midnight.
Lourenco Marques—CR7BE	9.843	30.48	10,000	News, 7.15 a.m.
London, England—GRH	9,825	30.54	50,000	Pacifice Service.
Leopoldville, Africa—RNB	9,780	30.66		Closes at good strength, 6.45 p.m.
Deutscher Kurzwellensender Atalantik, France	9.760	30.74		Heard throughout the day.
New York, U.S.A.—WKLJ	9.750	30.77		To Europe, 11 p.m.
Heredia, Costa Rica—T14NRH	9.740	30.80	1,000	English talks, signs 5 p.m.
Chungking, China—XGOA	9.720	30.86	35,000	News, 2 a.m.
Boston, U.S.A.—WRUS	9,700	30.93	50,000	Closes at 6 p.m.
Tyureki, Formosa—JIE3	9.690	30.96	1,000	News, 11.30 p.m., 1.30 a.m.
London, England—GRX	9.690	30.96	50,000	News for Europe, 8 p.m.
Guatamala City—TGWA	9.685	30.96	10,000	Signs at 4.45 p.m.
Mexico City—XEQQ	9.680	30.99		Signs off now 6.45 p.m.
Melbourne, Aust.—VLG-8	9.680	30.99	10,000	To North America; News, 3 p.m.
Perth, W. Aust.—VLW6	9.680	30.99	2,000	National programmes.
Berlin, Germany—DJX	9.675	31.01	50,000	News, 8.15 a.m.
Tokio, Japan—JVW2	9.670	31.02	50,000	News, 9 p.m.
New York, U.S.A.—WNBI	9.670	31.02	50,000	To Latin America, 8.30 a.m.-6 p.m.
Shanghai, China—XGOI	9.660	31.06		News heard at 12.15 a.m.
Brisbane, Aust.—VLQ3	9.660	31.06	10,000	Heard in afternoons, signs off 7.15 p.m.
Buenos Aires—Argentina—LRX	9.660	31.06	5,000	3.30-9 a.m.
London, England—GWW	9,660	31.06	50,000	European transmission.
New York, U.S.A.—WOOC	9,650	31.09	50,000	7-9.15 a.m., good signal.
Berlin, Germany—DJW	9.650	31.09	50,000	News, 5.30 and 7 p.m.
Manila, Philippines—KIAN	9,640	31.12	1,000	News, 10.30 p.m.
London, England—GVZ	9.640	31.12	50,000	News at 11 p.m.
Chungking, China—XGOY	9.640	31.12	35,000	News, 2 a.m.
Montreal, Canada—CBFX	9.630	31.15	7,500	Opens 11.30 p.m. with news.
Addis Ababa, Ethiopia	9.625	31.17		News, 4 a.m., signs 4.30 a.m.
Vichy, France	9.620	31.19		Directed to England, 8 a.m.
San Jose, C.R.—TIPG	9.620	31.19	10,000	Signs with English, 4.30 p.m.
London, England—GWO	9.620	31.19	50,000	European service.
Mexico City, Mex.—XERQ	9.615	31.21		Signs off 6 p.m.
London, England—GRY	9.600	31.25	50,000	Opens 5 p.m.
Azad Moslem Radio	9.590	31.30		News at 3.30 p.m.
New York, U.S.A.—WCRC	9.590	31.30	50,000	News 10 p.m., closes 10.45 p.m.
Cincinnati, U.S.A.—WLWO	9.590	31.30	75,000	Signs at 4 p.m.
Delhi, India—VUD2	9.590	31.30	10,000	News at midnight.
Melbourne, Aust.—VLR	9.580	31.32	2,000	National programmes.
London, England—GSC	9.580	31.32	50,000	North American programme.
Melbourne, Aust.—VLG	9.580	31.30	10,000	To U.S.A., 3 a.m.
San Fran., U.S.A.—KWIX	9.570	31.35	100,000	3.15 p.m.-4.05 a.m.
Boston, U.S.A.—WRUS	9.570	31.35	50,000	Opens at 8.45 a.m.
Moscow, U.S.S.R.	9.565	31.37		News, midnight.
Berlin, Germany—DJA	9.560	31.38	50,000	Latin American service.
Rome Radio, Italy	9.550	31.40		News and P.O.W., 5.45 p.m.
London, England—GWB	9.550	31.41	50,000	European service.
Mexico City, Mexico—XETT	9.548	31.42		Good signal; closes 5.55 p.m.
Shonan (Singapore)	9,548	31.42	100,000	News, 8.30 a.m., 10 p.m.
Moscow, U.S.S.R.—	9.545	31.43		Winterton's BBC dispatch.
Algeria, Algeria—AFHQ	9.540	31.43		News, 6 a.m.
Melbourne, Aust.—VLG2	9.540	31.45	10,000	To North America, midnight.
Tokio, Japan—JZI	9.535	31.47	50,000	News 6 p.m., 9 p.m., 10 p.m., 6 a.m.
Schenectady, U.S.A.—WGEO	9.530	31.48	100,000	News, 8, 9 a.m., signs 9.15 a.m.
London, England—GWJ	9.530	31.48	50,000	9 p.m.-12.45 a.m.
London, England—GSB	9.510	31.55	50,000	Pacific service.
Tokio, Japan—JLG2	9.505	31.57	50,000	News at 10.45 p.m., 11.54 p.m.
Mexico City—XEWW	9.500	31.58	10,000	Good signal at 5 p.m., signs 5.45.
San Francisco, U.S.A.—KRCA	9.490	31.60		Relays KGEI 7 p.m.
Radio Metropole (Belgrade)	9.480	31.65		News, 7.25 a.m.
New York, U.S.A.—WCBX	9.480	31.65	50,000	Signs off at 3.30 p.m.
Ankara, Turkey—TAP	9.465	31.70	20,000	News is read at 6.15 a.m.
London, England—GRU	9.460	31.75	50,000	General Overseas Service.
London, England—GRI	9.410	31.88	50,000	4.45-10.30 a.m.
Lima, Peru—OAX4J	9.340	32.12	1,000	Good at 4 p.m.
Radio Moroc-Rabat	9.082	33.03		News, 8 a.m.
Radio Algiers, Algiers	8.960	33.48		News, 3 a.m. (B.B.C.), 6, 8 a.m.
Moscow, U.S.S.R.	8.96	33.48	—	News at 11.20 p.m.
San Francisco—KES2	8.930	33.58		10.15 p.m.-5 a.m.
Havana, Cuba—COCQ	8.830	33.98	1,000	Best of the Cubans, 5 p.m.
Kweiyang, China—XPSA	8.484	35.36	10,000	News is read at 2 a.m.
Rabat, Morocco—CNR	8.035	37.27		English session 7 a.m.
"Radio Levant" Syria—FXE	8.035	37.27		Session for troops, 4.30 a.m.
New York, U.S.A.—WOOW	7.820	38.36	50,000	Heard from 10 a.m. till 6.45 p.m.

Location and Call.	Mega-cycles.	Metres.	Power in Watts.	Schedules and Items of Interest.
New York, U.S.A.—WKRD	7.820	38.36		News at 7 p.m.
Boston—WRUL	7.805	38.44	50,000	Opens at 6.15 p.m.
Rome Radio, Italy	7.575	39.60		English programme, 5.30 p.m.
Boston, U.S.A.—WRUA	7.575	39.60	50,000	Opens here at 8.45 a.m.
Cincinnati, U.S.A.—WLWO	7.575	39.60	75,000	4.15-6.30 p.m. to Europe.
San. Fran., U.S.A.—KWY	7.560	39.66		12.30-2.30 a.m.
London, England—GRJ	7,320	40.98	50,000	African service, news 7.45 a.m.
Delhi, India—VUD2	7.290	41.15	10,000	News midnight, 6 a.m.
London, England—GWN	7.280	41.21	50,000	Broadcasts to Europe.
Berlin, Germany—DXM	7.270	41.27	50,000	News, 6.30, 7.30 a.m.
London, England—GSU	7.260	41.32	50,000	Pacific Service.
London, England—GWI	7.250	41.38	50,000	From 6 a.m.
San Francisco, U.S.A.—KGEI	7.250	41.38	100,000	Fair signal, 5 p.m.-4.5 a.m.
Berlin, Germany—DXJ	7.240	41.44	50,000	News. 8.30 a.m., 3, 4, 5 p.m.
Brisbane, Aust.—VLQ	7.240	41.44	10,000	Opens at 8 a.m.
Bombay, India—VUB2	7.240	41.44	10,000	News midnight.
London, England—GSW	7.230	41.49	50,000	North American service.
San Fran., U.S.A.—KWID	7.230	41.49	100,000	7 p.m.-5.05 a.m.
Brisbane, Aust.—VLQ2	7.210	41.61	10,000	Opens 7.30 p.m.; signs 1.30 a.m.
Havana, Cuba—CMZ1	7.210	41.61	1,000	"Voice of Democracy," 4 p.m.
London, England—GWL	7.200	41.64	50,000	European service.
London, England—GRK	7.185	41.75	50,000	Home service, heard 7 p.m.
London, England—GRT	7.150	41.96	50,000	European service.
London, England—GRM	7.125	42.08	50,000	
London, England—GRS	7.070	42.43	50,000	Directed on us.
Schenectady, U.S.A.—WGEA	7.000	42.86	100,000	Closed Latin Programme, 4 p.m.
Wellington, N.Z.—ZLT7	6.715	44.67		News to the Pacific, 9.30 p.m.
New York, U.S.A.—WKTM	6.380	47.01		News, 7 p.m.
Berne, Switzer.—HER3	6.320	47.47		News, 8.50 a.m.
Noumea, N. Cal.—FK8AA	6.200	48.39	80	Opens 7.30 p.m.
London, England—GRN	6.200	48.39	50,000	European service.
Delhi, India	6.190	48.47	10,000	News, midnight.
Schenectady, U.S.A.—WGEA	6 190	48.47	100,000	7 u.m., signs off.
London, England—GRO	6.180	48.54	50,000	Used to Africa, 5 a.m.
New York, U.S.A.—WCBX	6.170	48.62	50,000	News, 6 p.m.
London, England—GWK	6.160	48.68	50,000	To China, 1 a.m.
Vancouver, Canada—CBRX	6.160	48.68	150	Closes at 6.30 p.m.
London, England—GRW	6,150	48.78	50,000	North American service.
Teheran, Iran—EQB	6.150	48.78	14,000	American news, 4.45 a.m.
London, England—GRW	6.145	48.82	50,000	Home service, news, 8 p.m.
Berlin, Germany—DXX	6 140	48.86	50,000	—News, 6.30, 8.30 a.m.
Boston, U.S.A.—WBOS	6.140	48.86	50,000	News, 9 p.m.
Boston, U.S.A.—WRUA	6,140	48.86	50,000	Closes 6 p.m.
Tokio, Japan	6.130	48.94	50,000	News, 1 a.m., 6 a.m.
Suva, Fiji—VPD2	6.130	48.94	400	6–9.30 p.m. Sundays only.
New York, U.S.A.—WOOW	6.120	48.98		Closes at 6.45 p.m.
London, England—GSL	6.110	49.10	50,000	To North America.
Manila, Philippines—KIAN	6,110	49.10	1,000	News, 10.30 p.m.
Shanghai, China—XGAW	6.100	49.10		News, 11.45 p.m.
Radio Metropole, Belgrade	6.100	49.10		English session, 6.30 a.m.
New York, U.S.A.—WKRD	6.100	49.10	—	News, 6 p.m., signs 6.45 p.m.
London, England—GWM	6.095	49.21	50,000	News, 9 p.m.
Montreal, Canada—CBFW	6.090	49.25	7,500	News, 3 p.m., signs 3.30 p.m.
Cincinnati, U.S.A.—WLWK	6.080	49.34	70,000	4.15-8.30 p.m., news 5, 6, 7, 8.
Vancouver, Canada—CKFX	6.080	49.34	10	Relays CKWX, signs 8 p.m.
Delhi, India—VUD	6,080	49.34	10.000	News at 6 a.m.
London, England—GRR	6.070	49.42	50,000	Good signal 7 p.m.
Toronto, Canada—CFRX	6.070	49.42	1,000	Relays CFRB, good 11 p.m.
New York, U.S.A.—WCDA	6.060	49.50	50,000	Signs at 6.45 p.m.
Nairobi, Kenya—VQ7LO	6.060	49.50	600	BBC news, 6 p.m.
London, England—GSA	6.050	49.59	50,000	Home service, 7 p.m.
Boston, U.S.A.—WRUW	6.040	49.66	50,000	Closes at 6 p.m.
Algiers, Algeria—AFHQ	6.040	49.66		News 6 a.m.
Chungking, China—XGOY	6.030	49.73	35,000	News at 2 a.m.
Berlin, Germany—DXP	6.303	49.73	50,000	To North America, news, 5 p.m.
Berlin, Germany—DJC	6.020	49.83	50,000	News 6.15 a.m.
Sydney, Canada—CJCX	6.010	49.92	1,000	News at 11 p.m.
Calcutta, India—VUC2	6.010	49.92	10,000	News, midnight.
London, England—GRB	6.010	49.92	50,000	News, 7.45 a.m.
Moscow, U.S.S.R.	6.000	50.00	50,000	News, midnight.
Vatican City—HVJ	5.968	50.26	15,000	To England, news, 7.15 a.m.
Washington, U.S.A.—WWV	5.000	60.00	10,000	National Bureau of Standards, frequency check.
Colombo, Ceylon	4.900	61.20		Local news, 1 a.m.; B.B.C. 3 a.m.
Calcutta, India—VUC2	4.840	61.98		B.B.C. news, 3 a.m.
Delhi, India—VUD2	3,490	86.000	10,000	Indian news, 2.50 a.m., 6 a.m.
Bombay, India—VUB2	3.365	89.20	10,000	News, 2.50 a.m.; B.B.C. 3 a.m.
Madras, India—VUM2	3.340	89.80	10,000	News, 2.50 a.m.
Calcutta, India—VUC2	3.305	90.80	10,000	Local news, 2.50 a.m.
London, England—GRC	2.920	102.90	50,000	To North America, 4 p.m.
Washington, US.A.—WWV	2.500	120.00	10,000	Frequency Checks 8 p.m.

INDIAN BROADCAST STATIONS

Indian stations provide a good signal in the winter, with B.B.C. news at 3 a.m., previous to which local news is heard. This list is compiled by our DX ADVISER, Arthur T. Cushen, 105 Princes Street, Invercargill.

Location and Call.	Kilo-cycles.	Power in watts.	Location and Call.	Kilo-cycles.	Power in watts.
Peshawar—VUP ..	629	10,000	Aurangabad	940	500
Colombo, Ceylon—ZOH .	700	5,000	Lucknow—VUW	1,022	5,000
Hyderabad—VUV ..	730	5,000	Lahore—VUL	1,086	5,000
Trichinopoly—VUT ..	758	5,000	Dacca—VUY	1,167	5,000
Calcutta—VUC	768	1,500	Bombay—VUB	1,231	1,500
Delhi—VUD	886	20,000	Madras—VUM	1,420	250

REPORTING DX STATIONS

(By A. Mervyn Branks, Editor of the New Zealand DX Club's Bulletin, "THE NEW ZEALAND DX-TRA.")

The term DX is an abbeviation of the word distance and, as a hobby, dxing is becoming increasingly popular. However, there is much more in dxing than listening to distant stations. The real thrill is when, as a result of sending a detailed report to a station, a verification in the form of a card or letter is received. As one's verified log begins to grow so does the dxer's enthusiasm. Also correct and intelligent reports are appreciated, for such are of great value to the chief engineer in grading the quality of music and speech, the frequency and intensity of fading, and the signal strength of his transmitter. It can thus be seen that a new dxer has to master the art of reporting.

At each session at the dials, write in your "rough" note pad the day, date and time, and when a new signal is picked up jot down the frequency and particulars of items and advertisements heard. The best plan is to start on the loudest and most frequently heard stations and so gain experience which will prove valuable when harder "catches" are logged. About half an hour's programme is sufficient, although a shorter period may be given to harder stations, providing that your details are definite—never guess. It is not always possible to hear every item, but see that you have sufficient to enable the station to identify the programme. List the time of each item and see your watch is correct. Other details to be noted are the strength and quality of the signal and any fading or interference present.

When writing your report put your name, address and the date at the top of the page. Give the time in New Zealand Daylight Saving Time (12 hours ahead of G.M.T.) and also convert into the station's local time and date. Fiji has the only stations on the same time belt as New Zealand, all other stations are behind us. World time can be calculated from the Time Chart appearing in this annual. Several countries observe Summer Time, so if in doubt quote their Standard Time, or G.M.T. Volume can be graded as exceptionally loud, loud, moderately loud, fair or weak. Or the "R" and "QSA" code given on this page may be used, as it is internationally known. Audibility is indicated by R1 to R9 and readability is graded QSA1 to 5. Because a signal is loud it is not necessarily readable; it may be distorted. It is important to give details of your receiver, aerial and earth systems, but because of war conditions only a brief reference to locality should be made and no mention whatsoever of the weather. Other facts to be stated are fading (steady, light, severe, rhythmic, irregular, or nil), also note the depth and duration of fades. Interference (generally state the nature of the interference, whether static or power noise and how the station came through it). Or if from another station try to name the offender. Tone say whether good and clear, harsh or mellow, rough and garbled, deep or high). Comparison of signal strength with other stations in the same country is beneficial. In the case of foreign broadcasts note carefully the time of each item and try to describe the kind of programme. Give particulars of any peculiarity such as gongs sounding, clock chiming, interval signal, whether man or lady announcer, etc. Write clearly and don't exaggerate by saying volume was "great" when you had almost to sit in the speaker to hear anything. Perhaps someone else may write and give a reverse report to your own, hence your first disappointment when no verification is forthcoming.

The New Zealand DX Club is an organisation solely devoted to the interests of DX listeners, and special report forms are available to members. These forms save hours of laborious writing and also set out the information wanted by station engineers clearly and precisely. Membership to the club is 2/6 and the subscription to the mimeographed bulletin, "The New Zealand Dx-tra," is 4/- a year. Any enthusiast wishing to join the N.Z. DX Club may do so by sending 6/6 to the Editor, "The N.Z. Dx-tra," 5 Dublin Street, Invercargill, or to the National Secretary, 8 Tawari Street, Auckland, S.1. A sample copy of the bulletin may be had from the former address.

AUDIBILITY

R1	Faint Signals
R2	Weak Signals
R3	Can be Copied
R4	Fair Signals
R5	Mod. Strong
R6	Good
R7	Strong Signals
R8	Very strong
R9	Overloading

READABILITY

QSA1	Unreadable.
QSA2	Readable Occasionally.
QSA3	Readable with Difficulty.
QSA4	Readable.
QSA5	Perfectly Readable.

THE EXPERIMENTER

Rahob 8411.

Editor's Note.—The use of any type of transmitter would be a breach of the war regulations. Experimenters should also be careful not to cause interference in neighbouring radio receivers.

It is quite possible that the experimenter already possesses an induction coil, in any case, quite a good one can be obtained for a few shillings; with this a few odds and ends, some bell wire and a little ingenuity, a Hertz oscillator may be constructed and operated.

Cut two pieces of tin about five inches square and solder them to the ends of a pair of metallic (head as well) ladies' hat pins. Support the pins on a light wooden frame as shown in the following diagram:

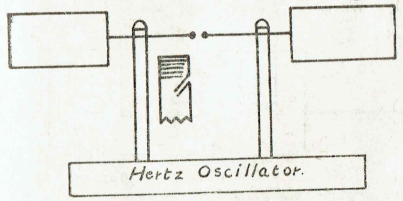


Fig. 1.

Now connect up, with some bell wire, the induction coil and a morse key, which can be bought or made as desired, a simple and quite good telegraphic key can be made as shown in Figure 2 from a piece of springy brass.

Fig. 2.

Having connected up and suitably adjusted the induction coil and the spark gaps of the oscillator by operating the key, the oscillator will be charged, and, discharging create a disturbance in the ether which will be radiated out in all directions.

The following is the circuit for the Hertz Oscillator, Figure 3:—

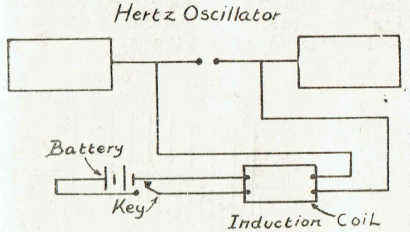


Fig. 3.

The next experiment or what is really a continuation of the one just described, is the construction of a receiver or resonator. This is best made by obtaining a piece of flat wire or strip about two feet long and quarter inch wide by an eigth thick. Bend this up into a ring as shown in Figure 4 and mount it on a light wooden support. The ends must be drilled and tapped to take two "contact" screws. These screws, which should be bought from an electrical or motor accessory shop, have a tiny piece of platinum or molybedinyum inset in the point which does not get dirty and allows freer sparking.

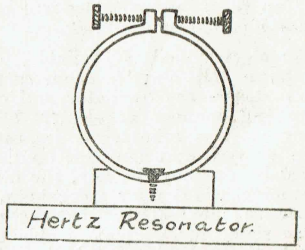


Fig. 4.

If the oscillator is now started up on one side of the room—get somebody to make dashes with the key—and the resonator placed on the opposite side of the room, by adjusting the contact screws, a tiny spark will be produced across the gap. It will be found to be a most interesting and instructive experiment and a quite striking demonstration of the existence of "wireless" or "Hertzian" waves.

Proceeding with the experiments, the next thing to attempt is a coherer. Obtain a piece of glass tubing of fairly liberal section about six inches long and half an inch (inside) diameter, and place a good cork in each end. Now get a piece of half-inch diameter brass rod about two and a half inches long, cut it in half and file the ends as shown in Figure 5, a hole must be drilled in the opposite end of each piece to take a stiff wire, which should be soldered in.

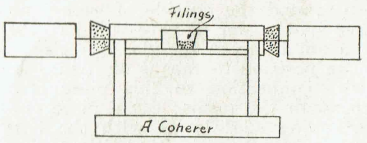


Fig. 5.

To assemble these various bits, make a neat hole in the centre of each cork and pass the stiff wire through it with the brass electrode soldered to the end, then on the extremity of each wire solder a piece of tin cut about eight inches by five inches. A light wooden frame or stand should be made to carry the tube.

Make some nice clean iron filings and, having placed one cork and electrode in position, take a pinch of the iron filings and drop them into the open end of the tube, carefully replacing the other electrode and adjusting the two about an eighth of an inch apart.

The first experiment with the coherer is to set it up on its stand and to start up the previously constructed "Hertzian Oscillator," getting somebody to send a succession of dashes as before. Watch the iron filings. It will be noticed that as the dashes are sent the filings become like a brush, and similar to their appearance when under the influence of a magnet. Tap the tube and they will collapse into an inert heap again.

If an electric bell is available, a wireless alarm bell may be constructed as follows: Leave the oscillator and coherer set up and connect an electric bell and battery to the coherer as indicated in Figure 6. Now when the oscillator is charged by pressing the key, the filings in the coherer, which offer a considerable resistance to the bell and battery circuit, become rigid, and current is able to flow through the coherer and bell which, of course, sets it ringing. A tap on the coherer will stop it.

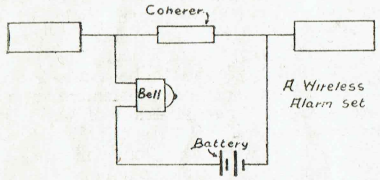


Fig. 6.

The last of this series of introductory experiments into wireless is the construction and use of "Leyden Jars." The easiest way of doing this is to make use of some pound jam jars. Obtain six of these and purchase some copper foil, copper, because it is stiffer and can be got more easily into the jar. Wrap a suitably cut piece around the outside of each jar and either spot solder it, care will have to be taken not to crack the glass, or else tie it firm in position by means of string, solder a wire connection to this piece of foil. Now, with the inside: cut a piece of foil, overlapping slightly as with the outside piece and roll it so that it acquires a spring. Insert it into the jar against the spring it has acquired and bend it carefully down with the fingers. A little practice with a piece of stiff paper will enable this to be done quite skilfully. Solder a piece of wire for a connection to each of these inside pieces and it is as well to tie it to the mouth of the jar to prevent movement. A little gum introduced into the jar and run round the edge will seal the foil on to the glass.

Having constructed the jars, go back again to the oscillator and connect one jar across the gap, leaving the coil connections as before. It will be found that a sharper discharge takes place. Increase the number of jars and the gap of the oscillator can be made wider. Then try the resonator, a larger spark will be received.

For those experimenters who want to use a Ford coil for the induction coil the circuit wiring is as follows:—

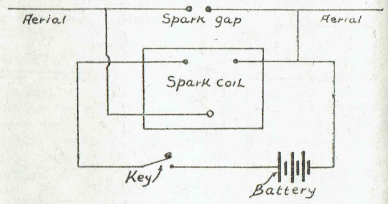


Fig. 7.

For those experimenters who wish to go further, they may try their skill in making a reflector for their spark transmitter, and those who succeed will have the thrill of wireless telegraphy transmission. A reflector for use with the transmitter and receiver would consist of a lot of brass wires, say $\frac{1}{8}$in. in diameter, and each about a metre long, arranged in the form of a parabola as shown in Figure 8, the aerial being at the focus. The reflector base may be made from a piece of well-waxed dry wood with holes drilled in it and the ends of the reflector rods placed in them. It may be stiffened by binding a very thin strip of celluloid or wood round it as at B. The space between the rods should be about 1-5 of a metre, and the aerial should be placed at the focus of the reflector, with its stand on a support at the back. With a transmitter and receiver of this type endless experiments can be carried out, showing absorption, reflection, polarisation, and refraction of short waves.

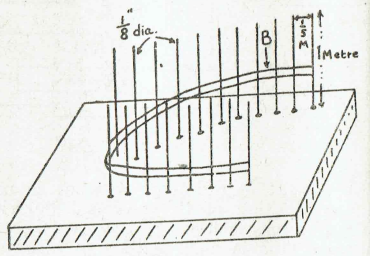
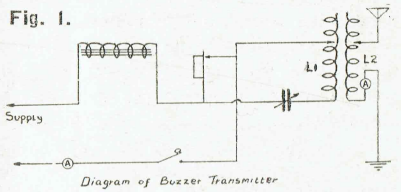


Fig. 8.

SPARK TRANSMITTER

A form of spark transmitter which is very simple, yet efficient, is shown in diagram Figure 1. The waves it sends out are only slightly damped and for this reason perhaps more efficient than a real spark transmitter of the same power. It consists of an iron core with a coil wound on it and connected through a trembler via a key, and ammeter to a source of supply (about 100v.). This actually forms a buzzer circuit similar to that described in C.W. reception. Across the trembler is connected a tuned oscillatory circuit L1, which is inductively coupled via L2 to the aerial circuit earth. The latter circuit has an ammeter in it to measure the current flowing, or what is really the output.

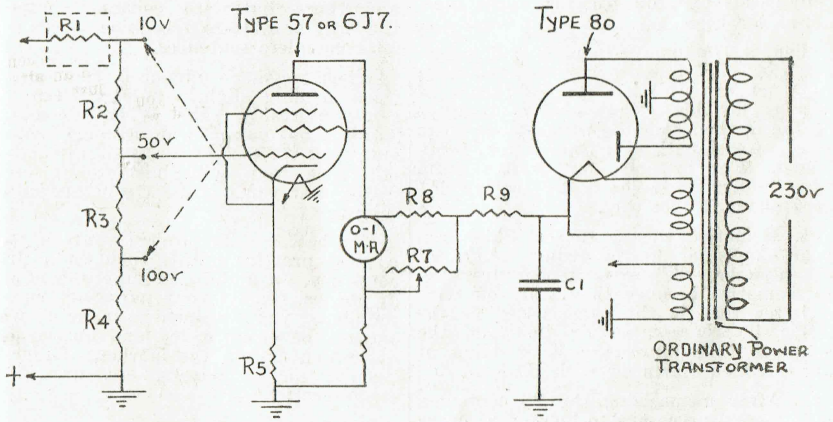
Fig. 1.



VACUUM TUBE VOLTMETER

A.C. Operated. Three Ranges: 10V., 50V. 100V.

Sent in by A. G. L. Smith,



R1. 5 megohms.
R2. 4 megohms.
R3. .5 megohms.
R4. .5 megohms.
R5. 1000 ohms.
R6. 50,000 ohms.
R7. 20,000 ohms., variable W/W.
R8. 10,000 ohms.
R9. 10,000 ohms.

C1. 4 to 8 μF.

The input impedance of this instrument is 10 megohms on all ranges, so that for measuring A.V.C. voltages, up to 10 volts for instance, the meter has a resistance of one million ohms per volt. Part of the divider system (R1) is included in the test prod itself, enabling measurements to be taken across grid circuits, etc., without detuning effects. R7 is the balancing control which reduces the meter reading to zero and is the only adjustment to be made before readings can be taken. Note that the meter resistance has to be adjusted to 100 ohms (if it is not of this value) by addition of suitable series resistance with the meter itself. Calibrate against known values.

THE MORSE CODE

The Morse Code might be termed the shorthand of Radio. Dots and dashes are arranged in different manners to represent letters and figures and can be used with sound or light flashes. It is used internationally as a means of communication by wires (telegraph), wireless (radio), and by light such as ship signalling.

On every waveboard of your short-wave set you will pick up messages being transmitted from and to every part of the globe. At the outbreak of war the value of persons able to receive and transmit the code was instantly recognised. and we have received many letters from Rahobs who are serving overseas expressing their appreciation of the fact that they received their first introduction and instruction in the code through the Lamphouse Annual. The need for Morse Code operators in the Services is greater than ever, and after the war there will be rapid strides in commercial radio communication and boundless opportunities for those prepared for them.

The first step is to master and memorise the code, and nearly every reference book we can find has its pet theory of how to do this. They nearly all agree on the method which is to memorise some word associated with the letter being learnt. For instance, one writer (who says his system is the best—they all do) goes about it this way.

1. Memorise the sentences which appear alongside the following letters of the alphabet. These sentences are easy to memorise because they start off with a letter that is the same letter as the letter it represents—for instance, the sentence that represents K is King at arms which starts off with K.

2. After memorising the 26 sentences it is merely necessary to know that every word of the sentence that has three letters or less than three letters represents a "dot" and every word that has four letters or more represents a "dash."

Thus when you have memorised the following 26 sentences you have automatically memorised the Morse Code.

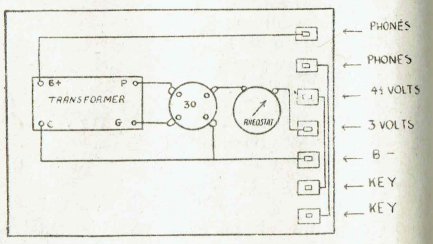
A	. –	At Arms
B	– . . .	Because it is so
C	– . – .	Cash and carry it
D	– . .	Dash it all
E	.	Et
F	. . – .	Fifty fire men
G	– – .	Good morning
H	. . . .	He Hi Ho Hum
I	. .	Ink it
J	. – – –	Jet makes fine beads
K	– . –	King at arms
L	. – . .	Let John do it
M	– –	Mess Mates
N	– .	Nasty
O	– – –	Once twice thrice
P	. – – .	Pre paid post age
Q	– – . –	Quick march to place
R	. – .	Re-peat-er
S	. . .	S-O-S
T	–	Thanks
U	. . –	Uniform
V	. . . –	Violets
W	. – –	We want work
X	– . . –	Xant is unknown
Y	– . – –	Young and handsome
Z	– – . .	Zest zeal and zim

Of course if you like to go to the trouble of making up your own words you can easily do so, and if you use words which are familiar you will learn very quickly.

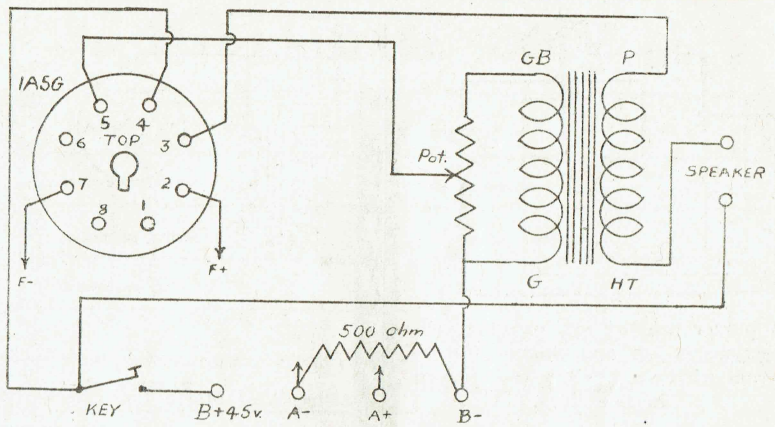
The next step is to try and receive messages. Try and tune in a station which is sending slowly and then take down the message. For a start you may be only able to pick out a letter here and there, but with constant practice you will be able to recognise words and later complete sentences.

When you have advanced, tune to stations sending slightly quicker than you can comfortably read. When you miss a word do not pause in an attempt to work out what it was, just skip it altogether, otherwise you will miss many other words that you might have otherwise received.

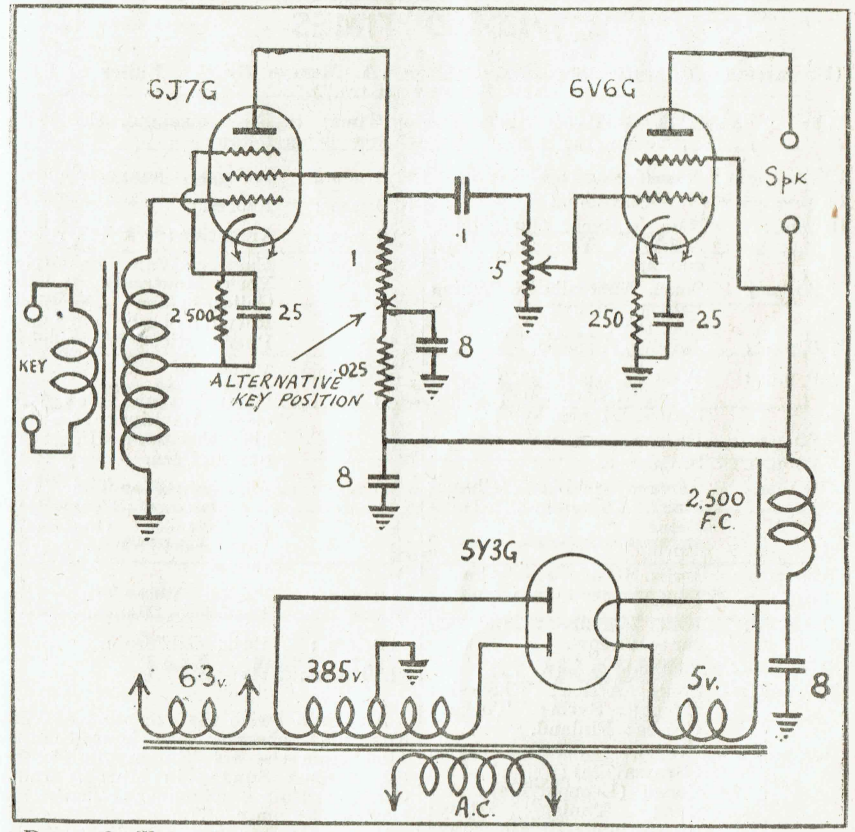
For best results provide yourself with a good practice outfit, such as a first-class key, an audio oscillator and a pair of phones. Should your purse not run to the above, you will have to make do with one of the cheaper key and buzzer outfits which are on the market. Different circuits for oscillators, etc., are given as follows:



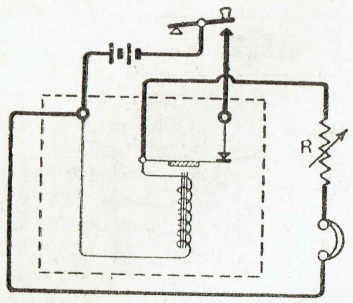
Simple Code Oscillator using only 30-Valve Transformer and Rheostat. Works from low voltage.



Oscillator for use with a speaker. Potentiometer is 500,000 ohm.



Power Oscillator for Morse Code class. "Australian Radio World" Circuit.



A buzzer practice set, showing connections of key and phones. The internal wiring of the buzzer is shown in fine lines.

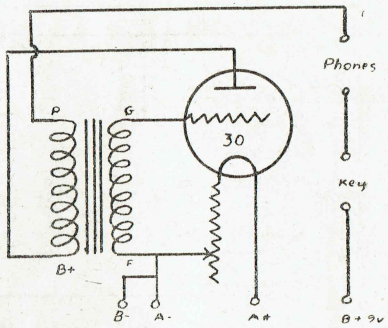


Fig 1 Standard Oscillator Circuit

Circuit of Morse Code Oscillator.

WORLD TIMES

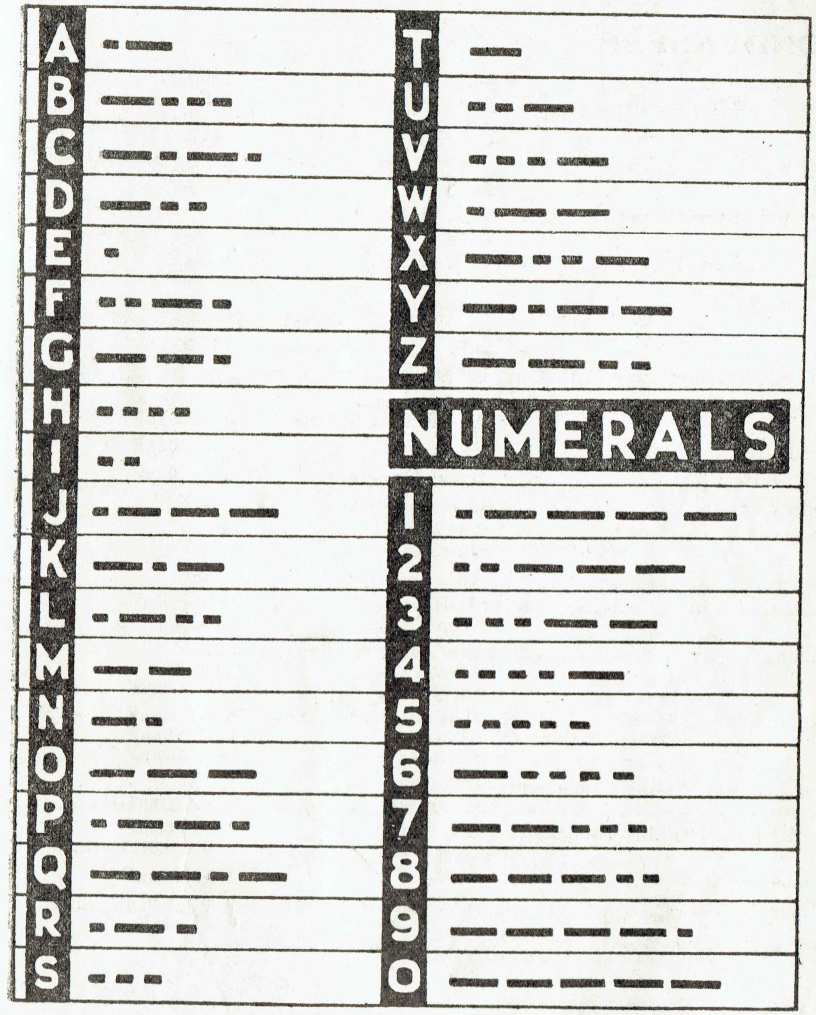
(Prepared for "The Lamphouse Annual" by A. Mervyn Branks, Editor of "The New Zealand Dx-tra.")

When it is MIDNIGHT (Daylight Saving Time) in New Zealand, the local time in the places listed below is as follows:—

12 Midnight:	New Zealand; Fiji.
11 p.m.:	New Caledonia.
10 p.m.:	New Guinea, Queensland, N.S.W., Victoria, Tasmania.
9.30 p.m.	South Australia (including Broken Hill), Northern Territory.
9.0 p.m.:	Japan; Formosa.
8.0 p.m.:	Western Australia, Coastal China (Shanghai); Philipines, Manchukuo.
7.30 p.m.:	Borneo, Java.
7.20 p.m.:	Singapore.
7.0 p.m.:	Central China (Chungking), Thailand, Indo-China.
6.30 p.m.:	Burma.
5.30 p.m.:	India Standard; Ceylon.
4.0 p.m.:	Iran.
3.0 p.m.:	Irak; Zanzibar; Madagascar; Moscow.
2.30 p.m.:	Kenya.
2.0 p.m.:	South Africa; Rhodesia; Egypt; Syria; Turkey; Greece; Finland.
1.0 p.m.:	French Equatorial Africa (Brazzaville); Belgian Congo (Leopoldville); Angola; Tunisia; Italy; Switzerland; Germany; Sweden; Norway; Denmark.
12 Noon:	G.M.T.; Morocco; Spain; France; Belgium; Holland.
11.0 a.m.:	Iceland; Canary Islands.
10.0 a.m.:	Azores.
9.0 a.m.:	Argentine; Brazil; Uruguay
8.0 a.m.:	Eastern War Time (New York, Montreal); Bolivia; Chile; Cuba; Dominican Republic; Paraguay; Puerto Rico; Barbados.
7.30 a.m.:	Venezuela.
7.0 a.m.:	Central War Time (Chicago, Winnipeg); Colombia; Ecuador; Haiti; Panama; Peru.
6.0 a.m.:	Mountain War Time (Denver, Calgary); Costa Rica; El Salvador; Guatemala; Honduras; Mexico; Nicaragua.
5.0 a.m.:	Pacific War Time (San Francisco, Vancouver).
4.0 a.m.:	Baja, California.
2.30 a.m.:	Hawaii.

Australia (with the exception of West Australia) observes one hour Summer Time from the first Sunday in October till the last Sunday in March. India, Great Britain (Summer Time and Double Summer Time), and several other countries carry Daylight Saving Time for portion of year, but their Standard Time is given above to avoid confusion. Those countries observing D.S.T. all the year have been listed in D.S.T. and not Standard Time.

THE MORSE CODE



THE PHONETIC ALPHABET

A	**Ack**	G	George	N	Nuts	U	Uncle
B	**Beer**	**H**	**Harry**	O	Orange	**V**	**Vic**
C	**Charlie**	**I**	**Ink**	**P**	**Pip**	W	William
D	**Don**	**J**	**Johnnie**	**Q**	**Queen**	X	X-Ray
E	**Edward**	K	King	R	Robert	Y	Yorker
F	**Freddy**	L	London	**S**	**Sugar**	Z	Zebra
		M	**Monkey**	**T**	**Toc**		

Letters in bold type are always spoken phonetically; others only when conditions make speech indistinct.

COMMON CIRCUIT CONSTANTS

(Rahob 8411).

CONDENSERS

Position.	Circuit.	Capacity.
Bias Resistance by-pass	H.F. or I.F.	0.1μF
	L.F.	25—250μF
	(old sets).	1—4μF
Grid Circuit Decoupling	H.F. or I.F.	0.05—0.1μF
	L.F.	0.5—1μF
Screen-grid Circuit Decoupling ..	H.F. or I.F.	0.1μF
	L.F.	0.5—4μF
Anode Circuit Decoupling ..	H.F. or I.F.	0.1—1μF
	L.F.	0.5—8μF
Inter-stage Coupling	H.F.	100—1000μμF
	Grid Detector	100—300μμF
	L.F.	0.01—0.1μF
R.C.-fed Transformer	L.F.	0.1—2μF
Anode by-pass	Grid Detector	100—2000μμF
	Anode Bend Detector	100—200μμF
Load Resistance by-pass ..	Diode Detector	100—300μμF
H.F. Filter	Diode Detector	100—500μμF
Output Feed	Choke Output	1—4μF
Reservoir Condenser	A.C. Sets	4μF
	Universal	4—8μF
Smoothing Condenser	A.C. or D.C.	4—8μF
Band-pass Filter Coupling ..	"Bottom-End"	0.01—0.05μF
	"Top-End"	0.5—2μμF
Tuning	M.W. & L.W. Bands	500μμF
	All-wave	350μμF
	Short-wave	100—200μμF
Reaction	M.W & L.W. Bands	100—500μμF
	All-wave	100—300μμF
	Short-wave	100—200μμF
Earth Lead Isolating Condensers	D.C. Sets	1—2μF
	Universal	0.1μF (max.)
Aerial Lead Isolating Condensers	D.C. Sets	0.001—0.1μF
	Universal	0.001—0.01μF (max.).
Mains Aerial	—	100—200μμF
Mains to Earth	A.C. and Universal	0.001—0.01μF (max.)
	D.C.	0.001—4μF
Valve Heater to Earth	A.C. sets, M.W. & L.W.	0.1μF
	S.W.	0.01μF

RESISTANCES

Position.	Circuit.	Value.
Bias Resistance	S.G. or H.F. Pentode	50—500 ohms.
	L.F. Triode	500—2000 ohms.
	Output Triode	500—1000 ohms.
	Output Pentode	145—500 ohms.
	Anode Bend Detector	2,000—10,000 ohms
Grid-circuit Decoupling	H.F. or I.F.	20,000—500,000 ohms.
	L.F.	50,000—250,000 ohms.
Screen-circuit Decoupling ..	H.F. or I.F.	100—1000 ohms.
	L.F.	2000—10,000 ohms.
Anode Circuit Decoupling ..	H.F. or I.F.	500—10,000 ohms.
	L.F.	5,000—100,000 ohms.

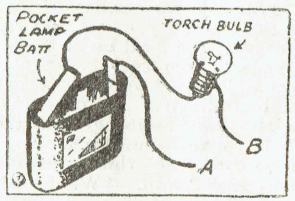
Resistances (Continued).—

Position.	Circuit.	Value.
Anode Coupling	L.F.	10,000—100,000 ohms.
	Grid Detector	20,000—50,000 ohms.
	Anode Bend Detector	0.1—0.25 megohms.
Grid Leak	H.F. or I.F.	1—2 megohms.
	Grid Detector	0.1—5 megohms.
	L.F.	0.1—1 megohms.
Load Resistance	Diode Detector	0.1—0.5 megohms.
Volume Control	Bias on V.M. (valve 6)	10,000—20,000 megohms.
	L.F. Potentiometer	0.1—1 megohms.
Tone Control	L.F.	0.1—1 megohms.
Grid Stopping (Anti-Parasitic)	H.F.	20—200 ohms.
	F.C.	20—500 ohms.
	I.F.	100—500 ohms.
	L.F.	1000—10,000 ohms.
Anode Stopping (Anti-Parasitic)	H.F. or I.F.	100—500 ohms.
	L.F.	50—100 ohms.

The D.C. Resistance of Coils and Chokes:

Component.	Circuit.	Resistance.
Tuning Coil	M.W.	1—5 ohms.
	L.W.	5—50 ohms.
Transformers	I.F.	5—100 ohms.
	L.F., Primary	500—2000 ohms
	Secondary	2000—20,000 ohms.
	Class "B," Primary	500—2000 ohms.
	Secondary	100—500 ohms.
	Output, Primary	200—500 ohms.
	Secondary	0.05—20 ohms.
Mains Transformers	Primary	20—150 ohms.
	H.T. Secondary	100—500 ohms.
Chokes	H.F.	200—1000 ohms.
	H.F., S.W.	20—100 ohms.
	Smoothing, 1st Stage	100—300 ohms.
	2nd Stage	200—1000 ohms.
Speaker Field	Series Fed	1000—2500 ohms.
	Shunt Fed	2500—7500 ohms.

SIMPLE TESTING



Probably the simplest of all testing instruments. Easily made. Test prods can be fitted to the leads A and B.

With it anyone can conduct numerous tests. In use this simple device forms an excellent tester of contacts and terminal connections, and of low resistance metallic paths such as are provided by loudspeaker connecting cords, battery leads, and so on.

LAMPHOUSE GUARANTEE

Any goods which prove in any way unsuitable may be returned in good order within seven days and your money will be refunded in full.

WHAT IS A SUPER-HET?

(Rahob 8411.)

"Will you tell me what a super-het is?"

The subject is one on which we could talk at some length, but we will try to convey the general principles as briefly as possible. First of all, we must explain the general principle of hetrodyning.

What is "heterodyning"?

A technical term for the effect produced when two oscillations are allowed to mix.

Suppose you have two men walking down the road, one of whom takes slightly quicker steps than the other. If they start off in step they will very quickly fall out of step and after a time, when the first man is putting forward his left foot, his companion will be putting forward his right. They will be, in fact, exactly out of step.

After a similar period they will be exactly in step once more and they will continue to fall in and out of step at regular intervals.

What does your analogy mean?

If we have two electrical oscillations of slightly different frequencies we obtain a rather similar effect. At the start, if the two oscillations commence together the total current in the circuit will be the sum of the two individual currents. If the oscillations are equal the total current when they are "in step" will be twice as great. Due to the fact that one current is oscillating more rapidly than the other, however, the two will very soon fall out of step and after a certain period we shall reach the condition when they are exactly out of step. When the current of one oscillation is flowing in one direction that of the other oscillation will be in the opposite direction.

Do you mean that they will cancel out?

Yes. If the oscillations are equal, as we assumed, the two will absolutely wipe out one another.

What happens then?

The effect only lasts for a moment or two. Then the oscillations begin to fall in step again and after an equal period of time they are exactly in phase, so that the current is once more at its maximum value.

The currents continue to fall in and out of step in this manner and the combined current varies gradually between zero and the maximum.

What happens if they are not equal?

You get a similar fluctuation, but it is not so large. The two oscillations will not completely cancel one another out when they are out of step, and in a similar way the maximum value will not be so large, but there will still be this relatively slow change in the overall length.

How often will they fall in and out of step?

That depends upon the differences in the frequencies. The complete change from maximum to minimum and back again is called the beat frequency, and this is equal to the difference between the individual frequencies.

If we have, for example, one frequency of 800,000 cycles per second and another one of 801,000 cycles per second, these oscillations will fall in and out of step one thousand times every second.

We can hear this frequency and if we combine two oscillations as just described in any ordinary wireless receiver we shall hear a high-pitched whistle at a musical frequency corresponding to 1000 cycles per second.

What do we use it for?

Ordinarily we don't want any whistles of this sort. You will, however, have experienced such "heterodynes" at various times. For instance, if you make your receiver oscillate and then tune in to the local station, you will obtain a whistle which alters in pitch as you turn the tuning dial of your set.

I have noticed that. What is it caused by?

You are producing oscillations in your set which are slightly different in frequency from the oscillations received from the transmitting station.

The musical whistle you can hear is the beat between the two oscillations and as you alter the tune of your set you change the frequency of the local oscillations, and the difference in frequency between these oscillations and those from the transmitter is altered accordingly. In other words, you alter the beat frequency and this is why the whistle varies in pitch.

Sometimes we use this principle to make the signal heard. When we are picking up a distant station we sometimes deliberately make our set oscillate in order to produce this heterodyne or beat whistle.

Once we have found the station, of course, we do not want the whistle and we have to stop our set from oscillating or the whistle will interfere with the telephony, but I want you to understand that the mixing of the two oscillations will produce a beat.

Yes, I think I understand that.

Now, let us consider for a moment that we are producing a whistle by making our set oscillate. As we alter the tune of our set and make the local oscillations more and more different in frequency from the oscillations picked up on the aerial, the pitch of the whistle gets higher and higher, until finally it becomes a very high-pitched squeal which we can only just hear.

Beyond this point the whistle seems to stop, but actually this is only because we cannot hear it. The beat is still produced, but it is now at an inaudible or supersonic frequency.

What do you mean by "supersonic"?

Above the audible limit. We say that we are producing a supersonic heterodyne, or, for short, a superheterodyne.

Then can you produce a super-heterodyne with any set?

Strictly speaking, yes, but the name is "superheterodyne," or "super-het" for short, is only given to receivers in which this supersonic heterodyne is used in a particular manner.

So far we have only considered radio-frequency oscillations as taking place at about one million times a second. It is quite possible, however, to have oscillations rather slower than this.

For example, a frequency of 50,000 vibrations per second is still a radio-frequency, and certain transmissions are carried out by the use of frequencies of this order.

Therefore, we can build a set consisting of one or more high-frequency stages, followed by a detector and an output valve which will pick up and amplify signals at a frequency of 50,000 per second just in the same way as we have already considered for the more usual broadcast frequencies in the neighbourhood of a million a second.

What use is that to us?

Suppose we have our incoming signal of 800,000 cycles per second and we generate a local oscillation of 750,000. We shall obtain a beat equal to the difference between the two which is 50,000 cycles per second.

This beat will itself be modulated at speech frequencies just as the original incoming wave so that if we pass this new oscillation which we have just produced through the special amplifier designed for 50,000 cycles per second, we shall magnify the signals and indeed receive them and place them on the loud-speaker in exactly the same way as if we had been dealing with a normal signal.

We have, in fact, converted our original oscillation at a frequency of 800,000 cycles to an intermediary or secondary oscillation of 50,000 cycles, and we have amplified this in the usual way.

What is the advantage of that?

There are several advantages. In the first place we can obtain more amplification and better selectivity by using a lower frequency. An amplifier built for 50,000 cycles would be better in every way than an equivalent amplifier having the same arrangements, but tuned to 800,000 cycles.

So we get better performance?

Yes. Moreover the operation is rather easier, for the following reason. Modern receivers require three or four tuned circuits in order to obtain the necessary selectivity. These tuned circuits have all to be adjusted whenever we alter the setting of the receiver from one station to another.

For simplicity we link all the tuning condensers on a common spindle, but for this to be successful very careful construction of the circuits is necessary, so that they shall all be identified.

In the super-heterodyne receiver we can build our amplifier for a fixed frequency of 50,000 or whatever it happens to be. There is no need for any provision for altering the frequency, and this again makes for simpler construction and better efficiency.

If you can't alter the frequency, how can you tune to the stations?

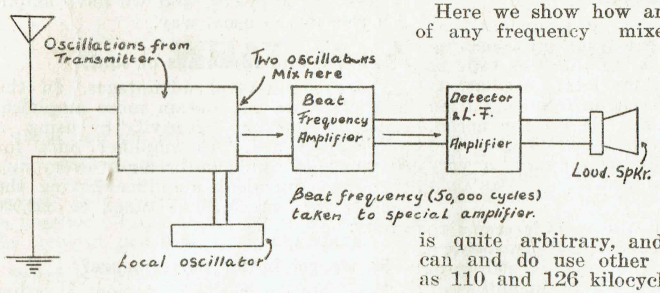
Simply by altering the frequency of the oscillator. Suppose we wanted to tune to a station of 900,000 cycles, we should adjust the oscillator frequency to 850,000.

The difference is then again 50,000 and we have thus once more converted our original signal into a secondary one of 50,000 cycles. By merely altering the oscillator frequency, therefore, we can convert any of the incoming stations to this new, or intermediate frequency, as we call it, and they are then amplified by the rest of the set, which is already tuned to this frequency.

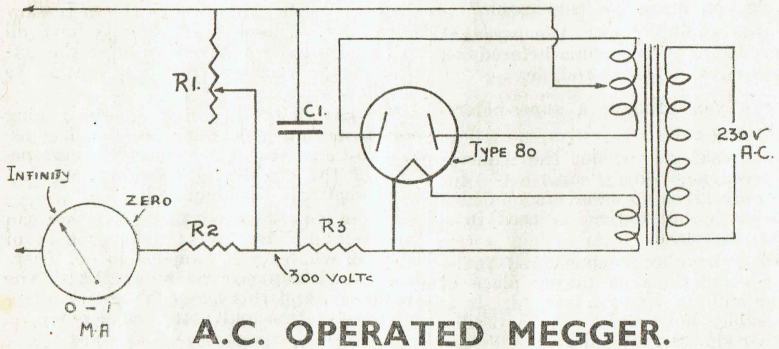
How do you alter oscillator frequency?

Merely by rotating the variable condenser. In the ordinary tuned circuit we vary the natural frequency of the circuit by using a fixed coil and the variable tuning condenser.

We adopt the same method here so that by operating the condenser just in the same manner as an ordinary tuning control we are able to vary the frequency of the local oscillation and thus convert our incoming signals to the intermediate frequency as we require. The skeleton lay-out in the following diagram will help you understand the complete sequence of operations.



Here we show how an incoming signal of any frequency mixes with a locally generated frequency to form a beat frequency in a super-het sequence of valves. Note that the 50,000 cycle beat frequency chosen for this figure is quite arbitrary, and in practice we can and do use other frequencies, such as 110 and 126 kilocycles.



A.C. OPERATED MEGGER.

Range 1000 ohms to 25 megohms

R1. 50,000 ohms, variable W/W.
R2. 300,000 ohms.
R3. 10,000 ohms.
C1. .5 μF.

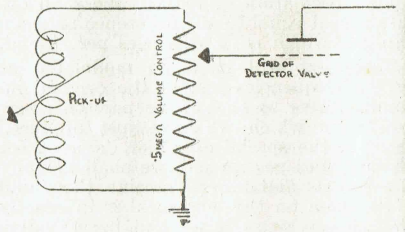
Suitable for measuring high values of resistance, grid leaks and condenser leakage. Ideal for insulation tests on small transformers, etc.

Note that condensers are tested for leakage under actual working conditions as a 300 volt potential is applied. Meter to be calibrated against known values.

Connecting a Pick-up or Mike to Your Radio

Connecting a pick-up to your radio will give you endless joy from your own records, and if a microphone is also used, great fun can be had making up and announcing your own programmes. Our circuit diagram shows the connections to be made. On most sets the detector valve is the shielded one with the grid clip on top and which is nearest to the two or more valves which have no cap on top. Usually it will be one of the following numbers: 57, 55, 6C6, 6B7, 224, 24A, 6B8, 75, 6Q7.

The grid clip, to which a wire is connected, is removed, and in its place the wire from the volume control on the pick-up or mike is fitted—preferably by means of a small clip. The other wire from the pick-up is connected to the chassis of the receiver, probably to the earth terminal will be simplest.



MAKING A SHOCKING COIL

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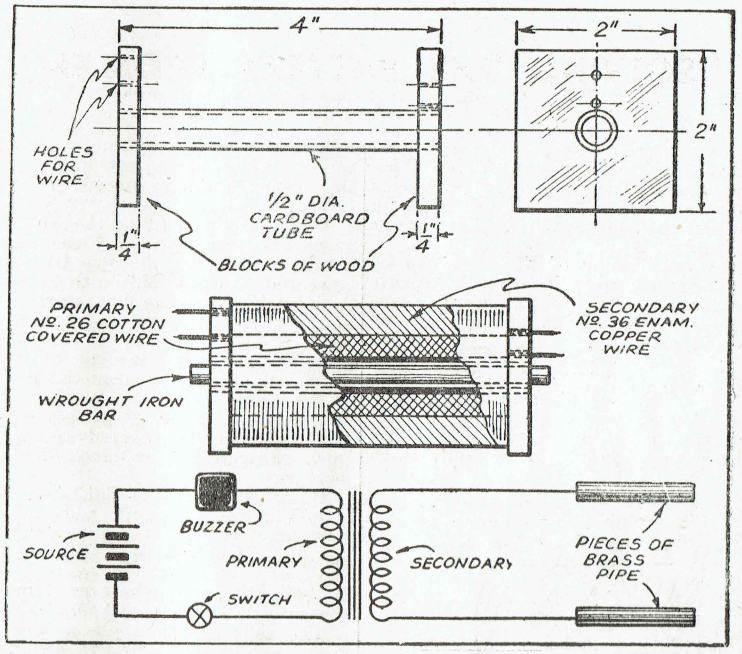


One of the simplest methods of making a "shocking" coil is shown.

This shocking coil will bring enjoyment and entertainment to both young and old. Simple and inexpensive, it can be built in spare time or in an evening. The shocking coil is operated on two flashlight batteries and can be made compact enough to be carried anywhere.

The coil is wound on a cardboard roller. The roller is four inches long and one-half inch in diameter. The roller must be hollow inside because a metal bar must be passed through it. If a suitable roller cannot be found, one can be made by rolling up pieces of paper and glueing them together. Two blocks of wood, one and a-quarter inches square and a-quarter of an inch thick, are glued at each end of the roller to prevent the wire from slipping off the roller. When the roller is completed it can be treated with insuvarn to make it stronger.

The primary is wound with number twenty-six double cotton covered wire. Three layers of this wire are required. If the layers of wire do not become even, a piece of heavy paper can be glued between each layer of wire. A piece of heavy paper should be placed between the primary and secondary coils. Seven layers of about number thirty-six enamelled wire are needed for the secondary. If these sizes of wire are not available, sizes close to them can be used. No smaller size wire is recommended for the secondary because of the difficulty in winding the coil. Each end of the wire should be passed through its proper hole. Before passing the wire through its hole in the secondary, twist some of the wire around the end, so that some of the danger of breaking the wire is eliminated. If in winding the coil the wire should break it should be thoroughly scraped and soldered.

When the coil is completed a piece of heavy paper should be glued over the coil. The primary, the current source, a buzzer, and a switch are connected in series. (The source is two flashlight batteries connected in series.) The secondary is connected to two pieces of brass pipe, about four inches long. The pieces of pipe are tapped and a screw placed in them, to connect the wire.

A bar of soft wrought iron, either square or circular, is passed through the hole in the centre of the coil. As the bar is passed through the coil the shock in-

creases. Moving the iron core in and out will vary the degree of shock obtained. Best results are obtained by using a bundle of soft annealed iron wires for the core. To obtain a stronger shock wind on more layers of fine wire on the secondary (or use more batteries).

SOLVING THE BATTERY PROBLEM

(By PHILIP A. G. HOWELL.)

Dry cells are in great demand and short supply at the present time. This is due both to the shortage of labour problem, and the increasing difficulties in obtaining the chemicals used in their manufacture.

Every extra hour of life that can be gotten from a battery is so much expense saved the country and the user; hence the request that stocks of dry cells be conserved carefully.

Large numbers of dry cells are used in the L.T. or "A" and H.T. or "B" batteries of many radio sets in rural districts. As the voltage falls and the internal resistance increases the majority of these are just thrown out, when

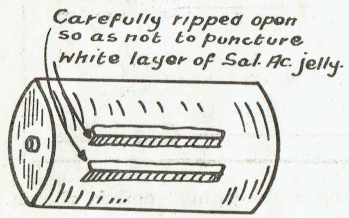


Fig. 1.

actually any person willing to go to a little trouble and expense can get approximately another half of their previous service life from them.

The materials required are: The worn-out batteries, plus any available torch cells which have come to the end of their useful life.

As many small glass, china or earthenware (glazed of course) jars, as there are cells in the batteries. (Small marmite or peanut butter jars, handleless cups, etc., are very satisfactory; metal containers will not do.)

Process: Firstly, sufficient water to about quarter fill the number of jars is heated till it is just too warm to place the fingers in comfortably, and sal ammoniac stirred in until no more will dissolve. After being left a few minutes the clear liquid is poured off and left to cool.

While it is cooling the "B" battery cases are torn open and the block dismantled with a soldering iron. Badly "sweated" cells should be thrown out, especially if the paste has started to dry and gone powdery in them. The others have about 2 inches of tinned copper connecting wire soldered to the zinc case, and then are ripped open down the side of the seam. See diagram, Fig. 1. Great care must be taken that the instrument used to open the cases does not cut or push through to the black depolarizing mixture.

By this time the Sal. Acc. solution should be cool; to it add an equal amount of clean water, thus doubling the volume. If it is desired that the solution shall act quickly on the cells it may be heated again to whatever temperature the jars will stand without cracking.

The cells are then placed in the jars and the solution poured in around them. Care is taken not to spill any on top where it might cause a short circuit or severe corrosion. After the cells have stood a quarter of an hour to twenty minutes, they are tested individually with a torch globe, stacked in a flat tray or old drawer, and soldered up. Connect zinc container of first cell to brass cap of second cell. Then from zinc container for second cell to brass cap of third cell, and so on. A cover is placed over to keep the dust out.

For low voltage receivers such as 49 sets a few old torch cells treated this way will give months of service. As regards rejuvenating No. 6 cells, a "necked" beer bottle makes a good jar to stand them in. Such cells will not, however, stand excessively heavy drains for long, and it is advisable to keep the current below a quarter of an amp. That is: One 33; two 49's; a 34, 32, and 31; four 30's, or five 1.4V. tubes.

ELECTRICAL CONSTRUCTION

AN ELECTRIC MOTOR FROM ODDS AND ENDS

To make this simple but powerful electric motor, you will need only a soft iron staple, some strips of soft iron, some insulated wire, cardboard, and two terminals.

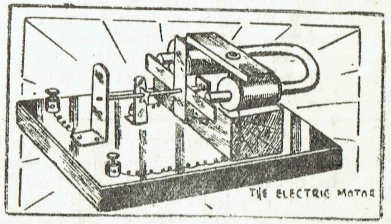
First cut the ends of the staple off square and make two bobbins from paper and cardboard to fit fairly tightly over the ends. Slip the bobbins over the ends of the staple and wind about 30 turns of 26-gauge S.W.G. cotton-covered or varnished copper wire on each bobbin.

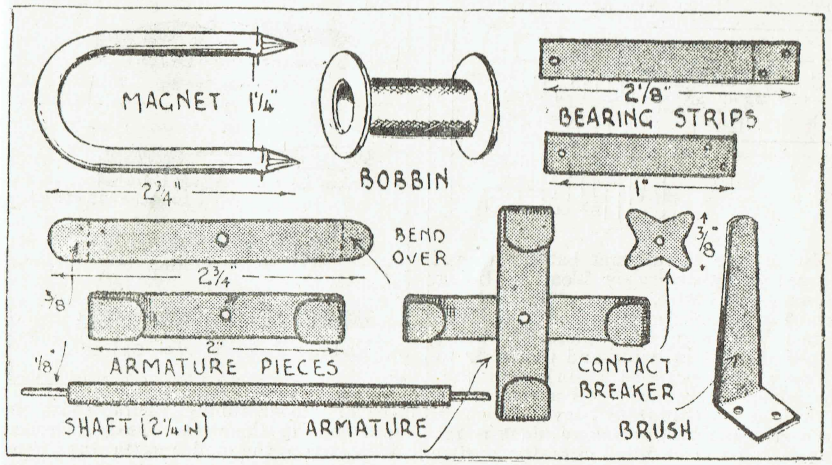
Wind the wire on the bobbins in opposite directions and leave about 6 inches free at each end. Glue a layer of brown paper over the magnet windings. Mount the electro-magnet thus made on a block of wood fixed to a wooden base about 6 inches by 4 inches. Let the ends of the magnet project about ½in. Now cut two strips of soft iron 2¾ inches long and ⅜ inch wide for the arms of the armature and bend over the ends as shown.

Solder these arms together at right angles and drill a hole for the shaft, which is a brass rod 2¼ inches long and 3/16 in. thick. The ends of the shaft are filed to ⅛ inch, leaving a shoulder which will bear against the strips which support the armature shaft. Cut these bearing strips and bend the end of the longer one at right angles. Screw this one to the base and the shorter one to the side of the block on the base.

Fit the shaft in position and solder the armature to it so that the bent-over arms turn just in front of the ends of the magnet. A star-shaped contact breaker is also soldered to the shaft half-way between the armature and the other support. The four points of this contact breaker touch a brush bent from a brass strip and screwed to the wooden base. The points are adjusted so that one of them just touches the brush when the arms of the armature are almost opposite the magnet pole.

Two terminals are fixed to the base and one free end of wire is fixed under one of them. A short length of wire leads from the other terminal to the outer bearing strip, and the other wire from the magnet windings is led to the brass strip which bears against the contact breaker. Connect two or three torch batteries in series to the terminals and when the current flows the magnet will attract the armature so that it spins rapidly. A small pulley attached to the shaft will enable you to use the motor to drive a model.

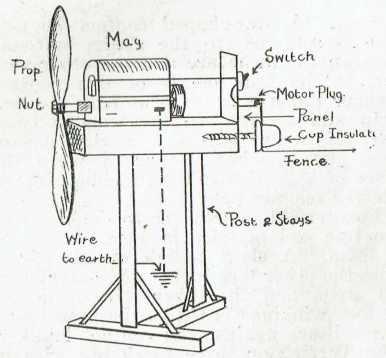




HINTS AND KINKS

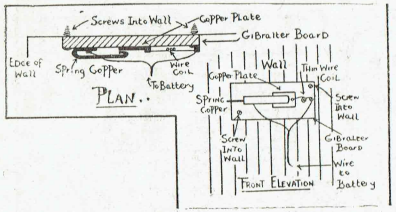
ELECTRIC FENCE UNIT.

(For Country Rahobs without Batteries.)



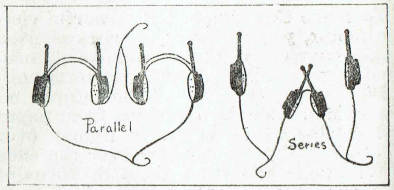
Any discarded motor magneto will do for the generator so long as it is in running order. Make and fix a propeller on to it, and make sure the unit is well earthed. This unit costs nothing to run, and will provide lots of fun as well as being a most useful unit. It can be connected to wiring across windows, as a burglar preventative, or used as a fence to keep cats and other animals from places where they are not wanted.—Rahob 3725.

Here is the outline of a set-up that will save boxes of matches and is very handy in actual use. This is definitely not a "pocket edition," but will prove invaluable in a big office or workroom where several smokers are congregated.



Use a 6 or 12-volt wet battery (a recharged car battery is ideal). Using ordinary flex wire, connect to battery terminals at one end and at the other connect one wire to a piece of spring copper about ½ in. wide and the other to a thin copper or steel (thin) wire coil. The copper spring and coil are mounted on a base of Gibraltar board, which is screwed to the wall at a convenient height (say 5 ft.). You just press the spring copper against a smaller plate of copper attached to the wire coil, thus completing the circuit, the coil becoming red-hot within a few seconds.—Rahob 6884.

When using two pairs of phones on a crystal set you will find that you can get



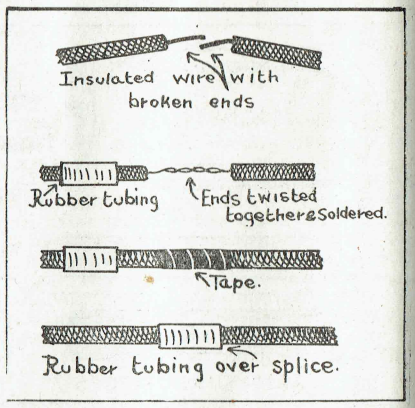
much more volume if they are connected in series instead of in parallel. Try it out for yourselves.—A.E.A.

SEALING WAX MAKES ELECTRIC PLUGS SAFE.

Short circuits often result because of the common practice of pulling electric fixture plugs out of the wall sockets by the cord. Strands of wire loosen bit by bit, eventually short and blow the fuses. Tighten up the screws in the plug, then pour in melted sealing wax until all wires are covered. The wax will anchor the cord securely and double the life of the extension cord.—Rahob 9124.

SPLICE IN LOW-VOLTAGE WIRE INSULATED WITH TUBING.

Wires carrying low voltage, such as those in the electrical circuit of a car, are quickly spliced and insulated with a



piece of rubber tubing. First twist the bared ends of the wires tightly together, solder, wrap the splice with tape, and then slip the tubing over the tape. This prevents the tape from unwinding and helps to exclude grease and dirt.—Rahob 5498.

ELIMINATING "TUNABLE" HUM.

One of the most annoying faults encountered in A.C.-operated receivers is that known as "tunable," or "modulated," hum. As its name implies, this fault is evidenced by hum interference which is only heard at certain settings of the receiver tuning dial, or when a station is tuned in.

The causes of tunable hum are many and varied, and range from induction effects, set up by stray A.C. wiring, to obscure faults in the A.C. power supply line. Whatever the prime cause, the means by which it becomes evident is usually the same — an unbalanced A.C. circuit setting up an induced voltage which is in some way super-imposed on the signal. The first points to check, when trouble of this nature arises, are the positions of all A.C. leads in the receiver and their relationship to leads carrying low-level R.F., or feeding low-level R.F. circuits. When such causes as these have been eliminated, attention should be turned to such points as heater earthing and the balance of the power transformer H.T. secondary. Failing these, faulty earthing of the electrostatic shield in the power transformer may be the culprit. If checks of the above points fail to reveal the cause, the trouble may be due to a fault in the power supply lines—in which case little can be done in the way of prevention.

However, practically all cases of tunable hum (with the exception of those caused by straight-out induction) can be corrected very easily with the aid of the ubiquitous mica condenser. A single 0.01 mfd. moulded mica unit connected from one side of the frequency-converter heater to earth, or across one side of the H.T. secondary, will usually clear up all traces of the trouble. For maximum safety, use a unit tested at 1,500 v. A.C. in the latter position.—"Radio & Electrical Retailer," March 4, 1943.

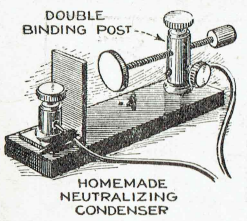
Nothing is more annoying when a set has been constructed than to find that some bad contact or breakdown is preventing proper operation. One of the best ways to safeguard against this is to examine carefuly all component terminals before placing them into position. A fruitful source of trouble exists in some of those valve-holders which are fixed underneath the terminals by means of nuts and bolts passed through the moulding and metal soldering tags.—

—Rahob 6616.

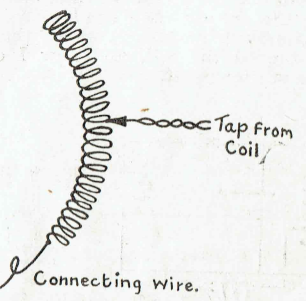
TUBE HINT.

Sometimes a tube that causes a crackling noise may be remedied by moving it up and down in the socket so as to remove grime and corrosion from tip jacks. This must be done with great care.—Rahob 9151.

The illustration shows a simple neutralizing condenser which could be made by any experimenter. A small brass strip is bent at an angle as shown, and screwed to the sub-panel by means of a brass screw and binding post. The adjustable unit consists of a copper disc about the size of a penny soldered to the end of a threaded brass rod, or long machine screw. The other hole in the double binding post is threaded to take this rod. A hard rubber or composition terminal head makes a good knob.

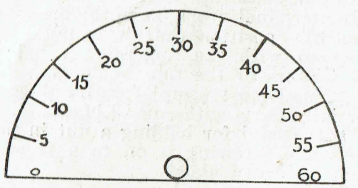


ALLIGATOR CLIP SUBSTITUTION.



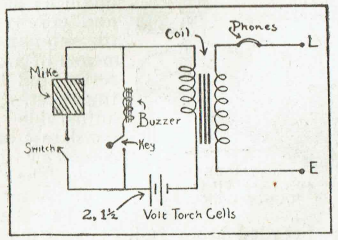
When making a "wave trap" I found that I did not have any "Alligator" clips to connect the aerial connection to the coil taps. To overcome this difficulty I took a small close-wound spring and soldered the aerial wire to one end of it. Then I opened the spring to fit the taps as shown in the diagram.—Rahob 7825.

DIAL.



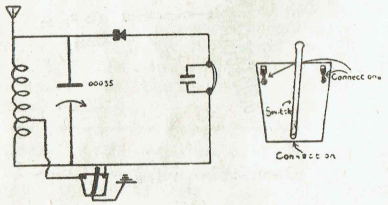
Removable plates of an old condenser may be used as a dial plate by carefully engraving them. With the aid of a sharp tool professional appearance is obtained. A pointer knob may be used to provide an excellent dial.

Here is the circuit of a Morse outfit which I made up and which should be useful to some of the Club members if they are Home Guardsmen. It uses an



earth return, and I have sent Morse over a distance of six miles. The outfit is very easy to make up, and occupies only a small space, and therefore is easily carried.—Rahob 8015.

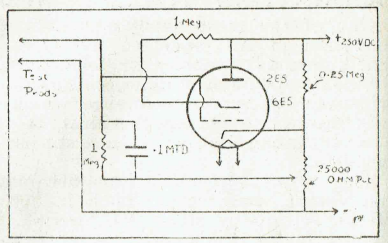
I built a small crystal set with which I could not get any more than one station with the one coil and condenser. I then made a switch which I put on the aerial, and tapped the coil, and now I can get three stations.—R.N.H.



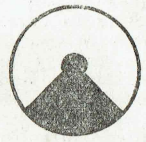
(Editor's Note.—A suitable coil for the crystal set circuit would be 60 turns wound on a 3in. former, and tapped 20 turns from the bottom. Experimenters wishing to carry the idea further could make more tappings on the coil, and obtain a rotary multi-position switch and connect the various points on the switch to the tappings on the coil.)

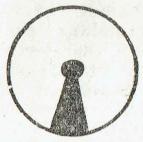
It frequently happens when building or making adjustments to a set that a small nut or terminal drops on to the baseboard in such a position that it is not easily recovered with the fingers. A pair of nail scissors of the thin blade type have been found most useful for this purpose, especially those with curved blades. They are also useful for holding a nut in position while screwing it on to a terminal in an awkward place.

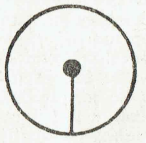
Rahobs should remember that a 33 valve can be satisfactorily used in the Hiker's One set in place of the 49. It may be necessary to experiment with the grid voltage to obtain the best results.—Rahob 7124.



The radio constructor can always use a simple condenser tester. This one is easily constructed, and the power required may be drawn from a power pack or another set. A rough idea of the condenser may be gauged by the time it takes for the eye to open after the test prods have been applied to the condenser. The greater the capacity of the condenser, the longer it will take for the eye to open. The efficiency of the condenser under test is indicated by the eye pattern. — R.M.C., Stratford.


Good


Slightly Leaky.


Shorted

Here is a quick and easy way to determine polarity of unmarked accumulators, dry cells, or mains unit. Fill a jam jar with water, add a tablespoonful of salt, and immerse both leads. The negative "feed" will soon identify itself by the mass of small bubbles which will gather round it.

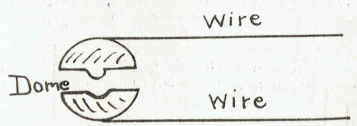
When making soldered joints it is sometimes difficult to hold the wire firmly on the soldering tag while the solder cools. If the wire is passed through the hole in the tag and nipped over tightly quite a good joint is made by the pressure itself. The addition of solder is then much easier and the completed joint much more secure.—Rahob 6616.

Ebonite panels are often discarded owing to having been drilled at various times. A piece of wax paper as sold as parchment for the making of lampshades is cut to the panel size and placed in position; fresh holes may then be drilled where required.

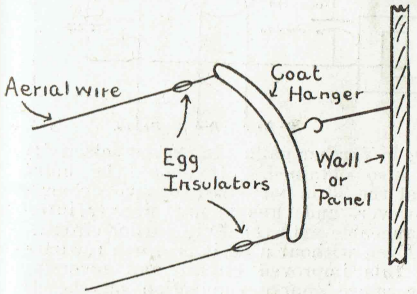
SOLDERING HINT.

Electric soldering irons when used with resin core solder become coated with a deposit which makes clean joints difficult. To clean the iron I use a glass jar filled with sand which is moistened with a salammoniac solution. Rubbing the iron once or twice in the sand will make it quite clean.—Rahob 7103.

SNAP SWITCH.



A dome fastener makes a good Switch or Connector if the dome parts are soldered to the wires which are to be connected.



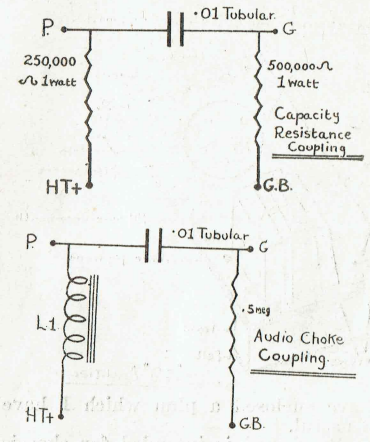
Although there is rarely any advantage in it, many people prefer aerials of the twin wide type in lofts or attics. When erecting this type of aerial, a satisfactory spreader can be made from an ordinary coat-hanger, as shown in the attached sketch. Make sure that the hook in the wooden part of the hanger is secure.—Rahob 6616.

R.M.D., Clevedon.

Here is a hint which may be useful to Rahobs who use dry A Batteries of No. 6 type. If the cells are weak and yet the zinc cans are still in fair condition, punch several holes through the zinc after taking off the cardboard case, and put them in glass jars. Now fill the jars almost to the top with sal ammoniac solution, and you will have many more hours of life from the cells.—Rahob 8188.

A piece of thin flex wound round the glass of a valve to be used in the detector stage, is sometimes found to cure instability, especially if no other screening is used in the set. The beginning of the winding is taken to the filament prong connected to earth and the winding extended to a point about half-way up the glass of the valve.—Rahob 6616.

TWO AUDIO COUPLERS.



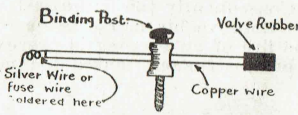
L1 = one side of burnt-out Radio or Output Transformer.

Loud Speaker Field Coil.
or Audio Choke.

While audio transformers are sometimes good, some of them tend to make a howl. These two audio couplers will be found good.

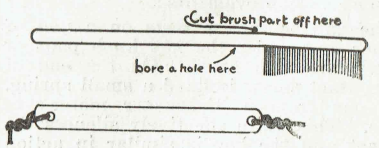
338 Crinan St., Invercargill, 15/12/42.

Dear Sir,—The December "Radiogram" told how to make your own crystals, but not the detector. This can be made by using binding post (wood screw

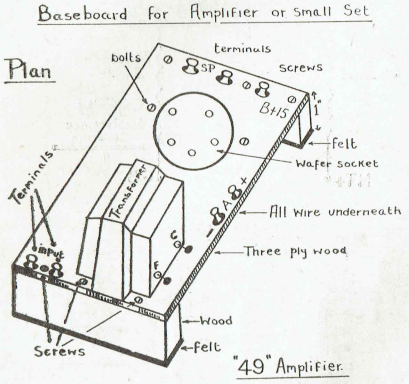


base) with a piece of copper wire to fit. A piece of valve tubing to fit on the end for insulating as per sketch, attached. The cat's whisker is soldered to the copper wire.—Rahob 6728.

AERIAL INSULATORS MADE FROM OLD TOOTH BRUSH HANDLES.



BASEBOARD FOR AMPLIFIER OR SMALL SET.



I have enclosed a plan which I have found useful.

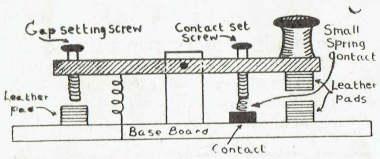
The Baseboard is intended for chassis valve sockets only. On account of baseboard sockets being hard to procure this baseboard will be most useful.

It looks neater than a wafer socket upside down, besides all wire is hidden underneath.

For use with a Hiker's or similar set a panel can be easily fitted.—Rahob 7463.

"MUTING" YOUR MORSE KEY.

Morse keys which employ metal contacts for setting the gap are apt to chatter and rattle in a most annoying way—we call them "chaff-cutters" in the Home Guard Signals here—and this chattering is a source of great displeasure to others. Consequently the enthusiast who wishes to improve his morse by practise round the fire of an evening is prevented because his instrument makes too much noise.



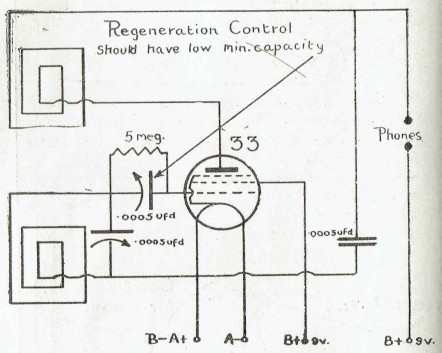
The following suggestion may be of help—it is not perfect by any means—and the writer would welcome any suggestions or improvements:

The gap set screw rests on a pad of leather and under the key knob pads of leather are also fitted. On the end of the contact screw is fixed a small spring, e.g., one from a Schraeder motor-tyre valve. This quite effectively silences the contact and the key is similar in action to a P. & T. key.—Rahob 6973.

IMPROVED HIKER'S LUNCH BAG ONE.

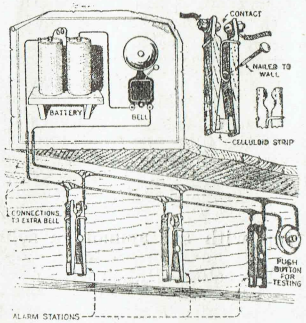
Anyone possessing an old 33 will find that this circuit will give considerably more gain than the earlier "Lunch Bag One," the additional lift of this tube being capable of compensating the loss incurred by the self-contained aerial system.

The grid condenser control of regeneration is also more efficient, enabling the screen to be run at the same potential as the plate without fringe howl, resulting in further gain. Improved selectivity is also obtained. It should be noted that the 33 is not wired for space charge, however, and thus is not directly interchangeable with the 49 in earlier circuit.



Even without a 33 it is worth rewiring to this improved circuit and reversing the space charge connection on the 49 and running the screen at + 7½ volts for the higher gain that results.—Phillip A. G. Howell.

FIRE ALARM.



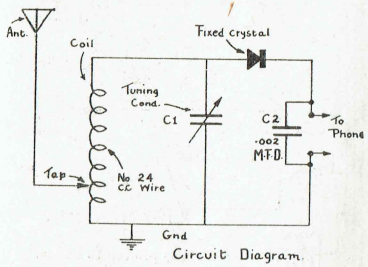
Although the Cost of This Fire-Alarm System Is Negligible, It Insures Adequate Protection

Although the cost of this Fire-Alarm system is negligible, it insures adequate protection.

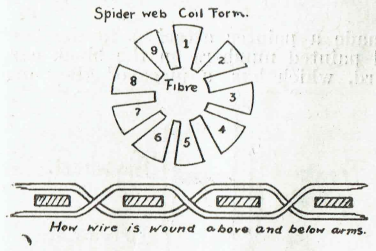
Alarm contactors are made from clothes pegs, contacts being held apart by thin strips of celluloid.—Rahob 5225.

HEADPHONE CRYSTAL RECEIVER

Here are particulars of a Crystal Set to be fitted into one side of a pair of phones. The other ear-piece is used in the ordinary way.

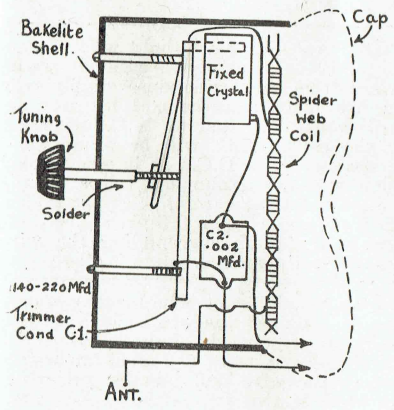


Strip the phone and drill hole in centre of shell bottom for the shaft of the procelain base Trimmer Condenser C1. Wind thin spider web coil with as



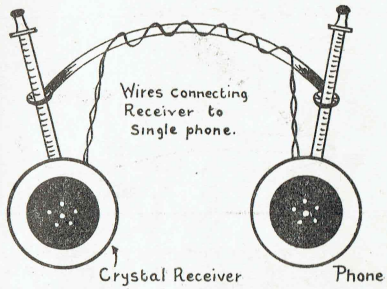
many turns of No. 24 wire as possible, beginning at the centre and ending about ¼ in. from the outer end of the spider arms.

Before mounting the parts in shell, connect them for a test on a small board,



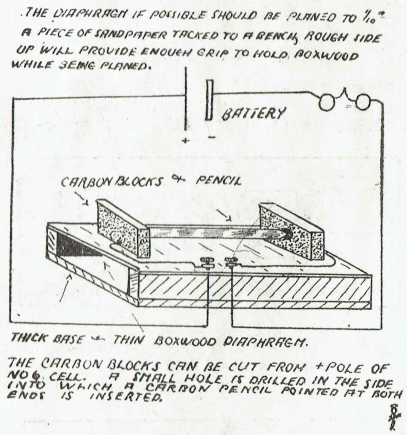
and check coil turns, tapping for the aerial tap lead at a point for best reception. Then solder. After assembling in shell, the aerial and earth leads should be several feet long and terminate in small spring clips to fasten to any convenient aerial and earth.

The fixed Crystal should be a small round flat type, with machine screw terminals. Short bushings and machine



screws are used to mount Tuning Condenser and Knob. The crystal detector may be hard to obtain, but all good Rahobs should be able to rig something up.—Rahob 8260.

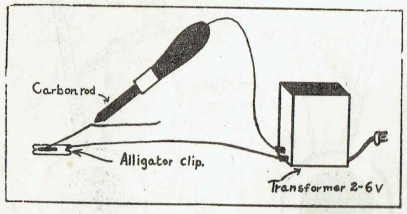
"Enclosed please find a plan of the microphone I promised to send you. The article should cost no more than a few pence, and anyone can have a grand amount of fun with it."—Rahob 7469.



COIL HINT.

Before winding a coil it is sometimes advisable to rub some "talcum powder" on your hands, as this will save the insulation on the wire a great deal.

Many Rahobs may have in their junk box an old filament or similar transformer for which they have no use. An excellent soldering outfit for use with resin core solder can be made from one of these transformers. A piece of carbon rod from an old dry cell is set into a suitable handle, and a lead taken from

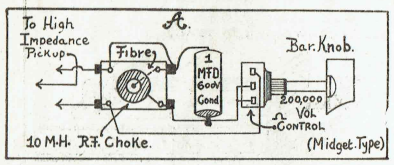


it to one of the secondary terminals on the transformer. To the other terminal is fixed a lead ending in an alligator clamp which is fastened to the article to be soldered. The iron becomes hot as soon as contact is made with the work. There is no danger of the iron becoming overheated.—Rahob 5082.

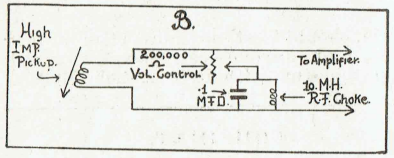
(Editor's Note.—Experimenters are warned to make sure that there is no possibility of obtaining a shock from the lead going to the primary side of the transformer. They should also acquaint themselves with the Public Works Department Regulations in connection with the use of transformers of this nature.)

SCRATCH FILTER.

Scratch filter and volume control for use with any high impedance radio-gramophone pickup. This will eliminate

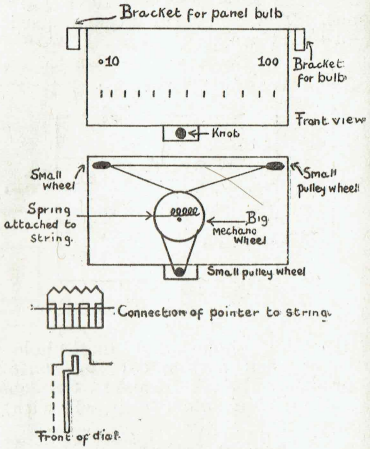


scratch noises usually present at approximately 5000 cycles, and surface noises from the record, such as needle scratch,

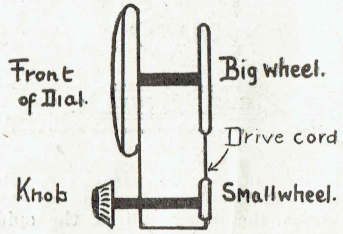


etc. Simplified diagram A and schematic B show filter for about this frequency.

Here are some drawings of a dial made from a piece of iron flattened out, and a piece of black cardboard pasted on to it.



I made a pointer attached to the back, and painted numbers on the black cardboard, which has a piece of glass over

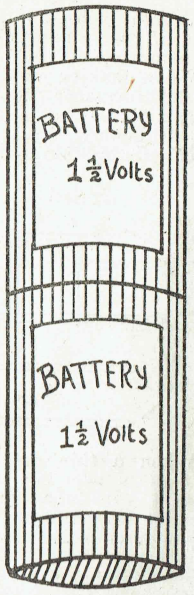


the front of it. The dial can be screwed on to the chassis at the bottom or at the sides, and it makes a really nice looking job.—R.N.H.

Here is a hint for Rahobs who possess Ford coils. If you have a 6-volt transformer from the main house supply, you can use it to run the coil because the Ford model "T" had an A.C. generator for the coils. A.C. will be found more satisfactory than D.C. It is also a good idea to solder Fahnstock clips to the terminals, but be careful to apply soldering iron for as short time as possible because the pitch surrounding the wire is very easily melted.—Rahob 5943.

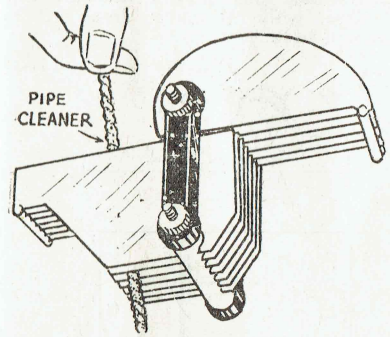
When repairing or winding transformers, etc., using fine wire such as 40 gauge, it frequently happens that the wire breaks. It is well-nigh impossible to bare the wire and join by soldering. However, if the two ends are twisted together and held in the flame of a match or candle a good welded joint can be obtained.—Rahob 6616.

A coil former can be made from two cardboard covers taken from ordinary torch cells. Fastened together as shown, they make an excellent coil former. Rahob 7068.



(Editor's Note: It is suggested that the cardboard be given a coat of good insulating varnish, such as Insuvarn, to make it impervious to moisture.)

Always keep your set spotlessly clean by overhauling it periodically. Clean out the dust between the vanes and the variable condensers, either with a pipe



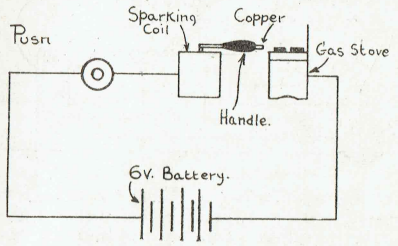
cleaner or a pair of bellows, or even with a vacuum cleaner. Tighten up all loose connections and dust all the components thoroughly. An old shaving brush is ideal for this purpose.

If you don't like the idea of putting up with an indoor aerial and you have not room outside to erect a proper outdoor one, try combining the two. Start off by fixing the wire as far as possible from the house at the highest point. Then thread the wire through a porcelain tube fixed in the window frame and continue by running the wire round two or three sides of the room to the set.

—Rahob 6616.

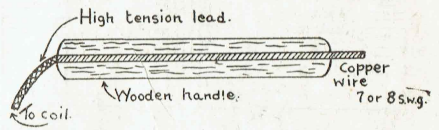
GASLIGHTER.

Herewith the details of a gaslighter which may be published in the "Radiogram," which, by the way, is the best radio magazine for the price that I have ever seen. A sparking coil (Ford coil is ideal), a push button, and four torch



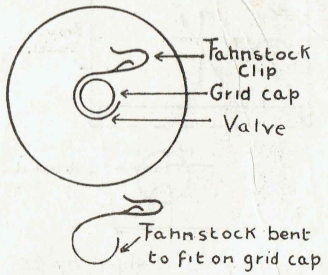
cells are connected in series as in the diagram.

One end of the circuit is connected to the gas stove, and the other end is connected to a piece of 7 or 8 s.w.g. copper wire about six inches long, which is mounted in a wooden handle. To operate,



the push button is pushed and the copper wire is held close to the gas-ring which is to be lit. Instantly the high current from the coil leaps from the end of the wire to the gas-ring thus lighting the gas.—Rahob 8322. We do not advise the gas stove being used as part of the circuit.—Editor.

SCREEN GRID CLIP.

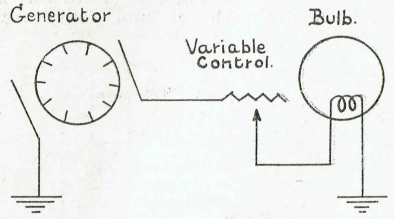


Screen Grid Clip made from a Fahnstock Clip from an old battery. The end of the Fahnstock Clip is bent so that it will slip on to the Grid Clip.

—Rahob 5498.

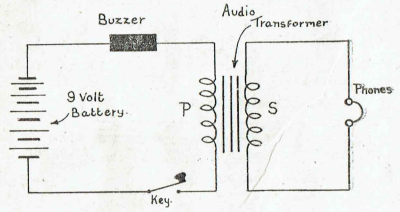
CYCLE GENERATOR DIMMING CONTROL.

This consists of a wire wound rheostat of from 6 to 20 ohms connected in series with the bicycle headlamp. Cor-



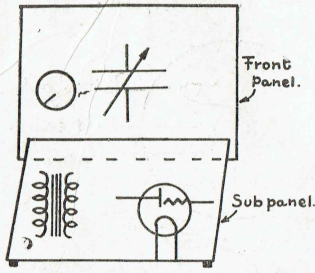
rect voltage bulbs are hard to buy nowadays, and by adjusting the rheostat the correct voltage can be applied to the bulb. The rheostat can also be used for dimming purposes.

MORSE PRACTICE SET.



It is a circuit Morse practice set, and the list of parts include:—Base, key, buzzer, audio-transformer, 3 to 1 approximately, and it operates on a 9-volt C. battery or a 6-volt car battery. Earphones are used in secondary circuit. A rheostat could be used in the circuit as a volume control.—Rahob 8527.

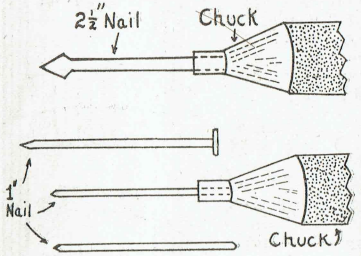
WOOD PANELS.



Wood sub-panels elevated by the use of wooden cleats fastened at each end allow the wiring up to be hidden below and also provide room for the mounting of by-pass condensers. The front panel is fastened more securely this way.
—Rahob 9151.

Dear Rahob.—I am sending in drawings of two kinds of make-shift drills I have used.

When making up the mike, described in the November "Radiogram" by Rahob 6528 I found that a 2⅜-in. nail placed in the drill-chuck with the head out was a good counter-sinking drill for carbon.



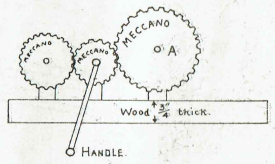
When a thin drill is not procurable to make a hole in a thin board to let a narrow wire through, a 1-in. nail with the flat head crushed in a large vice or on an anvil makes an excellent drill.
—Rahob 7364.

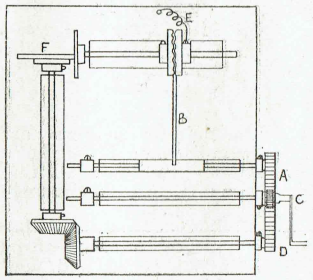
COIL WINDER.

Makes "universal" or honeycomb coils.

F. Cam is a tin lid mounted off centre, size will determine width of winding; 2 inch makes ¼ inch winding.

Gears must make a turn, not quite one full turn, while B moves from left to right and back.





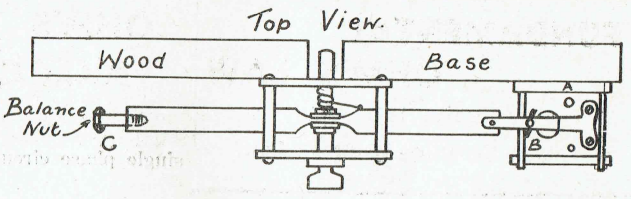
Any gears may be used as long as A has more teeth than D, usually 56, 50.

C. is used to couple A.D. and gives a smooth drive.

Spring E. keeps arm against cam.

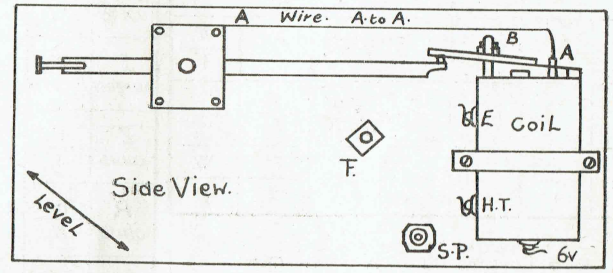
B. is a piece of ebonite with a fine saw cut for wire to pass through.—Rahob 4860.

ELECTRIC FENCE.



Parts.—Model T. Ford coil, spark plug, condenser, balance arm (centre of old bicycle pump or copper tubing), soft iron, set of points.

Coil.—Remove both tremblers. Remove contact point from bottom one and solder piece of soft iron on to top side. Bore hole to allow it to go over front adjusting bolt. Fit contact point on under side. Replace. Make rubber washer from old car tube and fit under the adjusting nut (B). Use lock nut after final adjustment. Close gap for faster movement and open for slower. Solder old battery clips to terminals. Make clamp.



Condenser.—Must be of type to allow of complete dismantling. Remove stator plates and two opposite corner screws and studs to allow swing of arm. Take rotor plates and spacers and use them for washers to set arm in position. Use a long and flexible pigtail. Screw or bolt to base.

Balance Arm.—Find point of balance, compress, and bore hole for spindle. At right angles compress end and fit contact point, using the one from the top trembler. Use the thin spring and solder firmly. Adjust at C.

Wiring.—From condenser frame to terminal on coil A. From HT to plug and fence from E to Mg. Batt. and ground. 6 V to Batt. pos.

Mounting.—Bolt F set at indicated angle on wall or post. Align points by movement of coil and tighten clamp.—Rahob 8997.

SHORT-WAVE COIL WINDING DATA

Wave-Range.	Aerial.	Detector. R.F.	Grid.	Reaction.	Gauge.
150 mmfd. Capacity—					
12 to 19 metres	3	3	3	3	16 enamel
19 to 39 metres	4	6	6	6	24 „
29 to 51 metres	8	15	15	9	24 „
45 to 84 metres	10	26	26	11	24 „
70 to 110 metres	10	33	33	12	24 „
100 mfd. Capacity—					
12 to 17.5 metres	3	3	3	3	16 „
17 to 26 metres	4	7	7	5	24 „
25 to 38 metres	6	10	10	7	24 „
37 to 55 metres	7	16	16	8	24 „
54 to 85 metres	8	25	25	10	24 „
84 to 115 metres	10	34	34	12	24 „
75 mfd. Capacity—					
12 to 17 metres	3	3	3	3	16 „
17 to 24 metres	4	7	9	5	24 „
23 to 35 metres	5	11	11	7	24 „
34 to 51 metres	7	17	17	8	24 „
50 to 78 metres	10	26	26	10	24 „
77 to 100 metres	10	35	35	11	24 „
50 mmfd. Capacity—					
12 to 16.5 metres	3	3	3	3	16 „
16 to 22 metres	4	6	6	5	24 „
21 to 32 metres	5	10	10	8	24 „
31 to 45 metres	6	16	16	10	24 „
44 to 65 metres	8	23	23	12	24 „
64 to 95 metres	10	36	36	12	24 „

FUNDAMENTAL OHM'S LAW

"OHMITE NEWS"

The 12 Equations of Ohm's Law.

$W=$	EI	I^2R	$\frac{E^2}{R}$			
$E=$		IR		$\sqrt{WR}$		$\frac{W}{I}$
$I=$			$\frac{E}{R}$	$\sqrt{\frac{W}{R}}$	$\frac{W}{E}$	
$R=$	$\frac{E}{I}$				$\frac{E^2}{W}$	$\frac{W}{I^2}$

I = Current in Amperes. **R = Resistance Ohms.**

E = Voltage. **W = Watts.**

The greatly stimulated demand for men (and women) with a working knowledge of electricity for service in the Armed Forces and industry has often brought forth the comment that this is an electrical war. With planes, tanks, ships and munitions all dependent on intricate electrical circuits for their efficient operation, many thousands of persons are learning about electrical fundamentals for the first time. We receive in our mail a great many questions that have to do with Ohm's Law and its use. Because of this interest in the basic laws of direct current electricity we are reproducing from a previous issue of the "Ohmite News" a table which shows the 12 equations of Ohm's Law.

From this table it can be seen that if any two factors governing an electrical circuit are known, it is easily possible to calculate the other two, as all four, voltage (E), current (I), resistance (R), and wattage (W) are all directly connected by the equations. Thus if a resistor or heater is needed to dissipate 200 watts from a 110 volt line, refer to the above table and find that the resistance (R) is equal to the square of the voltage (E^2) divided by the wattage (W), or

$$R = E^2/W$$

$$= (110)^2/200, \text{ or } 60.5 \text{ ohms.}$$

Any other problem involving resistance, current, voltage, or wattage can be solved in the same manner, as it is only necessary to select the equation which includes the two factors that are known along with the one unknown factor.

OHM'S LAW FOR A.C. CURRENTS

The following table shows Ohm's Law relations as applied to alternating current **single phase circuits.**

E VOLTS		$\frac{W}{I\cos\theta}$	IZ	$\sqrt{WR}$	$\sqrt{\frac{WZ}{\cos\theta}}$	
I AMPERES	$\frac{W}{E\cos\theta}$		$\frac{E}{Z}$	$\sqrt{\frac{W}{R}}$	$\sqrt{\frac{W}{Z\cos\theta}}$	
Z OHMS	$\frac{E}{I}$	$\frac{W}{I^2\cos\theta}$		$\frac{R}{\cos\theta}$	$\frac{E^2\cos\theta}{W}$	$\sqrt{R^2+X^2}$
R OHMS	$\frac{E^2\cos^2\theta}{W}$	$\frac{E}{I}\cos\theta$	$Z\cos\theta$		$\frac{W}{I^2}$	$\sqrt{Z^2-X^2}$
W WATTS	$\frac{E^2\cos\theta}{Z}$	$EI\cos\theta$	$I^2Z\cos\theta$	I^2R		
$\cos\theta$ POWER FACTOR	$\frac{IR}{E}$	$\frac{W}{I^2Z}$	$\frac{WZ}{E^2}$	$\frac{R}{Z}$	$\frac{W}{EI}$	$\frac{R}{\sqrt{R^2+X^2}}$
X OHMS	(X_L-X_C)		$\left(2\pi fL-\frac{}{2\pi fC}\right)$			$\sqrt{Z^2-R^2}$

Z = Impedance
X = Inductive Reactance
—Xc = Capacitive Reactance
f = Frequency in cycles per second
L = Inductance in henries
C = Capacity in farads

It is significant to note that the simple direct current forms of Ohm's Law are applicable for all practical purposes when resistors are operated on alternating current or frequencies from 25 to 60 cycles or even at frequencies near the limits of the audio range. This is possible because the reactance of the resistor at these frequencies is so small as to be negligible.

Study of the formulae in the table above will show that when the reactance is zero, the power factor (cos0) becomes equal to one and all of the formulae then become the more familiar direct current forms.

VALVE EQUIVALENTS

In view of the valve shortage this chart has been prepared to assist readers to obtain valves so as to keep their sets on the air. Compiled from information kindly supplied by Philips Lamps (N.Z.), Ltd.

EQUIVALENTS TO PRINCIPAL BRITISH AND CONTINENTAL VALVES.

Mullard	Cossor	Marconi Osram	Mazda	Brimar	Philips	Dario	Triotron	Tungsram	Telefunken
2-VOLT BATTERY TYPES (PIN BASES)									
FC2	210PG	X21	—	—	KK1+	BK22	0202	MH206	—
	210SPG								
FC2A	210PGA	X22	—	—	KK2+	PF472	S217	V02	—
VP2	210VPT	VP215	VP215	—	KF2+	PF472	S217	HP211	KF2+
	210VPA	VP210	VP210					HP221	
VP2B					KH1+	PF462	S218	HP210	KF1+
SP2	210SPT	Z21	SP215	—	KF1+	PF462	S218	HP220	
			SP210					S220	
PM12A	220SG	S22	S215B	5B1	B262	TB622	S207	S220	RES182
		S24					S215	SS210	
PM12	215SG	S215	S215A	—	B252	—	S215	S210	—
		S23	SG215						
PM12M	220VS	VS24	S215VM	—	B255	TB452	S208	SV220	RES192
	220VSG						S213	SE220	
								SE211	
2D2	220DD		DD207	—	KB2+	—	—	—	KB2+
TDD2A	210DDT	HD23	HL2/LD2	—	KBC2+	BBC12	DT215	DDT2	—
TDD2	—	HD22	L2/DD	—	KBC1+	—	—	—	KBC1+
PM1A	210RC	H2	H210	—	A225	—	W213	R208	RE052
PM1HF	210HF	HL210	H2	—	A225	HD2	H210		RE052T
PM1HL	210HL	HL2	HL210	HBL1	B228	WD2	HR210		RE102
PM2HL	210HL	HL2	HL210	HLB1	KC3/4+	—	—	—	RE102
					B228				
PM1LF	210LF	L210	L210	—	A209	TB102	TD2	LG210	RE062
PM2DX	210DET	L2/B	L2	—	B217	TB172	SD2	LD210	RE112
		L21					A214	PD220	
PM2DL	—	—	—	—	B216	—	—	—	RE112
PM2A	220RA	LP2	P220	PB1	—	TB122	YD2	LP220	—
								P220	
PM2	220P	P215	P215	—	B205	TB052	ZD2	P220	RE122
	215P	KP2/C						P215	
PM202	230XP	P2/B	P220A	—	B203	TB062	UD2	SP220	—
		P240	P240			TB032	E235	SP230	
							SP2		
PM22	230PT	PT240	PEN230	—	C243	—	P215	PP230	—
	230HPT							PP2	
PM22A	220HPT	PT2	PEN220	PENB1	C248N	TC482	P225	PP222	RES212
	220/0T				KL4+				KL4+

Mullard	Cossor	Marconi Osram	Mazda	Brimar	Philips	Dario	Triotron	Tungsram	Telefunken
PM22D	—	KT21	PEN231	—	KL3+	—	—	—	—
PM2B	220B 240B	—	PD220	—	B240	TB402	E220B	CB215	RE402B
PM2BA	—	B21	PD220A	—	—	—	—	CB220	—
QP22A	—	—	QP240	—	KLL1+	—	—	—	—
QP22B	240QP	—	QP230	—	—	—	—	—	—
					+ Side contact base.				+ Side contact base.
2-VOLT BATTERY TYPES (SIDE CONTACT BASES).									
KF1	—	—	—	—	KF1	KF1	S218	HP220 HP212	KF1
KF2	—	—	—	—	KF2	KF2	S217	HP215 HP221	KF2
KF3	—	—	—	—	KF3	KF3	S209	TFK3	KF3
KF4	—	—	—	—	KF4	KF4	S210	TFK4	KF4
KK2	—	—	—	—	KK2	KK2	0202	M0210 TKK2	KK2
KBC1	—	—	—	—	KBC1	KBC1	DT215	TKBC1	KBC1
KC3	—	—	—	—	KC3	KC3	T223	—	KC3
KDD1	—	—	—	—	KDD1	KDD1	TT210	—	KDD1
KL4	—	—	—	—	KL4	KL4	P226	TKL1	KL4
4-VOLT BATTERY TYPES.									
PM14	410SG	S410	—	—	A442	—	S409	S407	—
PM13	410SG	S410	—	—	B442	TB42	—	—	RES044 RES094 RES094 Spez
PM3A	410RC	H410	—	—	A425	R63	—	—	—
PM3	410HF	HL410	—	—	A410	R55	H412	HL406	RE074
PM4DX	410HF	L410	—	—	A415	R76	A430	LD408 LD410	RE084
PM4	410P	P410	—	—	B409	TB09 R85 RE880	B414	L414	RE134
PM254	425XP 415XP	P415 P425	P425	—	C405	TB05	B425	SP414	RE124
6-VOLT BATTERY TYPES.									
PM16	610SG	S610	SG610	—	A.642	—	—	—	—
PM5X	610HF	HL610	HF610 HL610 HL607	—	A630	—	—	RR607	—
PM5B	—	—	—	—	A635	—	—	—	—
PM6	610XP 610P 610FP	P610	P615 PV610	—	B605	—	—	SP614 P614 L610	—
PM26	615PT	PT625	—	—	C643	—	E615	PP616	—
PM256	625P	P625	P625B	—	C606	—	—	SP625	—
PM256A	610XP	P625A	P625A	—	G603	—	—	—	—
PM25	615PT	PT625	—	—	B543	—	P520 PD5	PP610	RES105

Mullard	Cossor	Marconi Osram	Mazda	Brimar	Philips	Dario	Triotron	Tungsram	Telefunken
INDIRECTLY HEATED A.C. MAINS.									
TV4	—	—	—	—	AM1+	AM1+	TH401	—	—
HX4	—	—	—	—	AH1+	AH1+	H425	TAH1+	AH1+
TH4	41STH	X41	—	—	ACH1+	ACH1+	TH401	TX4	ACH1+
TH4A	—	—	AC/TH1	—	ACH2+	—	—	—	—
FC4	41MPG 41PGD	MX40 X42	—	15A2	AK1+ AK2+	TK24	0407 0406	V04 TAK2+ MH4105	AK1+ AK2+
TH4B	—	—	—	20A1	—	—	—	—	—
2D4A	DD4 DDL4	D41	AC/DD V914	DDA1	AB2+	TB24	D400 D401	TAB2+ DD465	AB2+
2D4B	—	—	—	—	—	—	—	—	—
354V	41MHF 41MTL	MH4	AC/HL	HLA2	E438 AC2+	TE384 TE244	W415N T435	AR4100 AR4101 TAC2+	REN1004 AC2+
164V	41MLF	MHL4/C	—	—	E415	TE/15 14076	A430N W415N	AG4100	REN804
104V	—	—	—	—	E409N	TE/09	E430N	AP495	REN2204 REN2204W
244V	41MHL	MHL4	—	—	E424N	14077 TE244	A430N	AG495	REN904
484V	41MRC	—	—	—	E438	14078 TE384	W415N	AB4101	REN1004
TT4	41MP	ML 4	AC/P	—	—	TE094	E430N YN4	AP495	—
TT4A	—	—	—	—	—	—	—	—	—
904V	41MH 41MTA 41MTB	MH41	AC2/HL	—	F460	TE994	A440N	AR495	—
994V	—	—	—	—	E499	TE99	—	AR4120	REN914
S4VA	MSG/HA	MS/4/B	AC/S2	SGA1	E442S	TE424	304AC S430N	AS4100	REN924
S4VB	MSG/LA	MS/4B	AC/SG	SGA1	E452T	14094 TE524	S410N S412N	AS495	RENS1264
VM4V	—	—	ACS/VM	—	E445	TE45	S415N S431N	AS4105 AS4125	RENS1214
MM4V	MV/SG	VMS4 VMS4B	AC/SGVM	VSGA1	E455	TE554	S431N	AS4125	RENS1274
VP4	MVS/PEN	VMP4	AC/VP1	9A1	E447	TE474	S434N	HP4105 HP4106	RENS1294
VP4A	—	VMP4G	—	—	AF2+	—	S432	HP4115	AF2+
VP4B	MVS/PENB	—	AC/VP2	—	AF6+	AF3+	S423	VP4B TAF3+	AF3+
SP4	MS/PENB	—	—	—	AF4+	AF7+	S424	TAF7+ SP4B	AF7+
TDD4	DDT	MHD4 DH42	AC/HLDD	11A2 11A1	ABC1+	TBC14	DT436	DDT4160 DDT4 TABC1+	ABC1+

Mullard	Cossor	Marconi Osram	Mazda	Brimar	Philips	Dario	Triotron	Tungsram	Telefunken
PEN4V	—	—	—	—	E453	TE53	P440N	APP4100	RENS1374D
								APP4120	
PEN4VA	MP/PENA	N40	AC/PEN	7A2	E463	TE634	P441N	TAL2	RENS1384
		N42			AL2+	TE534	P445	AP4130	AL2+
		KT42							
PEN4VB	42MP/PEN	KT41	AC/2PEN	7A3	AL3+	TL3	P496	APP4B	AL3+
PENA4	420TT	N41	AC5/PEN	7A3	AL4+	TL44	—	APP40	
								TAL3+	
								APP4120	
							P495	APP4D	AL4+
PENB4	—	—	AC4/PEN	—	AL5+	—	P469	APP4D	AL5+
			AC6/PEN						
PEN4DD	—	—	—	—	ABL1+	—	—	—	—
					+Side contact base.				+Side contact base.

"A" SERIES 4-VOLT A.C. MAINS (SIDE CONTACT BASES).

AB2	—	—	—	—	AB2	AB2	D400	TAB2	AB2
ABC1	—	—	—	—	ABC1	ABC1	TABC1	TABC1	ABC1
AC2	—	—	—	—	AC2	AC2	T435	TAC2	AC2
AD1	—	—	—	—	AD1	AD1	T460	TADI	AD1
AF3	—	—	—	—	AF3	AF3	S423	TAF3	AF3
AF7	—	—	—	—	AF7	AF7	S424	TAF7	AF7
AH1	—	—	—	—	AH1	AH1	H425	TAH1	AH1
AK2	—	—	—	—	AK2	AK2	0406	TAK2	AK2
AL1	—	—	—	—	AL1	AL1	P434	TAL1	AL1
AL2	—	—	—	—	AL2	AL2	P445	TAL2	AL2
AL3	—	—	—	—	AL3	AL3	—	TAL3	—
AL4	—	—	—	—	AL4	AL4	P496	—	AL4
AL5	—	—	—	—	AL5	—	P469	—	AL5
AM1	—	—	—	—	AM1	—	TK406	—	—
AZ1	—	—	—	—	AZ1	AZ1	G459	TAZ1	AZ1
AZ2	—	—	—	—	AZ2	—	—	—	—
AZ3	—	—	—	—	AZ3	—	—	—	—

DIRECTLY HEATED A.C. OUTPUT VALVES.

AC044	4XP	PX4	PP3/250	—	D404	—	K12	P460	RE604
							K435/10	015/400	
AC042	2XP	—	PA20	—	—	—	—	—	—
PM24	415PT	425PT	PEN425	—	B443	R79	P420	PP415	RES174D
	410PT					PT415			
PM24A	—	—	—	—	C443	R89	P425	PP430	RES364
						TC434		PP431	
PM24M	PT41	PT4	—	PENA1	E443H	TE434	P435	PP4101	RES964
						TH43H		APP4100	
PM24B	PT41B	—	—	—	E443N	—	—	—	—
PM24E	—	PT25	—	—	F443N	TF43N	P440	—	—
D024	—	PX25	PP5/400	—	F410	TF10	K480	P25/500	—
D0/25	620T	LS6A	—	—	F410	—	—	—	—
D0/26	—	PX25A	PA40	—	—	—	—	P26/500	—

Mullard	Cossor	Marconi Osram	Mazda	Brimar	Philips	Dario	Triotron	Tungsram	Telefunken
FULL WAVE RECTIFIERS.									
DW2	480BU	U10	—	—	506	V3880	G470	PV495	RGN1504
	506BU				1821	TV80	G431		
						FW1	GN24		
						V54	GA24		
DW3									
DW4/350	442BU	U12	UU120/350	—	1807	FW2	G4110	PV495	
DW4/500									
DW4	460BU	U14	UU120/500	—	1561	FW3	G4120	PV4200	
IW2	—	—	UU2	R1	1881	—	—	PV4201	RGN2004
			UU60/250					—	—
IW3	—	MU12	UU3	1A7	1867	—	—	APV4	—
			UU4	R2				APV4200	—
IW4/350	431U	—	—	—	AZ3+	—	—	—	—
IW4	44IU	MU14	UU5	R3	1861	1FW1	G412ON	—	—
FW4/500	4100BU	—	—	—	—	—	—	—	—
INDIRECTLY HEATED D.C. VALVES.									
VP20	—	—	—	—	B2047	CT47	S2034N	HP2118	RENS1894
VM20	—	—	—	—	B2045	CT45	—	SE2018	RENS1819
SP20	—	—	—	—	B2046	CT46	S2035N	HP2018	RENS1884
MM20	—	—	—	—	B2055	—	—	—	—
SG20	—	—	—	—	B2052T	CT52	—	SS2018	RENS1818
L20	—	—	—	—	B2006	CT06	B2030N	P2018	REN1822
SD20	—	—	—	—	B2044	CT44	—	DS228	RENS1854
TDD25	—	—	—	—	—	—	—	—	—
H20	—	—	—	—	B2099	—	A2040N	—	REN1814
HL20	—	—	—	—	B2038	CT38	—	R2018	REN1821
								G2018	
PEN20	—	—	—	—	B2043	CT43	P2020N	PP2018	RENS1823D
DC/AC MAINS VALVES (PIN BASES).									
TH13C	—	X31	—	—	—	—	—	—	—
TH21C	202STH	—	—	—	CCH1+	—	—	TX21	—
TH22C	—	—	TH2320	—	CCH2+	—	—	—	—
			TH2321						
TH30C	—	—	—	—	—	—	—	—	—
FC13C	13PGA	—	—	15D1	CK1+	TB5013	01307	TCK1+	CK1+
	202MPG							V013	
VP13C	—	—	VP1322	—	CF6+	TF313	S1325	VP13B	—
SP13C	—	—	—	—	CF4+	TF713	S1324	SP13B	—
2D13C	—	—	DD520	10DI	CB2+	UB2	D1300	TCB2+	CB2+
								DD13	
TDD13C	13DHA	—	HL/DD1320	11D3	CBC1+	TBC113	DT1336	TCBC1+	CBC1+
	202DDT							DDT13	
HL13C	—	—	HL1320	4D1	CC2+	UC2	T1335	TCC2+	CC2+
								HL13	
PEN36C	4200T	—	PEN3520	7D6	CL4+	TL413	P3580	PP35	CL4+
			PEN3820						

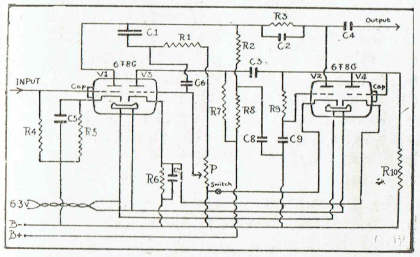
	Marconi Osram	Mazda	Brimar	Philips	Dario	Triotron	Tungsram	Telefunken
Mullard	Cossor	PEN1340	7D8	CL1+	UL1	P1320	TCL1+	CL1+
PEN13C	—	—	—	—	—	—	—	—
PEN40DD	—	—	—	CY1+	TW1	G2080	TCY1+	CY1+
UR1C	40SUA	U4020	1D5	—	—	—	V30	—
UR3C	—	—	—	CY2+ +Side contact base.	UY1	G3060	TCY2 +	CY2+ +Side contact base.
DC/AC MAINS (SIDE CONTACT BASES).								
EM1	—	—	—	EM1	EM1	TK606	—	—
FC13	—	—	—	CK1	CK1 UK1	01307	TCK1	CK1
VP13A	—	—	—	CF2	CF2 UF2	S1327	—	CF2
SP13	—	—	—	CF1	CF1 UF1	S1328	—	CF1
TDD13	—	—	—	CBC1	—	—	—	—
2D13A	—	—	—	CB2	CB2 UB2	D1300	TCB2	CB2
2D13	—	—	—	CB1	CB1 U1	D1301	—	CB1
HL13	—	—	—	CC1	CC2 UC2	T1335	TC02	CC2
PEN26	—	—	—	CL2	CL2 UL2	P2060	TCL2	CL2
UR1	—	—	—	CY1	CY1 UY1	G2080	TCY1	CY1
UR3	—	—	—	CY2	CY2 UY2	G3060	TCY2	CY2
PEN13	—	—	—	CL1	—	—	—	—
"D" SERIES 6.3 VOLT (SIDE CONTACT BASES).								
EM1	—	—	—	EM1	EM1	TK606	—	EM1
EM3	—	—	—	EM3	EM3	0606	—	EM3
EK2	—	—	—	EK2	EK2	—	—	EK2
EK3	—	—	—	EK3	EK3	—	—	EK3
EH2	—	—	—	EH2	EH2	—	—	EH2
ECH2	—	—	—	ECH2	ECH2	S617	—	ECH2
EF5	—	—	—	EF5	EF5	S620	—	EF5
EF6	—	—	—	EF6	EF6	—	—	EF6
EF8	—	—	—	EF8	EF8	—	—	EF8
EF9	—	—	—	EF9	EF9	—	—	EF9
EB4	—	—	—	EB4	EB4	—	—	EB4
EAB1	—	—	—	EAB1	EAB1	DT620	—	EAB1
EBC3	—	—	—	EBC3	EBC3	P628	—	EBC3
EL2	—	—	—	EL2	EL2	—	—	EL2
EL3	—	—	—	EL3	EL3	—	—	EL3
EL6	—	—	—	EL6	EL6	—	—	EL6
EBL1	—	—	—	EBL1	EBL1	—	—	EBL1
EZ2	—	—	—	EZ2	EZ2	G660	—	EZ2
EZ3	—	—	—	EZ3	EZ3	—	—	EZ3
EZ4	—	—	—	EZ4	EZ4	—	—	EZ4

VOLUME EXPANDER

(By P.R.P., Hawera.)

This Volume Expander circuit is by the well-known radio engineer, Mr. McMurdo Silver, and was taken from the publication, "All Wave Radio," April, 1938, and is a very efficient circuit, at the same time being very cheap to build. The expander consists of two 6F8G tubes (each two 6J5's in the one envelope), a 1 megohm potentiometer to control the degree of expansion, ten ½-watt resistors and nine fixed condensers.

As will be seen from the circuit diagram, the first section of one 6F8G, V1,



Resistors.

R1 300,000 ohms.
R2 30,000 ohms.
R3 200,000 ohms.
R4 1 megohm.
R5 2,500 ohms.
R6 5,000 ohms.
R7 30,000 ohms.
R8 15,000 ohms.
R9 500,000 ohms.
R10 100,000 ohms.
P 1 meg. Potentiometer.

Condensers.

C1 0.1 mfd.
C2 .0005 mfd.
C3 0.1 mfd.
C4 0.1 mfd.
C5 5.0 mfd. electrolytic.
C5 .0001 mfd.
C7 .25 mfd.
C8 0.1 mfd.
C9 0.5 mfd.

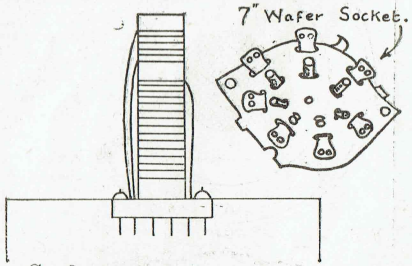
acts as a straight resistance-coupled audio amplifier, either to increase input volume when expander is not in use, or to pick up some of the average signal volume loss which occurs when the expander is in operation. Its circuit is purely conventional except for the 300 000 ohm resistor R3, between the plate of V1 and the output coupling condenser C4. This resistor is shunted by a .0005 mfd. condenser to hold up treble response. This resistor, in series with the plate resistance of V2, forms the signal controlled volume control potentiometer. From the "arm" or join of the two resistances making it up is fed the signal to the following stage. This triode V2 has a definite plate-to-cathode resistance, and by causing the signal to vary this tube resistance we in effect turn the volume control "knob" up or down.

This is done by taking the signal appearing at the plate V1 and feeding it to V3 through the potentiometer P for further amplification. The signal is then applied to V4, which is connected as a diode rectifier. In order to cause the reverse A.V.C. or volume expansion so obtained to vary, not at audio frequency, but at the slower rate at which volume varies in music, the rectified d.c. taken from the rectifier V4 is filtered by the 0.5 mfd. condenser, C9, and ½ megohm resistor, R9, connected to the grid of V2. This filter delays any change in volume by ¼ second, so that changes by the expander will not be too rapid or too slow, but correct for symphonic music. The degree of volume expansion is controlled by the potentiometer, P, which regulates the voltage actually used to vary the "gain control potentiometer," consisting of the resistance, R3, and the internal resistance of V2.

In action this expander, when operating at the low level of the ½-volt input, will give any desired degree of expansion from zero to 23 decibels, depending only on the setting of the potentiometer, P. From an average 1 volt signal input it gives 28 db. expansion, 33 db. for a 2-volt signal, and 35 db. for a 3-volt signal input. This it does without distortion due to curvature of any signal amplifying tube characteristic curves, and such distortion as is intentionally introduced through over biasing of expander tube amplifier tube, V3, is completely ironed out by the syllabic filter R9C9 in the grid circuit of V2, which allows no audio frequency voltage to get through but only the slow variations in rectified d.c. provided by the diode, V4.

In the circuit shown, when the expander control potentiometer, P, is in the off position, its on/off switch breaks the cathode lead to V2, thus eliminating its low resistance shunt from the audio circuit and allowing the full 23 db. gain of V1 to be added to the audio amplifier. No hum will show up due to the increased audio amplification, because of the filter R8-C8 in the plate circuit of the audio amplifier, V1.

USE FOR OLD SOCKETS.



Good use can be made of old 7-pin wafer sockets, the large type, as these are not used nowadays, by fastening wire to the bottom of coils and soldering to the pins and their leads from the lugs.—Rahob 4860.

HOME-MADE CARBON MICROPHONE

A. W. Ayton, Rahob 5556.

Here is an inexpensive, easily made microphone which "home broadcasters" will find useful. Most of the material required will most likely be found about the house or in the junk box.

The essential material is as follows: A boot-polish or similar shallow tin and two lids, a carbon rod from a large dry cell, a block of half-inch wood, nuts, bolts, etc.

The first thing to do is clean the tin and both lids of all traces of enamel and the original contents. This is best done with a solution of caustic soda. Use a pad of cloth on the end of a stick to do this and keep your fingers out of the caustic. One of the lids, which is to be used as the diaphragm, must be free of dents and deep scratches. The other lid has a hole of approximately 1½ inches diam. cut out of its centre. Inside this hole solder a piece of wire screen. The edge of this lid must be stretched to make it slip over the "diaphragm" lid. Stretch it by placing the flange over the head of a large hammer, gripped in the vice, and tapping the edge all the way round. Fit it lightly over the diaphragm and solder in place.

The tin, the back of the finished mike, has a hole punched in its centre and three or four holes near the edge for mounting the wood block, which is cut to fit inside the tin. A ¾-inch hole is bored half-way through this block and then continued right through at about ⅛-inch diameter. This is to keep the nut and bolt which holds the button from making contact with the back of the tin.

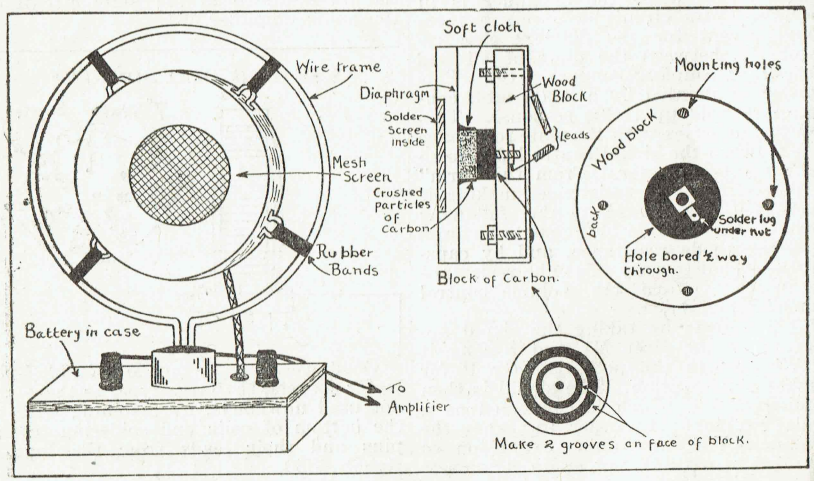
Next make the button. This is where the carbon rod is used. Cut a quarter-inch length off the terminal end, keeping the terminal bolt in the carbon for future mounting and connecting purposes. File the surface of the carbon flat and level. Two circular grooves are now made on this surface. If no other means are available for cutting these grooves, they can be carved in which a sharp-pointed pocket knife after marking the circles with dividers. Patience and care are required here if a good job is to be done and the fingers kept intact. Around this carbon block wrap two turns of soft cloth, the edge of which projects about ¼-inch past the grooved surface. Bind it firmly **on to the button with fine wire.**

Mount the button on the wood block with the nut down in the ¾-inch hole half-way through. Put a solder lug under the nut.

An alternative method for mounting the button, if no terminal bolt was available, would be to drill a hole through it and use a wood screw.

Before bolting the block into the tin, thread a piece of flex through the hole in the centre of the tin, and solder to the lug provided, or to the point of the wood screw. Another flex is soldered to a lug under one of the mounting bolt heads.

Next on the list of things to do is to crush a small quantity of carbon in a small tin and remove from it all traces of the fine black dust, keeping the small granules to fill the cup formed by the cloth wrapped round the button. Enough of this loose carbon should be used, to keep the "diaphragm" lid from going right home. If the lid is allowed to fit to its proper closed place the carbon granules are likely to be too slack. In any case, fit the lid so that it makes good contact with the button unit, and solder it in place. At the same time solder on three or four wire loops to the mike, for hanging it on rubber bands.



The microphone is now completed and all that remains to be done is the mounting and the trial run. The easiest way to mount it is to hang it from rubber bands inside a loop of stiff wire. The ends of the wire may be pushed into a large cork or soft wood block glued to the lid of a small box. A 4½ volt torch battery is kept in the box. Two terminals should be provided on the lid and a small on-off switch would be very handy.

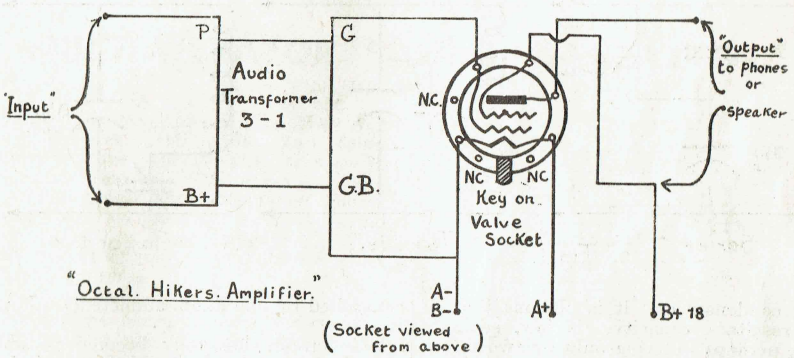
One lead from the mike is taken to one terminal. The other lead goes to the switch, from the switch to the battery and from the battery to the other terminal. Thus the mike switch and battery are in series from terminal to terminal.

To use, connect the terminals across the primary of a step-up transformer of high ratio. The secondary is connected to the grid and to ground. An ordinary telephone transformer will do the job quite well.

Although quite suitable for voice work, this outfit is not suitable for musical reproduction, naturally. If it proves noisy increase the pressure on the carbon, but too much pressure will decrease sensitivity.

OCTAL 1-VALVE AMPLIFIER

1.C5G. or 1Q5G.



In response to many requests we are publishing the circuit of a Single Valve Amplifier using an Octal type valve. This amplifier may be used in conjunction with any of the Hikers' Series Sets, or for amplifying a crystal set or other small receivers.

The input to the amplifier is simply connected to the headphone terminals of the Hiker's or crystal set, etc. At 3 :1 audio transformer is shown in the diagram, but a 3½ : 1 or 5 : 1 Transformer would do equally as well.

To obtain satisfactory results it is recommended that 18 volts be used on the plate of the valve, although the amplifier may work on a lower voltage. Using the 22½ volt tapping of a 45 volt B battery would be quite satisfactory.

Batteries with celluloid cases should be treated with respect. A touch with a hot soldering iron will burn through the case. An accidental short circuit may cause a fire. Keep away from fires and flames.

For acid in eye, seek medical assistance as quickly as possible. First aid can be given by alternately squirting in bicarbonate solution and pure water. Then drop olive oil into eye. Cover with wool and bandage.

BAND SPREAD

The advantages of bandspread shortwave tuning are only too apparent. We shall attempt to discuss a few practical circuits and begin with the three hookups shown in figure one. The tapped coil method is not very common and not very good, but may interest a few. There can be many variations on the other two, **however. The first hook-up, or parallel arrangement, of an ordinary 350 unf tuning** gang and a two-plate variable midget, has common usage in most small short-wavers. Operation is simple. One sets the small condenser at approximately half capacity and locates the shortwave band desired with the main gang, or bandsetter. The individual stations may be tuned in with ease on the small condenser. The same system operates well for fine adjustment on the broadcast band.

The series arrangement in figure 1B only serves to reduce the capacity of the main gang condenser and it is obvious that, if the resultant capacity is low, separate coils, perhaps differing only by two turns, will be required for each shortwave band. An interesting application of this circuit is shown in figure 2, where this series system is used for plug-in coils. An extra pin in the coil socket allows for an automatic switching circuit in which the broadcast, or coils on which band spread is not needed, short out the fixed series condenser. In the diagram two coils are shown. The top one is a typical broadcast coil and **the plug-in former has a link which when** the former is plugged into the coil socket, shorts out the small fixed series condenser and uses just the main gang. The shortwave coil is tuned by the series arrangement.

Now, when one is an "old man" of 17, with about five years of radio behind one (think of the fun one had), may be one has a desire to control everything from the front side of a shiny panel, where the only thrills to be had are those of tuning in foreign broadcasts. Anyway, I do, so next comes a circuit for others who feel like me—a complete bandspread tuning circuit which, wave changing and all, is controlled by one knob, admittedly a large one.

This circuit has only become possible **since five position wave change switches** have become available. In figure three is a rather queer looking circuit with a lot of condensers and switch contacts in it.

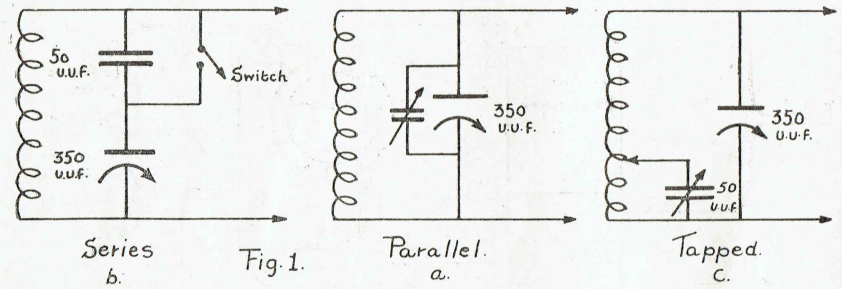


Fig. 1.

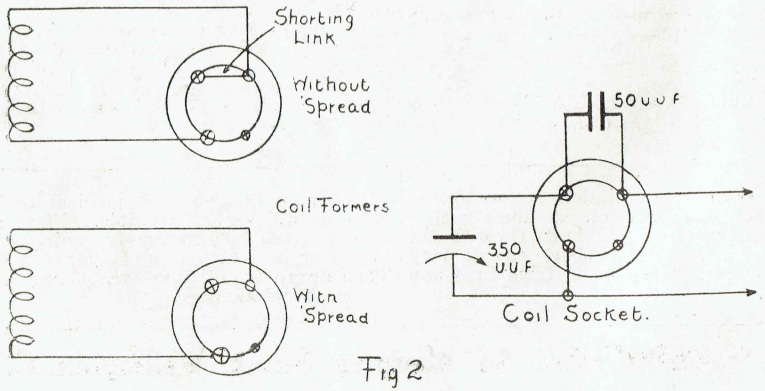


Fig 2

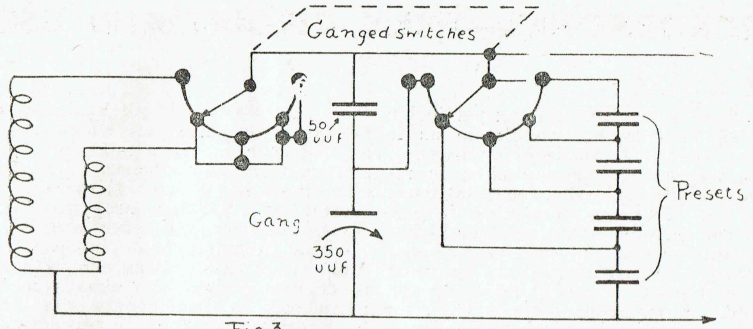


Fig 3

On inspection it will be seen that this circuit is no more or less than a combination of the two previous circuits. The coil combination is a standard dual wave coil arrangement. **The string of pre-set** condensers is for band positioning on the shortwaves, and like all obvious things, this circuit would take too much valuable space in the explaining. BUT, any crude construction or long leads have their own particular knack of removing R.F., so beware of lash-ups, which are not hookups, and put good work into this unit and you will reap the benefits of the system.

(Rahob 9275).

MULTI-VIBRATOR SIGNAL GENERATOR

(RAHOB 8067).

Entirely self-contained this low cost unit generates both audio and radio frequency waves for locating trouble in any radio receiver. The generator consists of a small high frequency buzzer operated by two flashlight cells connected in series and a fixed condenser. The signal generator may be built into a small celluloid soap-box.

If the receiver is "alive" a buzzing sound will be heard in the loud-speaker when the test prod of the signal generator is touched to the antenna post or to the grid or plate of any tube in the R.F. or I.F. stages. In checking the audio section is may be necessary to connect one side of the generator battery to the set chassis or ground of the receiver to produce a sufficiently loud signal. If speaker and output stage are working properly in a defective set, touch the prod to the grid of the preceding stage until the sound stops, which indicates the trouble lies in the stage that has just been passed. For lining up a t.r.f. set hold the generator close to the antenna and adjust the trimmers on the ganged tuning condenser for loudest sound in loud speaker.

In supers the prod is held close to the grid of the first detector tube and the trimmers on the I.F. stages adjusted for low-test sound, then follow usual procedure.

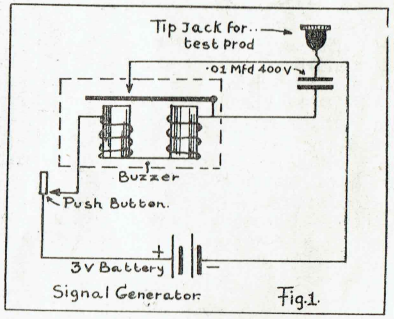


Fig.1.

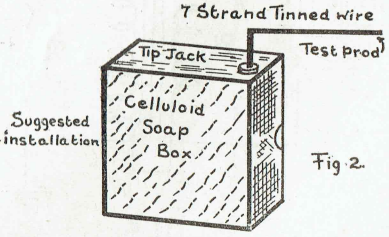


Fig 2.

MICROPHONES—THEIR CIRCUIT AND USES

(By RAHOB 9275)

Choosing a microphone for a particular piece of work is not so simple as it sounds. It must be realised, for instance, that a telephone mike is limited in response to frequencies between 100 c.p.s. and about 750 c.p.s. and that it just would not reproduce bass notes or higher harmonics such as one necessarily must include in any instrumental or vocal piece intended to sound at least like the original. A telephone mike is O.K. for service communications, where fidelity is a secondary consideration—in the services all that is required is clarity and reasonable ruggedness. A telephone mike has both of these, and is used extensively.

On the other hand, take the recording engineer, faced with the problem of recording an organ accompanied by a xylophone. The organ produces thumping great bass notes which, in a carbon mike, would sound lousy, while the xylophone emits notes of high pitch simply overflowing with harmonics which pass unnoticed over a carbon mike, or for that matter, most microphones. The inevitable choice in this case is the sound cell crystal type. These are two extreme cases, and they give a fair idea of what choosing a microphone involves. One could go on enumerating examples where contrast is desired, and usually the mike plays just as prominent a part in the final results as a filter, in photography.

Microphones may be divided into two groups: (a) Low impedance (carbon, velocity, and dynamic). (b) High Impedance (condenser and crystal).

We shall attempt to classify them for the reader and give appropriate preamplifier circuits.

For level reference we will take a model amplifier which requires an input of —30 dbs level, to deliver 10 watts of power output. The tube complement of such an amplifier could be 1 6J7 driving 1 6C5 phase-splitting for 2 X 6V6G in class A.B.

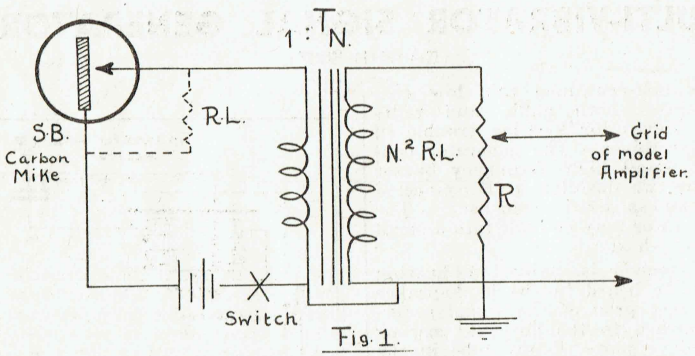


Fig. 1.

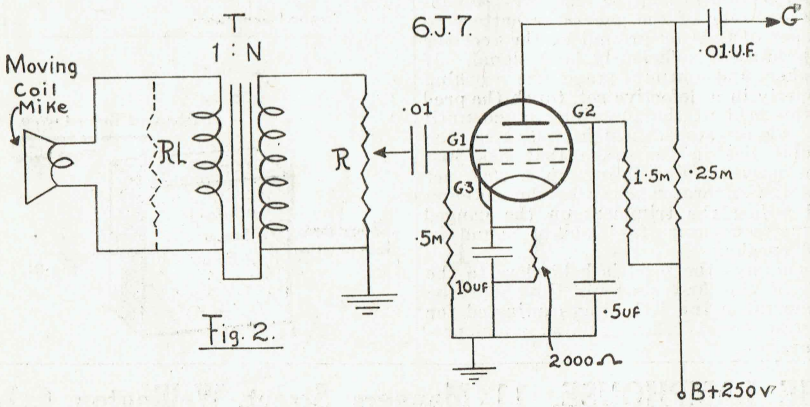


Fig. 2.

Since the output levels of the microphones to be discussed vary between approximately —30 and —90 dbs, it will be seen that preamplification is needed in some instances.

We shall start with the simple button carbon mike—simplest of all. It has an output of over —30 dbs so needs no preamplifier. To get the best results from any microphone, however, a correct load must be imposed. We shall arm ourselves with an old speaker transformer and a few formulae and go to work.

The load, RL, required for a single button carbon mike is about 40 ohms. The turns ratio, N, of a 7000 ohms primary and 3.2 ohms secondary is about 1 :50.

The value of the resistance R, in figure one, is N^2RL, i.e., 50^2 X RL, or 100,000 ohms. The uses of this mike are limited to voice work where quality does not count. The other types of carbon granule microphone, double button and Reiss, are capable of far better reproduction.

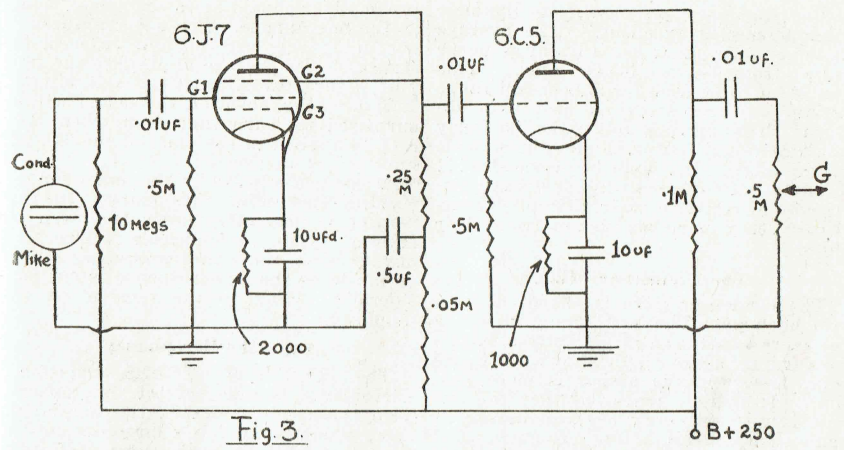


Fig. 3.

Dynamic Microphones.

The moving coil, or dynamic microphone, is next. The same method of applying a load on the mike is adopted as with a carbon mike. In the case of a five-inch "P.M." speaker used as a microphone, the correct resistance for R is 7000 ohms. Of course, one will have to make do with a 5000 or 10,000 ohm potentiometer here. As this microphone's output is much lower than —30, dbs, a preamplifier is needed, and in the case of the mike shown, a single pentode is more than enough preamplification. (If a velocity microphone was employed, instead of a moving coil microphone, a three-stage preamplifier would be needed to raise the level to —30 dbs.)

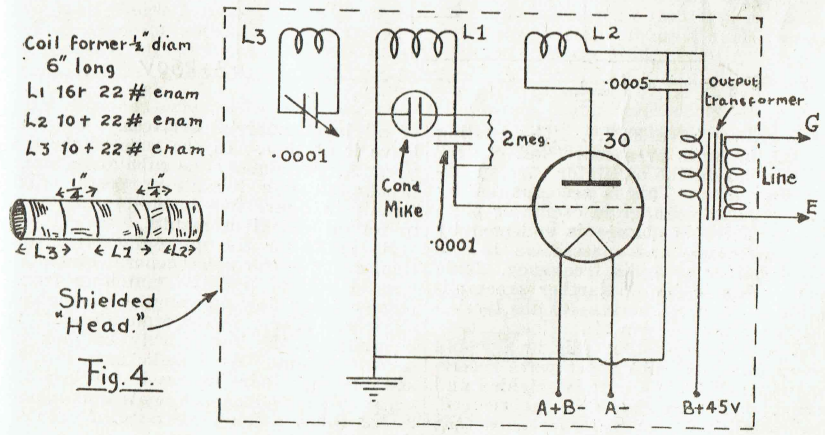


Fig. 4.

The frequency response from dynamic microphones is excellent. The average dynamic microphone has a linear response curve from 35 to 10,000 c.p.s. This enables it to be used for almost full range pickup on orchestras as well as voice work. The moving coil mike is fairly non-directional and this gives it a wide pickup angle. It cannot be overloaded!!! Velocity microphones, however, are extremely directive in their pickup. Theoretically they have no pickup from their sides.

The Condenser Mike.

The condenser mike is shown next in two hookups. The first, figure three, is the more usual, and is perfectly straightforward in action. As shown in figure four, however, the action is more sublime. It will be perceived that the circuit is an oscillatory one, oscillating at radio frequencies. The frequency of oscillation depending upon the microphone. The coil L3 is tuned to the high frequency side of the fundamental of L1 and L2. Thus it acts as a load on the oscillator circuit. When the mike is spoken into the diaphragm is depressed, thus increasing the condenser's capacity and lowering the frequency of oscillation

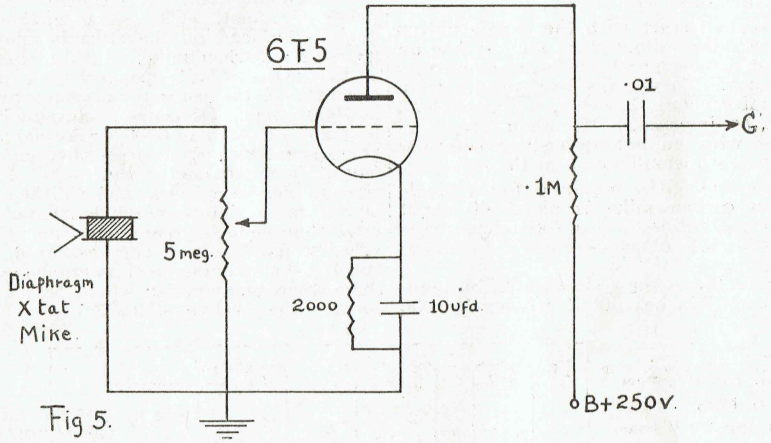


Fig 5.

(in short, we have F.M.). The loading coil, L3, becomes even more "off centre" and the load on the oscillator correspondingly decreases. This is accompanied by a corresponding change in oscillator plate current, and this change is collected by the transformer and passed on to the main amplifier as audio frequency. This audio voltage needs no further preamplification as it is at about —30 dbs level—ideal for what we want!

One would think that this idea would tend to interfere with short wave receivers, but provided the unit is shielded and earthed, no trouble should be experienced.

In both condenser mike instances the preamplifier should be in the same "head" as the microphone. The disadvantages of not doing this are obvious in both instances. The voltage applied to the first unit, figure three, **must** be well filtered. In figure four, however, the reader will be surprised to learn that even when Raw A.C. is applied to the plate of the '30, the hum is not in excess!

A condenser mike is the mike for recording bird calls. Its clarity in this respect is absolutely unrivalled even by crystal types. Condenser mikes are always a bit tinny in reproducing speech or music as the bass response is cut considerably owing to the tension on the diaphragm.

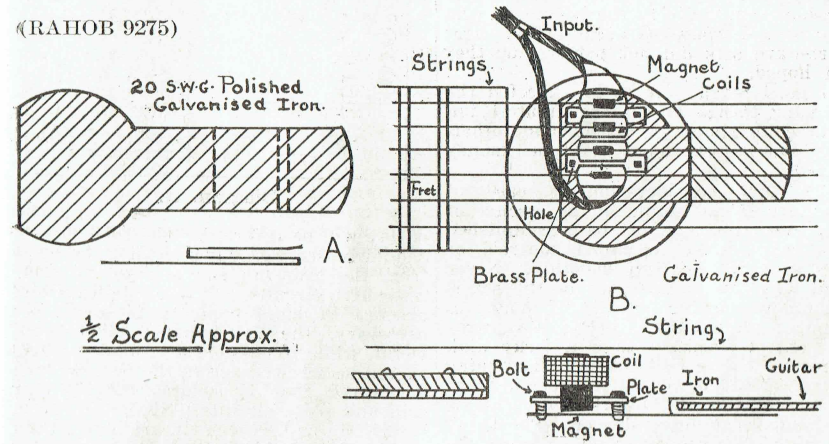
Crystal Microphones.

The other type of high impedance microphone is the crystal microphone. Two types are available, the diaphragm type, which has a fairly large output but average fidelity, and the sound cell type in which the air pressure acts directly on the crystal faces. The latter has an extremely low output, but unequalled fidelity. It requires something like a three stage pentode preamplifier to give anything like a reasonable output. The sound cell microphone is the most used of all in commercial services. We shall leave it at that. In the case of the diaphragm microphone, one tube gives ample preamplification for all purposes. The circuit in figure five is simple and easy to follow and gives results.

So much for the microphones in particular. Now for some general hints. Be careful not to put the matching transformer for a low impedance microphone anywhere near a power transformer. To do that, is the surest way to pick up induction hum. Also make sure low resistance line wire is used. When the voice coil impedance of one's microphone is 3.2 ohms, a line resistance of even an ohm will have a considerable effect on the output and fidelity. Effective shielding of high impedance grid leads is a necessity. One can use lines of over 30 feet with a crystal microphone, provided they are shielded. Low impedance lines can be run for miles unshielded, provided they are not led parallel with power lines, or get wrapped round high voltage distributing depots.

ELECTRIC GUITAR

(RAHOB 9275)



If any Rahob plays a guitar, here is a cheap pick-up, which I am using. Much fun can be had playing an electric guitar, and it will be well worth your while making it. I have played with a commercial steel guitar pick-up, and I find that my pick-up is just as sensitive to the high notes, and the volume is quite loud, when played through a radio.

Get a pair of earphones, and remove the outer covering and diaphragm. Keep the small brass bar and bolts, which hold the small horseshoe magnets in place. Take a piece of about 20 s.w.g. polished galvanised iron, and cut and bend it to the shape shown in diagram A above.

Bore four small holes to take the bolts in such a position that the pole ends of the small magnets come directly under the steel strings as in diagram B. One pair of earphones covers four strings, and as I play an Hawaiian guitar the top four strings are the most important. Place the galvanised iron on the guitar with a piece of paper under it, so as not to scratch the varnish, and screw the magnets and coils in place. A small piece of paper or cardboard can be put under the magnets to pack them up, so that the poles are within about $\frac{1}{8}$ inch from the strings.—Rahob 6756.

To seal batteries with celluloid case. Procure some amul acetate and dissolve it in a scrape of celluloid, so as to form a thick solution. Scrape clean the parts to be joined and apply in same way as you would rubber solution. The mixture can be used for repairing any articles made of celluloid.

Smear battery terminals with a little vaseline. It protects from the acid and fumes.

Always check level of electrolytic before charging and correct specific gravity at end of charge.

The charging rate should never be such as to cause excessive gassing or temperature rise in any cell.

To reduce specific gravity withdraw some acid and replace with pure water.

Battery plates must be kept covered. Use pure water for "topping up."

SOME POINTS ON HOW TO GET THE BEST FROM A SMALL SHORT-WAVE RECEIVER

(PHILIP A. G. HOWELL)

This article is not a full description of how a short-wave receiver ought to be built, but rather aims at presenting and making clear some points of major importance, especially to the beginners who have been discouraged because their first short-wave sets did not perform as they had hoped.

If good results are to be expected the following things are of the greatest importance and must be attended to; otherwise money expended will be money wasted.

The first consideration is ease of handling. Fine tuning is the essence of DX, and this cannot be accomplished with sets having cramped controls or dials which do not run smoothly. Never mind what the appearance of the set is like unless you have plenty of money to spend; a plain knob is better if it turns the control smoothly than a jerky dial, no matter how good it looks. The tuning control should be placed in the middle of the panel, and on DX receivers this is the bandspreading condenser. The bandsetter or large condenser which tunes the whole range of the coil is then mounted to the right so that it may be adjusted quickly. The regeneration control, which it is usually necessary to handle frequently, is set off to the left of the bandspreader. Each control should be mounted at least 3 to 4 inches apart.

It should now be seen that the above will determine the circuit layout. Take first the breadboard or baseboard set. The wood should be fairly soft, preferably varnished, and above all things clean. If the regeneration control is in the plate or screen circuit, as in any of the diagrams (a), the associated plate

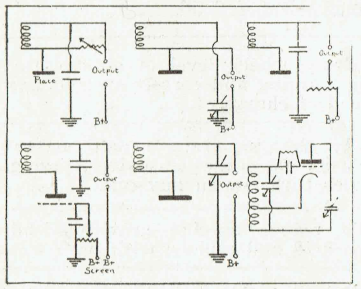


Diagram A.

circuit and screen grid components will go with their wiring over to the left of the board, while those of the grid circuit are placed on the right. If, however, it is in the grid circuit as shown in (b), the

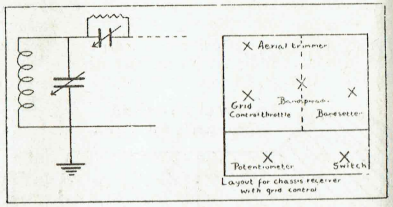


Diagram B.

outlay will be reversed. The tube sockets should be screwed down so that the leads from the elements run straight to their respective circuits. If total stability and absence of hand capacity is absolutely necessary, the front panel must be of metal, while if possible a grounded shield should be screwed across the base in such a manner that it isolates the detector grid and plate circuits. Sheets cut from biscuit tin or kerosene tin are better than nothing if suitably braced, for the shields must not be loose or flap. It is as well to keep the tube on the plate circuit side of the shield and the coil on the grid circuit side, provided the leads from the reaction coil can be well spaced away from the grid circuit parts. But do not make the only too common mistake of canning the tube and coil like sardines, as losses are the only natural result. Correct spacing and no shielding are always better than too much shielding. The antenna trimming condenser should be mounted at the top corner of the panel on the grid circuit side.

For a receiver built on a chassis the layout is much easier. All grid circuit wiring is kept above the deck and all plate wiring underneath, each stage being separated by a metal shield. The parts can be set with the bandspreader in the middle, antenna trimmer on the left and bandsettler on the right above the chassis, while the regeneration control is mounted below and to the left of the bandspreader through the chassis, while the on/off switch offsets it on the right. When using a condenser in the grid line (b) to control regeneration it will be mounted in place of the antenna trimmer, which will go up to the left top corner of the panel. Even when using grid control it is advisable to leave the potentiometer in the screen lead or plate lead in the case of triodes, to act as a variable

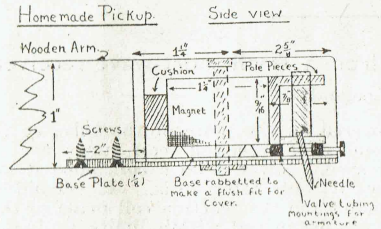
(Continued on page 128)

BUILDING A PICK-UP

Rahob 9275.

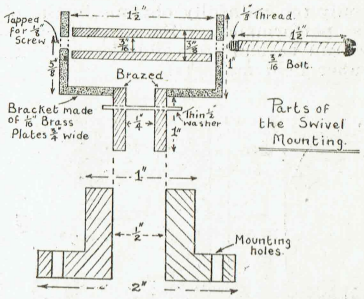
In order that one may make a pick-up such as the one to be described, one needs access to a workshop and a junk heap. One visits the junk heap on a dark night and returns to the workshop with furtive glances and sagging pockets. But one is not likely to find a mine of cobalt magnet steel, for the horseshoe magnet needed, in an average junk heap, so one visits the magneto of a model T Ford. Then follows a tussle between the magnet, an oxyacetylene torch and a grindstone. The result is a small horseshoe of required dimensions. This is dipped out in oil and remagnetised.

The best way to begin the pick-up is to make the arm assembly and fit the "works" in later. A wooden arm has its advantages. It is light, less liable to rattle, is easily worked and acquires a smooth finish when painted. So for the arm of your pick-up select a straight grained piece of wood (grain running lengthwise, of course) about one foot long, 1½ inches wide and one inch thick. Oregon pine does very well. On one end check out a space to fit the base plate. (It will be a check 2in. long by ¼in. deep.) This done, a small rabbet is required for a flush fit of the cover of the head unit. The rabbet extends ¼in. back along the arm and is 1/32in. deep.



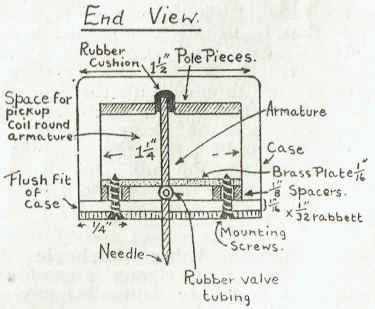
The base plate could now be made. This is a piece of non-magnetic metal, or bakelite 4½ in. long, 1⅜in. wide, ⅛in. thick, there being a rabbet about its edge, as shown in the diagram, which takes the bottom edge of the head cover. This cover is made of some easily-worked non-magnetic metal and is in the form of a rectangular box with only four sides. Its job is to cover the head assembly and it is fixed in position by a bolt, shown in the diagram. An ordinary ⅛in. brass bolt is soldered to the inside top of the box 1¼in. from the open end. This bolt passes through the base plate, and has a nut screwed on the protruding end.

The swivel mounting is a straightforward affair needing a small amount of lathe turning done on it. Although the arrangement is not as good as ball-bearings, it runs a close second. The tube shown between the uprights of the brackets is pushed in a ⅜in. hole bored in the arm of the pick-up, about three inches from the counter-weight end, where it acts as a bearing for vertical motions of the arm. Any counter-weights needed to lighten the needle pressure of the pick-up will be put on the extreme end of the arm.



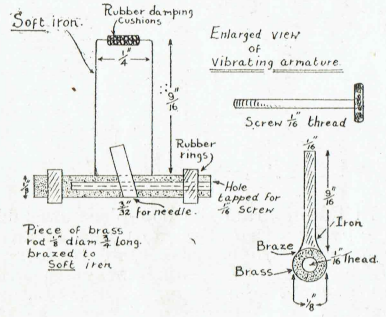
In the diagram the pole-piece assembly is shown as two separate pieces of angle iron brazed to a brass plate to form a "U" channel. The gap between the iron poles should be 3/32 in. A brass bottom plate is used on the pole pieces so the magnetic circuit cannot be completed. The brass is now divided and tapped with two mounting poles and has a groove cut in it so the rubber-ringed bearing stays put. A hole has to be made for the armature, which must go through the brass plate. It need only be 3/16in. long, and the width will depend on the neatness of the brazing at the base of the armature.

The method of mounting the pole pieces is simple and can be seen in the plan of the end view of the pickup.



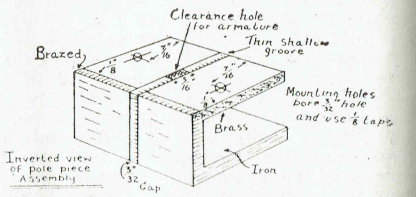
No trouble should be experienced in making the armature and bearing, provided due care and respect is given to the small taps and dies used. In tapping the hole for the needle holder, with the

1/16in. tap (the hole is bored by 1/32in. drill) take the turns gently, do, say, half a turn at a time and use first a taper tap, then clean out the thread with a plug (1/16in.) tap. (Note: Hard brass is easier to tap than soft, so after brazing the soft iron armature to the ⅛in. brass rod, let the thing cool slowly and the brass will harden and the iron will tend to soften.) The iron used for the armature really must be soft. If it is not soft, it will show considerable magnetic reluctance, and the effect of that would be only too painfully obvious in the pick-up's performance. Some suitable soft iron can be had from old electro-dynamic speaker field magnets.



The pick-up coil is a small bobbin, with a hole through it big enough to take the armature, wound with fine wire—an earphone bobbin would probably do fine. Different impedance windings could be used, and it should be remembered that the impedance of this type of pick-up is nearly five times its D.C. resistance, so an earphone bobbin of 2,000 ohms D.C. resistance would have an impedance of 10,000 ohms. The leads to the amplifier from the coil go under the magnet, and through a hole bored up the arm.

As a refinement, a needle channel could be cut in the front of the base plate.



That is a groove leading from the front of the base plate to the hole intended for the needle. This facilitates changing needles, as they slide along the channel to the proper hole.

Ingenuity, pride and precision are qualities without which pick-ups of any sort are not made.

Some points on how to get the best from a small short-wave receiver

(Continued from page 126)

resistance to regulate the voltage for different wavebands.

How to construct satisfactory coils is a thing which comes only with experience, but nevertheless there are some points worth noting which are not customarily described. Coils should be wound as close to the base of the former as is practicable—that is, usually about ¼in., keeping leads as short and direct as possible, taking care to see that the reaction coil leads are not tangled with the grid winding leads. It is advisable to make the grid winding of as heavy a gauge wire as can be handled, and the converse applies for the reaction coil. Also it should be kept in mind that as the voltage is lowered on the plate of the tube, so the number of reaction coil turns are increased. Never wind a coil, dope it and try it out afterwards. It should be wound and the reaction coil made so that it can be moved within limits (only fine gauge wire will permit this). Then it can be plugged in and the windings adjusted for maximum performance. It may then be doped with a light and clear dope.

Finally, good headphones and antenna are essential. All sawing in the line and lead should be reduced to a minimum to stop capacity effects.

So remember these points and improve your reception.

For Rahobs using sulphuric acid. Keep a bottle of strong ammonia at hand with which to neutralise any acid spilt on clothes and to soak rag for wiping terminals and outside of battery cases.

To treat a burn by acid, at once wash the affected part with either pure water or bicarbonate solution, and then cover up immediately with a burn dressing to exclude the air.

HOW TO USE DIAGRAMS IN RADIO SERVICING

(M. N. BEITMAN, author of many technical books and articles. This article prepared from data supplied through the courtesy of Supreme Publications, and "Radio Craft."

Relatively few radio servicemen know how to get every bit of information from a shematic diagram. This article is prepared to help you learn how to use effectively radio diagrams for quicker and better repairs. Give this material a fair chance and, even if you are an old timer, you will agree with us that you learned plenty from this article about the use of diagrams and servicing methods. Let us begin with a simple question:

1. WHAT IS A RADIO DIAGRAM?

Short-hand symbolic notations are used in all branches of science. Radio diagrams show different parts used and the circuit connections in a simplified symbolic form. To save time, permit easier tracing of the connections, and allow quick comparison, radio diagrams are used. For the readers who are beginners, and to serve as a reference for others, symbols of common radio parts are listed at Fig. 1.

In complete diagrams straight lines are used to indicate the connections between parts, but these lines do not indicate the actual wires. The parts may be wired in any fashion as long as exactly the same component parts are connected with the lines and are also wired to permit the passage of current.

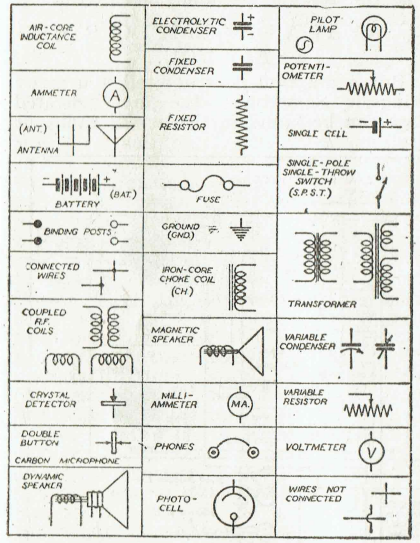


Fig. 1, above, shows the general radio symbols, used in diagrams of radio sets. Once these are carefully studied and memorized, you will soon be able to read complicated diagrams with relative ease.

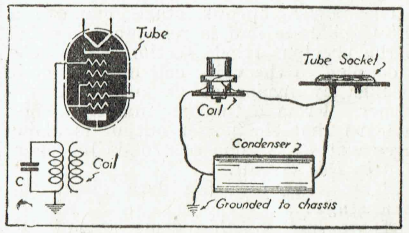


Fig. 2, above, shows the relation between a schematic diagram and the actual physical connection of a coil and a condenser to a tube socket. If you look over the diagrams in this magazine, you will soon learn the relation between the two.

Figure 2 above illustrates that the actual wires and the diagrammatical lines will permit the same passage of current and are, therefore, considered the same connections. But the lines are not exact representations of the wires for circuit tracing purposes.

If all radio sets were made on large bases, all parts carefully laid out and clearly marked with their exact values, all wires were clearly visible, and we could see above and below the chassis at the same time, no schematic diagram would be required. Of course, this is not the case and what a job it really is to trace out even a small portion of a circuit. But a complete radio circuit diagram gives you this picture of the radio set and we will see the multitude of helpful hints and service pointers which can be found in any diagram.

2. 1000 FACTS IN EVERY DIAGRAM.

Probably you cannot see how a single diagram can give 1,000 facts about the circuit, but it does. Let us consider the diagram of a seven tube Pilot set below.

Here is the general information about the complete radio set:

This is a seven tube radio using a tuning eye tube and designed for A.C. operation. The set covers two bands and has a novel arrangement of pilot lights

for band indication. Assuming single dial control, band switch, tone control, and volume control, there should be four knobs employed. A dynamic speaker is used and it is indicated as a 6" unit. The set is a superhet using one stage of I.F. Of interest is the resistance-capacity coupled R.F. coil giving superior tone quality. Also note that the I.F. transformers joining the tubes 6SA7, 6SK7, and 6SQ7 are of the permeability tuned type. These facts are only a few of the many to be learned from this circuit.

Here is the basic information about the audio output stage:

The power output stage employs a 6F6-G pentode and is resistance coupled to the previous triode section. The tube is coupled to the voice coil of a dynamic speaker by means of an output transformer. From a tube manual it is easy to learn that the power output is about three watts. A tone control is incorporated in this circuit.

Here is the specific data about the same stage:

If we analyze this same stage with greater detail, we can obtain specific information on the value of each condenser and resistor used. Many of these parts are also listed with exact manufacturers' numbers. Circuit details also can be found. For example a .02 mfd. condenser is used as a tone compensator and the tone control consists of a series condenser and variable resistor and is also placed in the plate circuit. Of interest is the biasing method used for this 6F6-G tube. The cathode is kept at a ground potential and the .02 mfd. condenser serves as a grid return decoupling by-pass. The total drop in the negative leg of the power supply (in the 250 and 50 ohm series resistors) is used for this purpose. The voltage at the tap of these two resistor is used as the minimum bias for the tubes with A.V.C. This will give you an idea what we mean by specific data and, of course, there is plenty more.

And here is the specific information about one part—the plate coupling resistor of 6SQ7 tube, part 13191:

This resistor has a resistance value of 200,000 ohms, as marked. It is used to load the triode section of the tube mentioned and carries the plate current for this tube. Without consulting tube characteristic information, you can guess that the current is in the order of a few milliamperes. Applying the wattage formula: Watts equals current in amperes multiplied by itself multiplied by the resistance, we can find the power handling requirements of this resistor. (Actual problem: about .002 x .002 x 200,000 equals 0.8 watts; probably one watt resistor used.) An important fact to notice is the possibility of this resistor to burn out if this plate R.F. bypass 500 mfd. condenser shorts.

Now consider the several stages used as well as the power supply, multiply this by the many different parts used in each stage, multiply this by facts known to you in general but made specific with the aid of a circuit diagram, and you have the total information needed to service the set quickly and efficiently.

3. WHAT A DIAGRAM DOES NOT TELL YOU.

But a diagram does not tell you many things. Sometimes the non-indicated data can be found in the actual radio, or

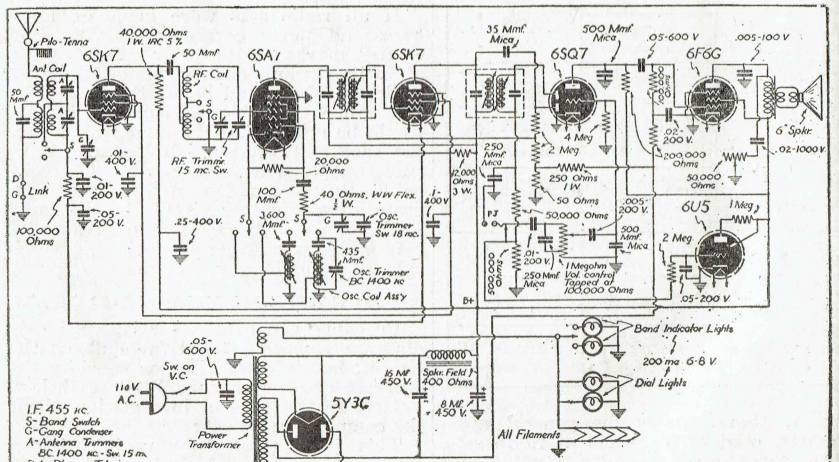


Fig. 3, above, shows the hookup of a seven-tube Pilot short and broadcast wave receiver. Beginners will find the explanatory text given in the article.

figured out by reasoning or formulae, or obtained from a parts list. Let us see how this additional information may be obtained.

In the previous chapter, we assumed that there were four control knobs from the data given in the circuit. This, of course, can be checked by examining the chassis itself. Using a formula for wattage, we have also calculated the wattage of a resistor.

Now looking back at the circuit we have been using in our discussion, we notice several switches marked "S" located in different sections of the circuit. The footnote in the lower left-hand corner of the diagram tells us that this is the band switch and these many separate switches must be controlled by a single knob. This fact, you will notice, is not obvious from the circuit, but can be understood by an experienced radio man with the aid of a diagram.

Information on number of turns in a coil, the type of base used for pilot lights, and other such facts are not often included, but they are not needed for servicing.

4. HOW TO USE DIAGRAMS IN SERVICE WORK.

Facts about radio diagrams are interesting, but you are primarily interested in knowing how to apply the knowledge to actual servicing problems. Let us show you how a circuit diagram

(1) Saves time in servicing,

(2) Points directly to the fault, and

(3) Eliminates the need for complex and expensive test equipment for many jobs.

We will study several service jobs and consider the procedure used with and without a suitable diagram for each case.

For example let us assume you are called to repair a large, rather complex radio. You suspect that the service work was first attempted by the self-styled mechanical expert of the household, and this probably resulted in several connections being changed to some wrong positions. While the more able of us in the servicing game can trace a circuit with ease, only a few are able to find a wrong connection in the 20,000 different models manufactured to date. To find actual changes made in wiring a circuit diagram is absolutely essential.

But even if the wiring has not been changed, how does one locate a shorted by-pass condenser in the grid circuit of a power output tube which receives its bias from a tap in the field coil? We will require twenty to thirty minutes to trace things to a point where we can realize that the field coil is used as a choke and is connected in semi-fixed bias arrangement.

With a diagram the symptom of this fault will be a guide which cannot fail. The continued "hum" will suggest poor filtering of the power supply at same point, and, seeing that a special biasing circuit is employed, you would immediately suspect the condenser mentioned. You must agree with us that hours can be saved almost every day by using diagrams.

5. HOW TO FIND THE PROBABLE TROUBLE USING DIAGRAMS.

A radio diagram divides the set into definite sections and thereby permits you to find quickly the single section at fault. In actual placement, a filter condenser may be located near the antenna coil, but even a beginner can see from a diagram that these parts belong to totally distinct sections. If the one faulty section is discovered, you need not search among all the parts for the fault, but can confine the work to a limited number of parts in this single section.

And here is the simple way to find the section at fault. Every section or stage of a receiver can be upset electrically, so that, if this one section being tested and all following stages leading to the speaker are functioning, this change in the circuit under test will alter the output volume or tone, or cause a hiss or click. See Fig. 4.

For example, in making this test in the 1st audio stage, a certain response may be expected (see table) if this stage, the following audio stage, the loud speaker, and power supply are working properly.

While test instruments may be used, these informative tests may be made with two pieces of wire and a resistor. This simple test unit is explained below. See Fig. 5.

Fig. 4, below, shows a simplified block diagram of a Superhet receiver, and where to look for trouble in such a set.

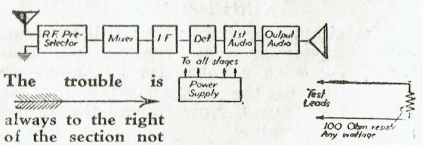


Fig. 5 above shows a simple resistance test device explained in the text.

It is best to begin upsetting the circuit in the power supply. For this, as well as for almost all other tests, hold one lead of the test unit shown (Fig. 5) to the chassis—usually B minus. Touch the other prod to a B plus point, such as the positive side of a filter condenser, or the screen grid of an output pentode. If there is a noticeable spark at the point of contact assume the voltage is OK. Of course, a voltmeter can be used with greater accuracy. Please notice that the

B+, and B— connections can be found immediately with a diagram.

Next test the speaker. Determine from the diagram if the speaker is of the electro-dynamic type, and, if so, bring an iron blade of a screwdriver near the field. There should be a magnetic attraction—none will be present if set is off or field not operating.

To test voice call operation, one prod should be held to the chassis as mentioned before, and with the other prod touch the plate prong of the output tube. There will be a spark at the contact and a loud single click in the speaker. Any previously existing "hum" in the speaker will be reduced. These facts indicate that the speaker probably is operating correctly. See chart for other tests.

You can see that a diagram will help you find the places for these suggested tests. A diagram is like a "floor-plan" of the radio hook-up and permits immediate location of all parts and circuit connections for quick tests by any method.

By using instruments, the different parts of the circuit can be actually measured (resistors with an ohmmeter, condensers with a condenser tester) and compared to the values indicated in the diagram. At times, the voltages at important points are marked in the diagram. In such cases, using a voltmeter, you may measure voltages between these individual points and chassis. Incorrect reading suggests that the trouble lies in the associated circuit.

You can see that with diagrams the fault in a radio can be found faster. And since any service job is primarily a task of finding what is wrong—only a few minutes being needed for the actual repair or part replacement—you well earn the same service charge for less time spent on the job.

6. HOW TO MAKE SURE OF YOUR SUSPICION.

The simple localizing test will suggest, or perhaps your own favourite point-to-point test with a voltmeter or ohmmeter will point to the section of the radio receiver at fault. Now to find the actual source of trouble.

The recommended procedure can be best described with a few examples. If the trouble seems to lie in the section between the I.F. tube and the detector, your localizing test will give expected response at the detector but not at the I.F. tube.

If the tubes have not been tested initially, first test the tube used in the I.F. stage. This I.F. tube is part of the section at fault. Next the circuit of this suspected section should be examined and a diagram is essential for this purpose.

Our test-unit, described before, or a voltmeter may be used to determine if the expected voltages are at the plate of the I.F. tube, screen grid, and the B connection of the I.F. transformer (usually the red lead). If the home-made test-unit is used, connect one lead to the chassis, and touch the other to the points mentioned, watching for a small spark which will indicate voltage present. A voltmeter is used the same way, but will indicate exact voltage.

In a AC-DC type of radio about 100 volts may be expected at the points mentioned, in AC sets with transformers about 200 to 250 volts. An I.F. stage from an AC-DC set is illustrated at Fig. 6 below.

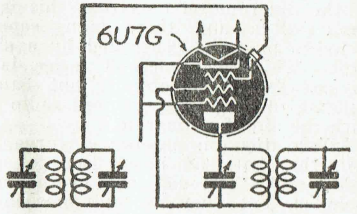


Fig. 6—Typical I.F. stage in a receiving set is here illustrated and referred to in the text.

Lack of voltage at a point where it is required and expected indicates that either it cannot get to this point because of a part being open or wire broken, or because an associated by-pass condenser is shorted and passes the voltage to the chassis. This means we will look for broken wire in wiring or coil, or shorted wire, or try disconnecting condensers one at a time.

This is but a single test procedure applicable to a section; however, it does suggest a simplified servicing method made possible with a circuit diagram of the radio under repair.

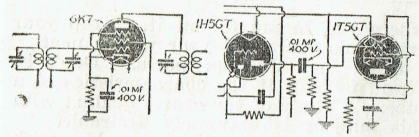
7. MAKING THE ACTUAL REPAIR.

When you finally locate the actual source of trouble—a shorted condenser, two wires touching or an open winding in a transformer—you are ready to do the mechanical work of actual repair. And here again a wiring diagram is an indispensable aid.

The diagram also serves as a catalogue of parts employed, and will permit you to obtain the proper replacement. But more than just this—the diagram will tell you how far off in value a replacement condenser or resistor may be without noticeable ill-effects.

For example, a .01 mfd., 400 volt condenser needs to be replaced. It is used to by-pass the biasing resistor of a R.F. amplifier tube. This data about the use of this condenser obtained from a diagram will tell you that the capacity really is not critical. A somewhat smaller capacity will serve and, of course, .05, .1, or even .5 mfd. will do.

The diagram also will let you know that the voltage in this cathode circuit is small and a 200 volt condenser may be used. Besides you also know that higher voltage condensers are always permissible in any circuit.



In Fig. 7, above, the condenser used for cathode by-pass is not critical.

A condenser used for cathode by-pass is not critical, but for audio coupling exact replacement is recommended.

If this same size condenser was used in a resistance coupled stage, the value of the condenser would be much more critical. In this application, as is evident from the diagram, any other size condenser will sacrifice audio response. A larger unit will permit greater "hum" amplification; while a smaller capacity will reduce the response of the "highs."

8. HOW ANY SERVICEMAN CAN MAKE MORE MONEY.

A radio circuit diagram of the set you are servicing will:

1. Eliminate the need for complex equipment.
2. Help you localize the trouble.
3. Help you to find the actual fault.
4. Permit you to select a replacement part.

This really means that you can

1. Save time on every job.
2. Do the job better.
3. Earn more money.

By doing any radio repair better, you can charge more and will eliminate the expense of the call-backs. But not only will you be getting more money per job, but the job will take less time when using diagrams. And so your earning per hour will increase. As you will see in the next section, diagrams are very inexpensive and always more than repay for themselves.

9. HOW TO OBTAIN AND FILE DIAGRAMS.

An active radio serviceman is interested in commercial diagrams of sets he repairs or in circuits of recently developed radios for the purpose of keeping up with the times. Several technical magazines publish a limited number of circuits of lately released sets. These should be filed by you in a suitable binder which will form a manual.

Very few radio manufacturers have diagrams for distribution to servicemen. If the diagram you want is available, a week or more will be required by the manufacturer to answer your letter. We do not recommend trying to obtain diagams from a set manufacturer.

The diagrams should be kept in a suitable notebook or filing case. A complete index with cross references should be made for a quick location of the diagram you need or as a check to see if a certain diagram is available.

LOCALIZING TEST CHART, IN RECOMMENDED ORDER.

First prod (momentary contact only)	*Second prod*	*Visual observation of contact*	*Aural response*	*Where to look for faults*
B+ point before filter at rectifier tube	Chassis B—	Arc made, wire will weld	Clicks, hiss	Rectifier tube, 1st filter, power transformer
B+ point after filter	Chassis B—	Large spark	Dual click	Choke, or field, 2nd filter cond. short in set
Plate prong output tube	Chassis B—	Spark	Click, less hum	Output transformer
Control grid output tube	Hold in hand	None	Hiss	Wrong bias on output tube
Triode, or pentode detector tube cont. grid	Antenna post	None	Click, strong hiss	Bad condenser or resistor in circuit of detector tube
Control grid of any R.F. or I.F. tube	Hold in hand, remove grid cap	None	Strong oscillations, hum, change in tone	Parts of the associated circuit

GETTING STARTED

(By H. VERNON WHEATLEY)

GENERAL COMMENTS

You may wonder why I have specified certain tubes in this article. Well, I've no particular reason, save simplicity. Again, why did I use condenser reaction? For the same reason also. You may try out different methods of reaction at some later date when you are familiarly contemptuous of the parts you use. The same applies to the use of a screen grid valve in place of the triode detector and so on. Always remember the Chinese proverb: A falcon must walk before it flies.

This proverb is also applicable to your next step: your graduation to the A.C. class. A.C. presents no obstacles and the knowledge you have gained, plus an understanding of the symbols and with an intelligent study of the proposed circuit, will allow you to tackle an A.C. "B" power supply for this receiver, or an "electrification" of the receiver.

You have a host of valves to use, from 1.4v. battery types to 6.3v. A.C. types, and from the old-timers to the most modern ones. Touching upon superheterodynes, I would remind you of the proverb I quoted. Supers will come later, once you have found out all the whys and wnerefore, and this is dependent upon you.

Don't be afraid to ask anyone a question. An embarrassed silence on your part may hold your knowledge up for weeks. Don't rush. Make sure whether the wire you are soldering really goes where you intend to put it. Keep your grid leads short and your wiring neat.

Don't use dubious parts. Don't be afraid to look at the characteristics of a tube. A study of the charts dealing with this subject is extremely desirable.

Familiarize yourself thoroughly with the circuit of any receiver you plan to build. It is easier, once you have built it in your head.

Hints on the Construction of This Particular Receiver.

It may be necessary to place a metal can round the R.F. valve.

Keep the plate lead from the R.F. valve to No. 1 in the det. coil fairly short.

Using a common earth in this receiver only requires your earth terminal to be connected directly to the chassis.

If troubled with "audio howl," place a high value resistance across G and F on the audio transformer, or even a low value condenser between P and F on the transformer. This latter works well, but only sometimes, so I do not recommend it.

The condensers shown by the dotted lines in diagram H may have to be added, in the interests of stability or noise reduction. You will soon know whether you have to install them. Last, but by no means least, give the Radio Dictionary in the Annual your close attention occasionally.

Having taken you this far, I now make a graceful exit and wish you every success in your future endeavours.

SECTION ONE

Simple Circuits.—A fair while back, it was considered quite a business to break into radio as a hobby. This was principally due to lack of standardization, and also because if one happened to meet a fellow dabbler, he probably knew less than you did—in my case, most improbable. I, personally, started the hard way. The radio magazines which I managed to beg, borrow, etc., contained illustrations of parts which were wholly foreign to me. With the aid of an ex-naval signalman, who incidentally did me a great service in pushing the Morse code into my receptive (I hope!) brain at the age of 10 or 11 years, we pottered around and produced after much labour and tears, a receiver known as the "Ultra-Audion." We had to send overseas for quite a lot of the parts, and I am very much afraid that my friend's radio knowledge had barely passed the coherer stage. At any rate, I did not become acquainted with that simplest of receivers, the crystal set, until some time later.

Things have altered since those days, and it is not so fearsome after all to break into the most fascinating of all hobbies. If you will glance at figure A, you will see the most simple of all receiving circuits. If you are close enough to a broadcasting station, you will hear speech and music in your telephones. This is an "untuned" circuit. If we tune the circuit we are able to "tune-in" different signals. So we construct a coil. The coil may be of any diameter, but in this case I have selected an outside diameter of 1¼ in. Obtain a former or a cylindrical piece of cardboard sufficiently

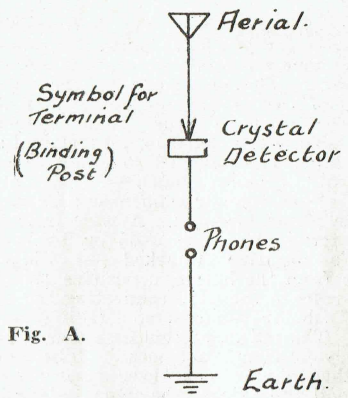


Fig. A.

long to accommodate 100 turns of 32 gauge enamelled wire, and at the same time leaving you room enough at either end to add turns of wire at a later stage in your venture. (See diagram C).

Once you have this 100 turn coil neatly wound, with the ends anchored securely by passing the free wire through a couple of small holes pierced or drilled through the former at the beginning and ending of your coil winding, you may connect it at points "X" (diagram A.2). Mark your coil as shown, 5 and 6. In Fig. 6 connect your condenser to points "X" also as shown in diagram A3, the fixed plates going to the No. 5 end of the coil and the moving plates going to the No. 6 point. The

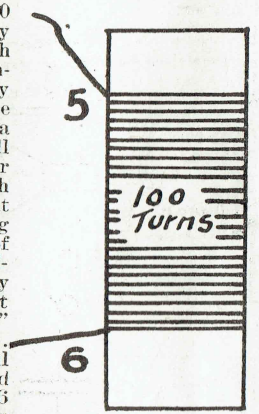


Fig. C.

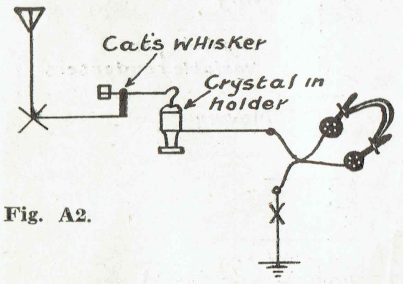


Fig. A2.

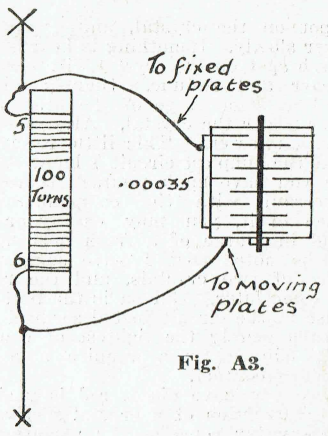


Fig. A3.

whole may be fastened on to a small baseboard.

Tracing the Circuit—Now look at Fig. B.

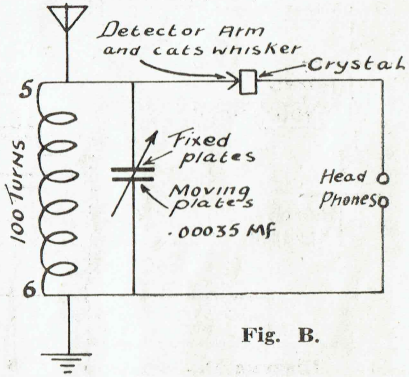


Fig. B.

From your aerial terminal (to which is connected No. 5 end of the coil and the fixed plates of the tuning condenser) we have a wire running to the arm of the detector. From the crystal cup a wire runs to the phone terminal. A wire running from the other phone terminal to earth (to which is connected No. 6 end of the coil and the moving plates of the tuning condenser) completes the circuit.

Parts Required.

Coil former
Spool of 32g. enam. wire.
Crystal detector.
Galena or silicon crystal.
Four terminals (Fahnestock or other types).
Pair headphones.
About 18 inches of hook-up wire and a small wooden baseboard.

To Tune: Connect your aerial and earth to their respective terminals, select

a spot on the crystal, and rotate condenser slowly. If nothing is heard, select a fresh spot on the crystal with the cats-whisker and re-tune. Signals will be heard at some stage of the proceedings. Never finger the crystal. Always handle it with tweezers. This little receiver is about the simplest circuit I know of, and once you have made yourself thoroughly conversant with the components embodied in it, you may cast your eyes round in search of a fresh horizon. It will be noted that I have suggested a choice of two crystals, and the reason will come later. Galena is the best type to use in the circuit just described, as it requires merely the lightest of contacts whilst silicon types require a heavier means of contact.

Once you have discovered how simple the construction of a crystal receiver is, you may try some of the variations of the original circuit. These are legion, and some excellent examples selected from previous Lamphouse publications are printed on next page.

By shorting out the crystals and detector and the head-phones a crystal set may be used as a wave trap. To do this remove the phones. Now connect your aerial to the aerial terminal of the crystal set. Connect a wire from the earth terminal of the crystal set (now a wave trap) to the aerial terminal of the family's receiver. Tune the main set to the interfering or unwanted station. Now turn the wave trap dial to a position which will eliminate or greatly reduce the signals from the unwanted station. Leave the wave trap and tune in the wanted station on the main set.

Since at some time during your acquaintance with radio you will have to introduce yourself to batteries, it will be fitting to start now, by "battery-izing" the receiver you have built. Across the headphone terminals we connect two condensers. The one going to the crystal side of the phone terminals is a .005 microfarad mica type fixed condenser. One side is connected to the terminal and the other is connected to one side of a .02 mfd. tubular condenser. The other side of the tubular condenser goes to the other phone terminal. A wire from this last terminal goes to a 4½ or 9-volt battery's negative (marked —) whilst a wire from the battery's positive (marked +) runs to the wire connecting the mica and tubular condensers. (See diagram D). The object of this experiment is to give your signals a "boost." The charge in the tubular condenser runs through the coil and "kicks" the signals along just as they are about to be detected by the crystal. In words which you will understand later: The electrostatic charge in

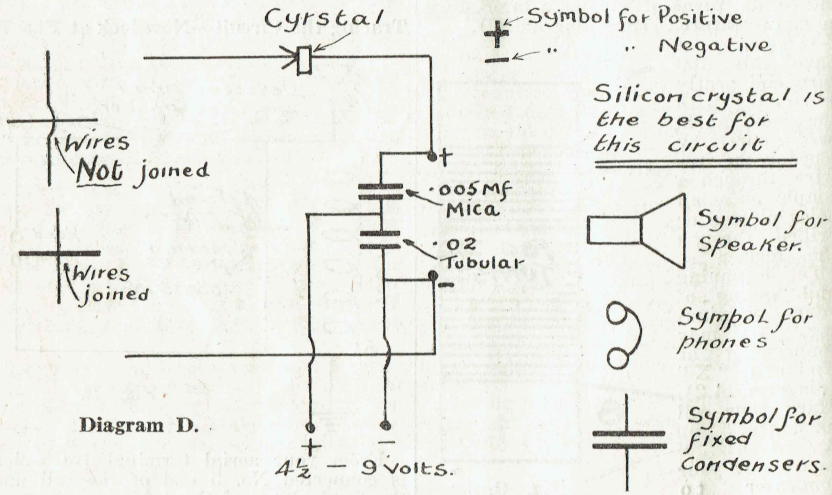
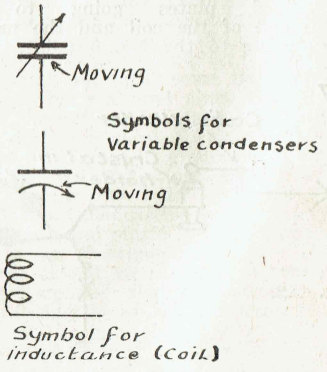
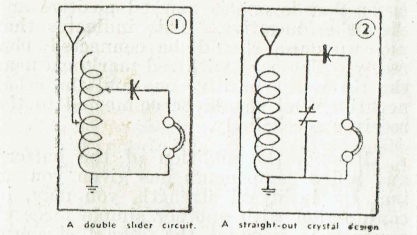


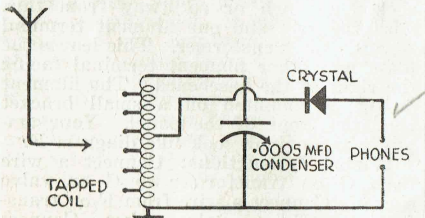
Diagram D.



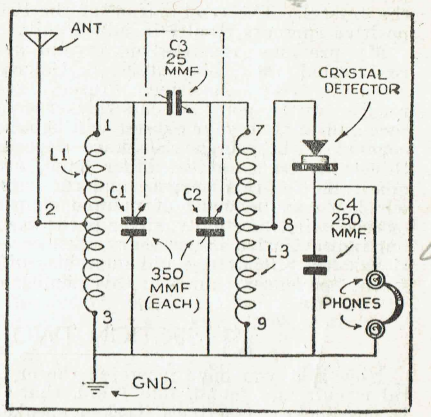
CRYSTAL SET CIRCUITS



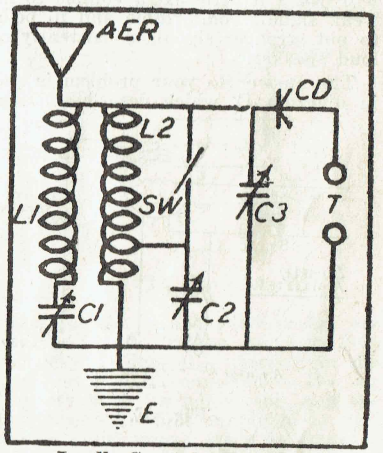
Eight Proved Crystal Set Circuits.



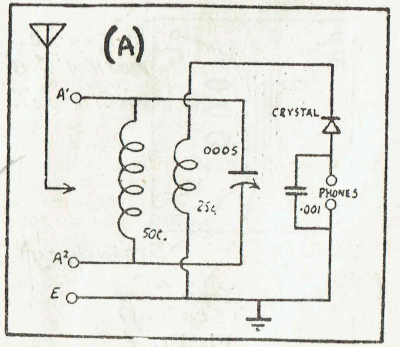
Tapped Coil Circuit.



Selective Crystal Circuit.



Lyall Crystal Circuit.



17 Station Crystal Circuit.

the .02 condenser is converted to a positive current whilst passing through the tuning coil. It is then imposed on the positive charge about to be rectified by the crystal. The combination of the two positive currents results in added gain.

My previous remarks on crystal are resurrected at this stage. Galena, although very sensitive, "fuses" too readily at the point of catswhisker contact and in time your crystal will become covered with a high resistance deposit. Silicon crystals, on the other hand, are admirable for this purpose and the catswhisker may be made of pointed copper or steel wire. Actually, silver is the best, but improvisation is necessary upon occasions. Only don't try and improvise different condenser values in this adaption. The values given allow for maximum efficiency.

N.B.—You will observe in diagram D that the phone terminals are now polarized; that is one is marked positive and the other negative. This indicates that your phones should be connected correctly. The cord with red markings near the tip is the positive one and the other negative, and should be connected to the receiver accordingly.

Although the addition of the battery and allied components has given you an increase in signal strength, you may, in conjunction with another simple piece of apparatus, increase the signal strength still further. This accessory is a simple transformer coupled amplifier.

SECTION TWO. Simple Amplifier.

Now that you have mastered the crystal circuit and found, like I did, that it is possible to sometimes work a speaker from the "battery-ized" crystal set, you will desire a little extra volume to make weak signals comfortable and to be able to put stronger signals consistently on a loud speaker.

The answer to your problem is shown in diagram E, which describes a simple

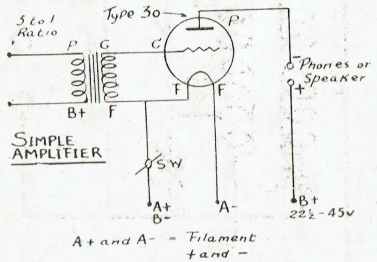


Fig. E.

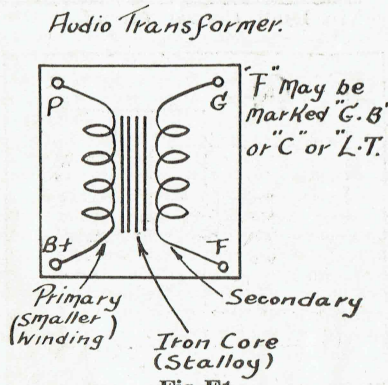


Fig E1.

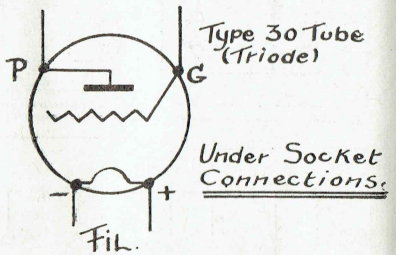


Fig. E2.

amplifier, using an interstage transformer of 5:1 or higher ratio, plus a type 30 tube.

Additional parts required for the amplifier are:—

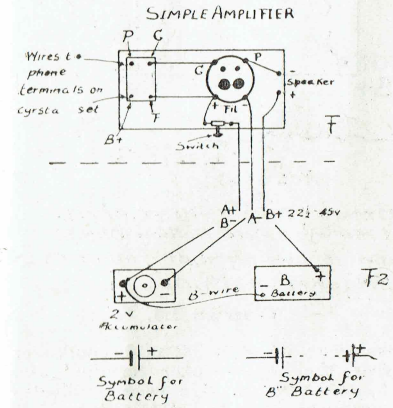
1x audio transformer.
1x 4-pin valve socket.
1x type 30 tube. See E2 for connections.

Two more terminals, a small baseboard, a few odd woodscrews and a small switch. A few feet of single flex is also necessary.

To the left of the baseboard mount the audio transformer with the primary on the left side. Then mount your valve socket an inch or so away from this, with the grid and one filament terminal towards the transformer. This leaves the plate and other filament terminal facing the right of the baseboard. The filament switch is mounted on a small bracket near the front of the panel. Your amplifier layout will look like diagram F.

Wiring Instructions: Connect a wire from G on transformer to G on valve socket. Connect a wire from F on transformer to F+ on valve socket. Connect a wire from P on valve socket to the

speaker terminal as shown in diagram. Connect a wire from F+ on valve socket to one side of the filament switch. A wire about 2 feet long is connected to the other side of the switch and is marked A+ and B—. A wire of the same length is soldered to the F— terminal of the valve socket and marked A— Another wire of similar length is connected to the other speaker terminal and marked B+. Check and re-check your wiring. Insert a type 30 tube in the socket and connect a 2v. accumulator to the wires marked A— and A+. Naturally, the wires are connected to coincide with the similar markings on the accumulator. Switch on and the tube should glow. Switch off, remove the tube and connect your 22½ or 45 volt B" battery as per sketch (F2). The B— wire is connected to



Figs. F1 and 2.

B— on the "B" battery and this wire runs from this terminal to A+. Connect the B+ wire of the amplifier to B+ 22½ or 45v (as the case may be) on the "B" battery. Connect your phones or speaker to the amplifier, and the crystal set to the amplifier. One wire from the phone terminals on the crystal set goes to the P terminal of the transformer and the other wire from the other phone terminal is connected to the B+ terminal on the transformer. Insert the 30 valve, switch on and tune your crystal set. If any noises occur which shouldn't be there, switch off the amplifier and re-connect the wire running from F on the transformer to F+ on the tube socket, to F—. This usually cures audio "howl" if it is apparent. If you happen to strike an ancient transformer marked IP, OP on one side and IB, OS on the other, these markings coincide as follows:

IP—B+	Diagram E1 shows the
OP—P	internal connections of
IS—F	an audio transformer.
OS—G	

Incidentally "H.T." on a transformer means B+.

If your transformer has 4 coloured wires issuing from the inside,

Green = G.
Red = B+.
Black = C—.
Blue = P.

That is provided the manufacturers have used their usual method of coding.

A study of the various simple amplifiers illustrated from time to time in the "Radiogram" and also the Annual, will greatly assist you. They may look complicated, but an intelligent discussion to yourself or with a similarly interested friend will soon iron out any little difficulty which may crop up. Always remember—once you know how, nothing is complicated.

Should you desire more volume, duplicate your previous effort. The first step you have just completed tells you how to carry on. The same "B" voltage will do. The wiring of your second amplifier is the same. The wires from your filament

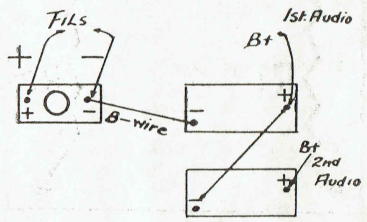


Fig. F3.

terminals of the second valve socket are soldered to their fellows on your first valve socket. The B+ wire from the speaker terminal is connected to B+ on the battery with its fellow one, and the output from the first amplifier is connected to your second stage by connecting the speaker terminal that is connected to P on the tube socket, to P on the transformer. The other wire from the terminal marked B+ runs to your speaker terminal that runs to the B+ terminal on the "B" battery. Quite simple, isn't it? Connect your speaker as you did with your first amplifier and you now are operating a two-stage amplifier. More volume may be obtained by supplying the last valve with a higher voltage. See diagram F3, showing two "B" batteries connected in series. You may have a single block 120-volt "B" battery, in which case consult F4, for a diagram of the connections.

Before we finally leave the good old crystal circuit, did you know that a small piece of coke soaked in a heavy solution of salt-petre will, when thoroughly dried, make quite an efficient crystal? You may

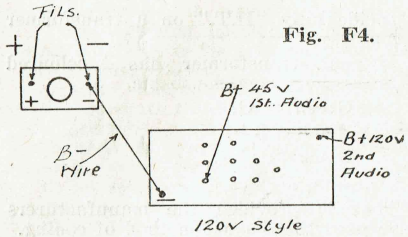


Fig. F4.

have to try this out three or four times before you hit on one that works with any degree of efficiency.

Touching on resistance-capacity coupling in place of transformers, visualize the components as being inside a transformer case and make the same connections. (See diagram E3). The values given are suitable to replace your transformer but with 90 to 120 volts B+ applied instead of the original 45 volts. It will work o.k. with 45v., but better with the higher voltage. Although you do not get results as loud as transformer coupling with resistance-capacity coupling, this latter method has much to commend it. Purity being the main consideration, and economy being also prominent in the picture. The values given in diagram E4 are eminently suited for a "B" supply of 90 volts. You may find it necessary to insert a .02 mfd. condenser between the B+ speaker terminal and earth. (Earth, in this case, indicates your common B— and A+ terminal on the tube socket).

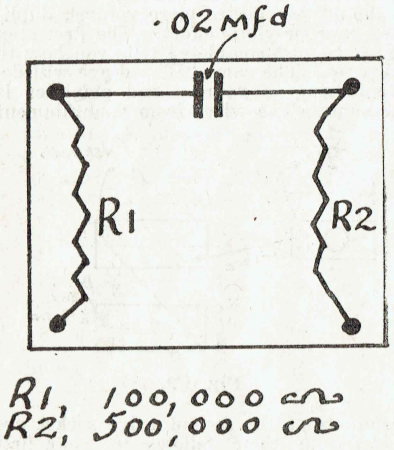


Diagram E3.

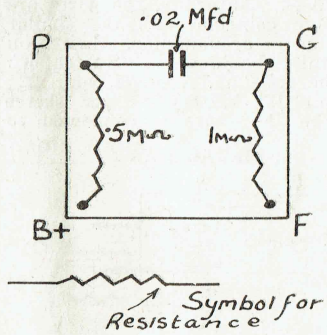


Diagram E4.

So, having mastered a simple amplifier circuit, we now proceed to the next stage of the proceedings.

SECTION THREE. Refinements and Improvements

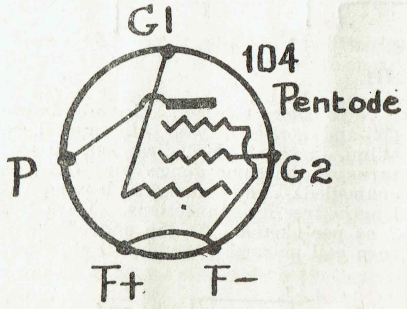
Now that you possess a crystal set coupled to a one or two stage amplifier, it is well to pay attention as to how the apparatus may be improved. You will find by applying a small value of negative grid bias to the grids of the audio tubes, that the tone will improve and your plate current will decrease, thus making your "B" batteries last longer. The addition of grid bias is a very simple affair. Simply disconnect the wire that runs from F on the transformer to the filament connection on the tube socket. Solder two longer wires to these two points, and attach the wire from the tube socket to the positive (+) terminal on the grid bias battery. The wire from the F terminal on the transformer goes to a negative terminal on the bias battery. The value of grid bias is dependent on the plate voltage applied to the tube. The table given below will assist you.

Plate voltage.	Negative bias.
45v.	1½ to 3 volts
90v.	4½ volts
120v. to 135v.	9 volts

You will find a considerable tonal improvement once you have carried out these instructions.

If you have built the two-stage amplifier, just repeat the process, but it is only necessary to solder a wire on to the F terminal on the transformer, and disregard the last tube socket altogether. So, your applied grid bias to the amplifier should be: With 45 volts "B" on the first valve, grid bias, = —1½ to 3 volts; with 90 volts "B" on the second valve, grid bias = 4½ volts and so on.

Next we come to pentode tubes. The inclusion of an extra grid in this type of valve makes them superior to the triodes you have been using in the construction of your amplifier. Strictly speaking, a pentode does not give an absolutely pure output as a triode, but the difference is not noticeable. However, you will find that as far as volume is concerned, the pentode leaves a triode standing. A five pin socket is necessary to accommodate the comparatively modern 1D4 or 1F4 pentode. Either of these two types are suited for the purpose, so we'll select the 1D4 for no reason at all.



The sketch shows the connections (bottom view of socket) for a 1D4 pentode tube. Three grids are shown, but you are only concerned with two of them, as the other one is connected internally. G1 is the normal grid and is connected to the transformer as in a triode, while G2 has the same voltage as the plate of the valve applied to it. The connection from this G2 grid runs to the B+ speaker terminal. Bias voltage for 120 to 135 volts plate is —4½ volts, with about —3 volts bias for a "B" supply of 90 volts. For a pentode, the higher plate voltage is recommended. I have not given you very many instructions in this section as I think you have mastered the intricacies of the triode. The multi element tubes are not hard to understand. A study of a valve characteristic chart and the accompanying socket connections will help you far more than any words of mine.

So, with the help of a five pin socket, your transformer and filament switch, it is quite a simple matter to construct a single audio stage using the 1D4. The volume from this valve will just about equal two triode stages. Should you precede this pentode stage with a transformer coupled type 30, you will get quite a noise out of the speaker. Too much in fact and I do not recommend you trying this. You can do no damage if you do.

Note.—It is sometimes necessary to connect a .001 mfd. condenser between G2 and the plate of the 1D4.

Should you desire to control the volume of your amplifier, you may connect a 1 meg. potentiometer across the secondary of the 1st audio transformer. You will see three lugs on the potentiometer. The middle one usually is connected to the contact arm and is connected to F on the transformer. Either one or the other of the two remaining lugs is connected to G on the transformer. If your control works "back-to-front," change the wire from G on the transformer to the other lug. Manipulation of the control will give you any degree of volume you desire. There are various styles of obtaining volume control and a study of the first audio section of any amplifier circuits will give you these variations.

If at any time you get very weird and distressing noises from your amplifier, place a high valve resistor across F and G on the transformer. By high valve, I mean anything over 20 or 25,000 ohms, the higher the better.

Another triode that may be used in the last audio stage is the power amplifier tube type 31. This tube fits into the same socket as the type 30. A drawback from your point of view, is that this tube requires a high value of bias (1—22½ volts at 135 volts "B").

SECTION FOUR. Simple One Tube Regen. Receiver

Having discovered that a crystal receiver is "broad" in tuning, and that your distance is limited to a few miles only, the construction of a circuit that will, under favourable conditions receive stations hundreds and thousands of miles away, is indicated.

Such a receiver is about to be described and pains taken in its construction will ensure you of a first-class receiver. Firstly, I want you to scrap your crystal set and amplifier, and put the parts on one side, because you will be using them very soon. Take a look at diagram G1 and become conversant with the circuit. It is advisable to build this receiver on a metal chassis with a metal panel. On its own, it may be built very compactly on a chassis 6 in. x 6 in x 1 in. deep with a panel 7 in. long by 6 in. high. However, you may want to follow my future instructions and build on to both ends of this simple receiver, in which case it will be necessary to have a chassis 12 in. long by 6 in. wide and 1½ in. deep. The panel is the same length as the chassis and just high enough to accommodate your dials. The chassis may be a flat piece of metal

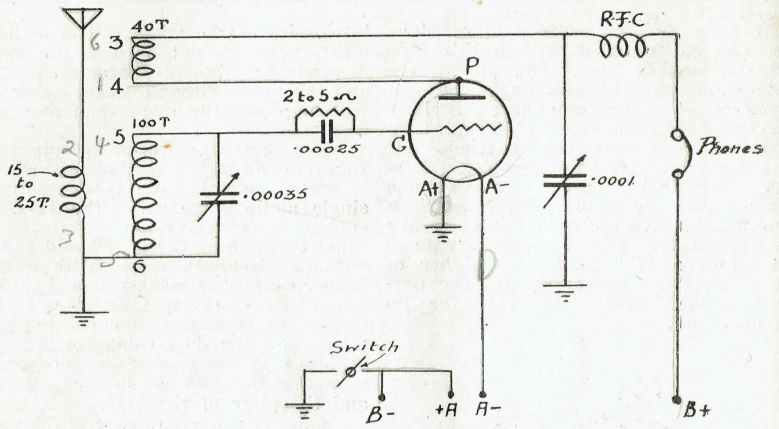
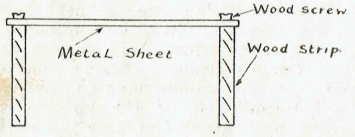
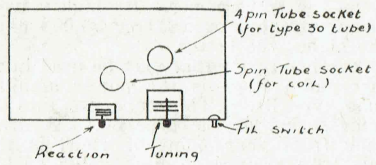


Fig. G1.

screwed on to two flats strips of wood at either end to support the metal strip as per sketch.



Such an arrangement as this is admirable. Screw the panel on to either the wooden strips, or utilise a couple of small angle brackets and bolt on to the metal sheet.



The parts mounted as shown in the sketch look very forlorn. Use wafer sockets and these are mounted underneath the chassis when you have cut a 1⅛ in. dia. hole for each of the two sockets. The five pin socket holds your coil and the 4 pin, your type 30 detector tube. The tuning condenser is your old friend the .00035 mfd. from the crystal set and the reaction condenser has a value of .0001 mfd., and, of course, is variable like the tuning condenser. These condensers are mounted on the panel just clear of the chassis, or may be bolted to the chassis. N.B.—The moving plates of both condensers should make contact with the metal base or panel NOT the fixed plates. The filament switch is mounted so that it is underneath the chassis.

Next comes the coil. Consult diagram C2 and sort out your old crystal coil. Wind, in the SAME direction, 15 to 20 turns of the same gauge wire (32 gauge enamelled) and anchor, leaving two lengths free for connections. Mark 1 and 2 as per sketch. At the end of the 100 turn coil marked (previously) 6, wind in

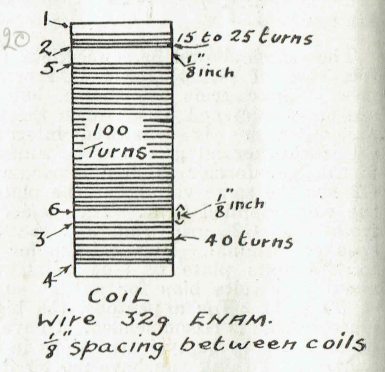


Fig. C2.

the SAME direction as your other windings, 40 turns of the same wire, marking the free ends 3 and 4. Your coil now has 3 windings. The top winding marked 1 and 2 containing 15 to 25 turns. Your 100 turn winding marked 5 and 6 and your reaction winding of 40 turns marked 3 and 4. A spacing of ⅛ in. is made between the windings. If you are using a former without a base, cement the former to an old 5-pin tube base, but the complete 5-pin former is a better proposition. Mark your coil socket as shown in diagram C3 and duplicate the markings on the pins of the coil former. The fixing of the wires to the pins is now a simple matter. An extra hole is pierced

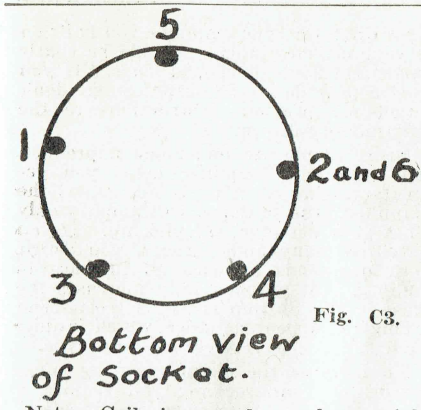


Fig. C3.

Note.—Coil is wound so that aerial winding (1 and 2) is at top of former.

by each free end of wire, the wire threaded through this hole and soldered to its numbered pin. The wires on the former are conneected to their duplicate pin numbers. In the case of wires 2 and 6, these two are connected together on pin No. 2. So, it is now a straightforward job to go ahead with the actual wiring.

We'll start at the aerial and work through to the phone terminals. The wire from the aerial terminal goes to No. 1 on coil socket. No. 2 is bridged to earth. (The common earth is your chassis and panel.) The No. 2 connection can be made to a solder lug that is under one of the fixing bolts for this socket. No. 5 on the coil socket runs to one side of a .00025 mfs mica fixed condenser and your grid leak (shown in parallel with the grid condenser in diagram G1). A wire connects from this point to the fixed plate of the .00035 tuning condenser. The two free wires of the other side of the grid condenser and leak are twisted together and soldered to the G terminal on the 4 pin valve socket. From No. 4 on the coil socket, run a wire to P on the valve socket. No 3 on the coil socket goes to the fixed plates of the .0001 reaction condenser. To No. 3 terminal also, solder a 2.5 mh (millihenry) radio frequency choke. The other terminal has a wire soldered to it and this runs to your phone terminal. From the other phone terminal, connect a length of wire and mark B+ det. From F— on the valve socket, solder a length of wire and mark A—. The other filament terminal goes to the nearest earth (as with the case of the No. 2 connection of the coil socket). From one side of the filament switch, run a length of wire and mark A+ and B—. The other switch terminal goes to the nearest earthing point. You will see by the diagram E1 that, by medium of the metal chassis and panel, Nos. 1 and 6 of the coil, the moving plates of the condensers (tuning and reaction) and A+ and B—, are connected together, thus simplifying the wiring. The earth terminal of the receiver is connected straight to the chassis. It is essential that a good connection is made between the chassis and panel. If there is any doubt about this, bridge the both with a piece of wire. Check your wiring carefully, and carry out the instructions re testing as given for the amplifier. Once you have satisfied yourself that everything is O.K., connect your aerial, earth and phones and switch on, after you have opened the .0001 mfd. reaction condenser fully. Slowly mesh the reaction condenser until a smooth hiss is heard, back off till it disappears and slowly rotate the tuning dial. Stations will be heard and the degree of volume is controlled by the reaction. Tune always to the middle of the carrier wave, not on either side, otherwise distortion will result. "Rock" your tuning condenser across the carrier and you will soon get the idea.

Try not to operate the receiver in an oscillating condition (when it oscillates, that is the hiss you hear). A little practice with this receiver will enable you to receive Aussie and N.Z. stations, with, perhaps, in a good locality plus a good aerial, a possibility of an occasional powerful Pacifice Coast American broadcaster.

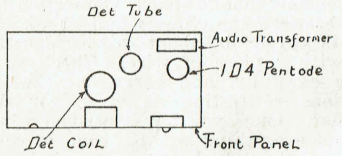
You will find that by judicious manipulation of the reaction control, a high degree of sensitivity can be attained, and hours of fun await you.

SECTION FIVE. Improvements on the One-Tube Circuit

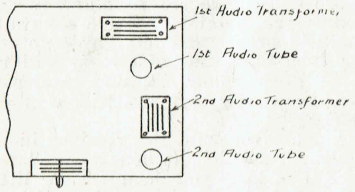
The simple receiver you have just built is perhaps one of the most efficient of its type and one which has held its popularity for a good many years. It is known as "grid-leak detection," but its correct name is Cumulative Grid Rectification. Just what happens in the circuit, in plain language, is: During the positive half cycle of the tube's operation, the grid attracts negative electrons, and the grid condenser plates connected to the grid of the tube become negative. During the negative half cycle, nothing happens. The grid leak allows some of the negative electrons to leak away, and partly restores the grid to zero, thus allowing it to receive the next wave train. Theoretically, if the leak were not in the circuit, the grid would tend to become more negative until a point was reached where the tube would fail to operate. (Blot itself out.) Similarly, if the grid

leak value was too low, the valve would not operate, due to the fact that variation on the grid would not be sufficient.

Well, to return to the story. You now have your detector stage built, and, I hope, neatly wired, in the centre of your chassis. A little extra volume is now desirable, and I would suggest a pentode transformer coupled audio stage. This will give you plenty of volume to come and go on, and the 1D4 tube will do the trick nicely. If you require something a wee bit super, precede the 1D4 with a resistance-capacity coupled stage, using one of your 30 tubes. Or you may use two transformer coupled type 30's. This is up to you, but I recommend my first suggestion. Mount the transformer/s to the right, and at the back of the chassis, with the core at as near to physical right angles as you can get, with the detector tube and coil.



The small sketch will give you an idea. If you are using a two-stage transformer coupled audio stage, your transformers would be mounted thus:



The idea of this right angle business is to prevent the fields produced by the transformers causing howls and instability. In these days of efficient and amply shielded transformers, this particular bugbear is not so apparent as what it was a few years ago. You have previously built an amplifier so there is no need for me to cover old ground. Build your amplifier and, when finished, you can couple your detector stage to it. To B+ on the transformer runs your B+ detector lead whilst your other phone connection is fastened to P on the transformer. Check your wiring carefully, see that your amplifier has the correct amount of bias and "B" supply, connect up your phones or speaker and the result is that you are able to operate a speaker on most of the more powerful broadcasters, and that little voice in the wilderness you were unable to identify because of insufficient volume, is, in all probability, a B class Aussie,

So whatever type amplifier you built on to your detector stage it should be neatly wired and have short grid leads. If you used a pentode in the output stage, don't forget my previous instructions re the .001 mfs. condenser.

Some people are under the impression that an audio amplifier helps you get greater distance. This is not so, as the amplifier, true to name, will amplify only what your detector will pick up. If you have too many audio stages, you defeat your own ends as with an increase in audio gain it automatically increases the noise level. So that is why I recommend a single 1D4 pentode stage, which is quite sufficient for a receiver of this type.

To increase the distance-getting capabilities of your receiver you require a stage of radio frequency amplification. This stage may be tuned or untuned. Naturally a tuned stage is the better, but there is a lot to be said in support of an untuned stage too. But before we go into R.F. amplification, there is another way whereby we may span greater distances with this receiver, and this means exploring the short wave bands. This is achieved by winding a coil composed of a very small number of turns. By rights, the tuning condenser should have a capacity of .0001 mfd., but your present .00035 mfd. one will do.

I could start a first-class argument over the suitability of a .00035 mfs. condenser for short-wave work, but no useful purpose would be served, just now.

Details of the coil to cover the short-wave bands are:—

Former, 1¼ dia. (same as your broadcast coil with base). Wind the coil and mark the same as your broadcast one.

Aerial coil (1 and 2): 3 turns No. 22g enam. or D.C.C. wire, close wound.

Grid coil (5 and 6): 10½ turns of No. 18 g. enam. or D.C.C. wire, spaced between each turn a distance equal to the diameter of the wire.

Reaction coil (3 and 4): 6 turns of 22 g. enam. or D.C.C. wire close wound.

All coils wound in the same direction. About ½ in. between coils.

This coil covers the wavelengths between 17 and 58 metres and thus covers the main shortwave bands. It is desirable that you have a slow-motion dial as a tuning aid, as short-wave stations are easy to pass by. Tune the set as you would for broadcast, only you have to rotate the tuning condenser slowly. The slower the better, as you will discover. Once you have gained a little practice on short-wave, you will find that you have no trouble in picking up distant stations, thousands of miles away, and sometimes with quite respectable volume. To give you an idea what this set will do: During August, 1943, the following were consistently heard at speaker volume:—

B.B.C.—25 and 31 metres.
Japan.—25, 31 and 49 metres.
U.S.A. (San Francisco).—31 metres, occasionally on 25 metres also.
Germany.—(On odd frequencies).

Good phone reception was heard from numerous other countries.

You, too, will hear all these, and more.

SECTION SIX. Adding R.F. Amplification

Having successfully navigated the course this far, you now have a regenerative detector in the middle of the chassis, coupled to an amplifier to the right. On the left-hand side, you still have a bit of room so we'll consider an R.F. amplifier. This stage is no harder than the rest of your labours, and possibly it will be a lot easier.

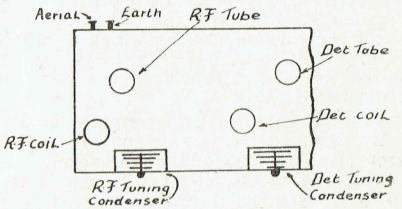
An R.F. amplifier may be compared to its fellow, the audio amplifier. In a sense, they are practically the same. One amplifies radio frequencies whilst the other amplifies audio frequencies.

That is the only difference. Diagram H shows you an R.F. stage preceding your regen. detector and audio stage. The coil (in reality a transformer) which is marked 1, 2, 5, and 6, may be compared to the audio transformer. Both "transfer" energy, but the R.F. component contains less wire, and in this case has no iron core. But remember, some R.F. components of this type do have iron cores, but not to be compared with the core of an audio transformer.

So, cut two more 1⅛ in. holes in approximately the positions given in the small sketch.

The one nearest the panel has a 5-pin socket fixed in position, whilst the one nearest the back of the chassis is a 4-pin to accommodate the 1C4 R.F. valve. I have selected the type 1C4 for no particular reason. A 1K4, 32, or 34 will do equally as well.

Additional components are: 1 radio frequency choke, a .0002 mfd. condenser, a .1 mfd. condenser, another .00035 mfd. variable condenser (or change your detector tuning condenser with a two-gang .00035 mfo. type), another 5-pin former, plus the necessary wire.



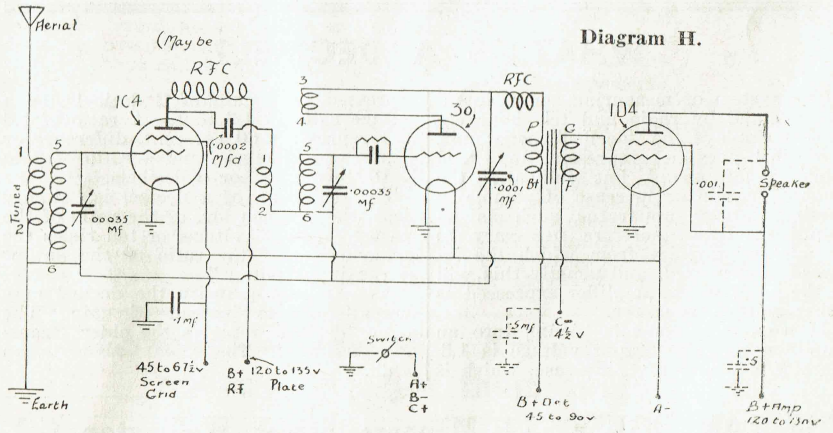
There is no need to install a two-gang condenser as an extra tuning control presents no great struggle when it comes to operating the receiver.

Coil.—Mark coil socket the same as you did in the detector stage, disregarding marks 3 and 4. Wind the broadcast coil as you did for the detector disregarding coil marked 3 and 4.

Coil (short-wave).—Same as above, only duplicate the S.W. coil. The reaction winding (3 and 4) is not wound in either case.

Assuming you are using two separate tuning condensers, mount the R.F. tuning condenser as you did the det. condenser. The grid of the 1C4 is connected to the metal cap on top of the glass envelope, otherwise the wiring is just about the same as for the detector stage, only you don't have a reaction coil and condenser. Aerial goes to 1 on coil socket. Earth No. 2 terminal on coil socket, the same being done to No. 6 also. No. 5 on coil

Diagram H.



socket has a wire running from it, and through a hole in the chassis by the tube base and terminates with a grid clip to fasten on to the 1C4. From the nearest point carrying B+ Amp. voltage (120 to 135 v.) run a wire to the free terminal of the R.F. choke which has been soldered on to the P terminal of the R.F. tube.

From the P. terminal also, solder a .0002 mfd. condenser, the other terminal of the condenser being connected to EITHER 1 or 5 on the detector coil base. Personally, I prefer the connection to No. 1 for various reasons which need not be discussed now, but I fancy the set is more "flexible" when the connection is made to No. 1.

From the screen grid terminal on the valve base, a wire may be run to the B+ connection on the audio transformer. If you are using 90 volts try it and if you do not consider it satisfactory, run a separate lead from the S.G. connection to connect to the battery externally. If you do this, mark the wire "B+ S.G. 45 to 67½v." It is more satisfactory to make the connection as previously suggested. A .1 mfo. condenser soldered to the S.G. connection on the tube base with the other side connected to earth completes this section. A wire running from the fixed plates of the R.F. tuning condenser to point 5 on the coil socket makes the set ready for testing. Check over thoroughly and once you are satisfied, hook up all the necessaries and **Tune the Detector section.** From time to time manipulate the R.F. dial to bring it into a position similar to the detector condenser. As you go up the dial advance the R.F. condenser. Once you have tuned in a station, then pay attention to the R.F. condenser. Carry out these instructions also on short-wave.

You'll find that the addition of a tuned R.F. stage will bring in stations you never heard before and will appreciably increase the volume of those you have received.

Should you desire to tune your set with a two gang condenser, reserve the section nearest the panel for the R.F. stage and the last section for the detector. Wiring is no different, but to get the very best results you need to "trim" the R.F. condenser on each station, especially on short-wave. However, this is easily taken care of and you simply solder a piece of fencing wire to the screw on the trimmer on the **R.F.** section of the condenser. This piece of wire projects just above panel height, and has six or eight turns of insulating tape wrapped round the end to afford a finger grip. To "trim" the receiver, tune in a station about in the middle of the broadcast band and screw in or out the trimmer until the most volume is obtained. A slight variation either way of the trimmer takes care of the broadcast band, over its range.

Follow the same procedure on the short waves.

To use an "untuned" R.F. stage, obscure with a piece of paper the components 1 and 2, 5 and 6 and the .00035 mfd. tuning condenser.

Connect a 25,000 or resistor across points 5 and 6, and between 1 and 5, connect a .0001 mfd. fixed condenser (or smaller). Of course you remove the coil from the socket when trying this out, and also disconnect the wire running to the fixed plates of the R.F. tuning condenser.

You will find that this works equally as well on both S.W. and broadcast, but you do not get the same volume as with a tuned stage. However, it is well worth trying even if it only eliminates dead-spots in tuning.

No matter what style of R.F. amplification you prefer (and I think you'll prefer it tuned) you will find this receiver a very classy little performer and well worth the trouble taken in building it.

WHAT IS A DECIBEL?

The system of measuring sound intensity adopted by radio and telephone engineers employs the "decibel" as a unit. A decibel does not represent any fixed intensity of sound, but indicates the amount of gain or increase of volume in passing through apparatus such as an amplifier. It is therefore necessary to fix a starting point from which the increase is measured, and usually this will be the input to the amplifier expressed as either voltage or power.

If we put a one-volt signal into an amplifier, and the output voltage is 1.3, there is a 33 per cent. increase, which is expressed as a gain of 2 decibels, or a voltage ratio of 1.3 to 1. A ratio of 1.6 to 1 represents 60 per cent. difference or a gain of 4 decibels, and a ratio of 2 to 1, 100 per cent. or 6 decibels.

The definition of a decibel is "twenty times the common log. of the ratio of the output to input voltage, or ten times the common log. of the ratio of the output to the input power."

As a minus quantity the decibel may indicate a loss instead of gain. The name "decibel" replaces the older "transmission unit." The usual abbreviation is db.

THE N.Z. RADIO HOBBIES CLUB

HERE'S ALL ABOUT IT

Objects.—The Club was formed in 1930 with the sole object of fostering Radio as a hobby. The Club was started by the Electric Lamp House, Ltd., and has its mutual advantages to the Club members and to the Company.

The Company stands the very heavy cost of the organising and control of the Club, and assists in financing the publication of the "Radiogram" and other Club publications and activities. It also assists members by allowing a special discount on some of their purchases.

In return the Company benefits by the business sent by Club members.

Rules.—There are no rules or regulations. Members may take part in any of the Club's activities, or they may be satisfied just to receive the Club's literature. As long as members are contented with the value they receive from the outlay of their annual subscription, the Company will always be well satisfied.

Subscription.—An annual subscription of 6/- (Australia 7/6), which is paid in advance, is charged to all members.

Registration Card.—As soon as a new member is accepted into the Club he is provided with an attractive Registration Card showing his number and other details.

Technical Service. — Members may write to Headquarters and obtain advice on their Radio or any other subject. Owing to shortage of staff, members are asked to restrict their questions as much as possible, and to note that it is not practicable at present to design circuit diagrams for individual requirements.

DX Radio Adviser.—Rahob A. T. Cushen, 105 Princes Street, Invercargill, has undertaken to advise members on DX problems. Members requiring information should enclose a stamped and addressed envelope, and give as much detail as possible in connection with the stations about which they want information.

The Name Rahob.—All members of the Club are called Rahobs, and when writing to another member should commence the letter "Dear Rahob." The word Rahob was coined from the first syllables of "Radio" and "Hobbies."

Rahob Library.—A Technical Library is at present in the process of formation. A brief outline of this activity is as follows:—Books will be purchased from time to time and will be available to all members on loan at a small charge to cover postage, etc., and as many technical books are very expensive it may be necessary to ask members who wish to borrow this type of book to pay a deposit to cover the cost, so as to ensure that the books are returned promptly, so that the maximum number of members can obtain benefit from them.

A record will be kept of all donations and those Rahobs who have assisted financially will be given first preference when the books become available. Receipts will not be forwarded to donors, but gifts will be acknowledged in the "Radiogram." Rahobs should indicate when making a donation whether they want their name or club number used in the "Radiogram" acknowledgment.

Club Improvements. — Members are invited to write to Headquarters and make any suggestions how we can improve our Club. Suggestions may cover additional activities, or services, ideas for the "Radiogram," or any way in which we can give better service to the members.

Rahob Fraternity.—Rahobs wishing to meet or write to other members with the object of swapping notes on Radio or other subjects should write to Rahob 1, who will arrange to have his name and address published in the "Radiogram." Pen-friends can also be obtained in this manner. Rahobs should give brief particulars of their interests and indicate whether they have limited radio knowledge and experience or are advanced constructors.

"Radiogram" Advertising. — Members will find that an advertisement in the Small Advertisements page will bring excellent results, and members should use this means of obtaining hard-to-buy parts, or for disposing of their surplus parts, etc. Particulars of advertising rates are as follows:—

1 inch Advertisements .. 6/6

Small Advertisements .. 2d. per word

10 per cent. discount is allowed to Rahobs. Copy for advertisements should reach Rahob 1 not later than the 15th of the month preceding date of issue.

Literary Efforts.—Members are invited to send items suitable for publication in the "Radiogram." They may submit complete technical items, or small items for such pages as "Hints and Kinks," "Slips at the Mike," etc. While most

Rahobs —Show this Article to your friends and get them to join!

Rahobs are only too pleased to assist the Club in this way, particularly good efforts are paid for.

Rahob Transfers. — Transfers are available for use by Club members. These are suitable for putting on a radio set, on letters, envelopes, etc., etc. The Transfers are available as follows:—

Singles, 4d. each.

Sheets, containing 5 different Transfers 9d. each, or 6 Sheets for 3/-.

The big difference in price between single Transfers and quantities is owing to postage.

We hope Rahobs will use these Transfers, as it should be an ideal method of advertising our Club.

Instructions for Use of Transfers.—Clean surface, where it is desired to place the Transfer, and leave surface slightly damp. Cut paper on which Transfer is printed to a convenient size. Soak in clean water for 45 seconds, and place on surface near the place where the Transfer is to be put, **Transfer side up.** Carefully slide Transfer off paper into correct position and smooth out any air bubbles with a soft rag. Leave to dry.

Competitions.—Competitions of various types are held for Club members. Particulars of the competitions are given from time to time in the "Radiogram."

Badges.—A neat Badge is supplied free to all members. Should members lose their Badge, or require additional Badges so that they can have one on each coat, etc., these are available at 9d. each (postage 2d. extra). Members are requesbted to wear their Badges as much as possible.

"Radiogram" — This is the Club's monthly paper, and contains particulars of the Club's activities as well as the latest Radio information, circuits, advertisements, and hosts of other invaluable reading matter. Members are invited to send in articles for our paper; particularly good items are paid for, but most members send in their Ms. as an effort to help the Club. All members receive the "Radiogram" without charge.

"Lamphouse Annual"—This has been published annually since 1933. All members receive a copy without charge. The Annual contains a complete Catalogue of goods obtainable at the Lamphouse, and each edition is a reference book worthy of a place in any library. Contents have included Station Logs, Radio Instruction Courses, Radio Dictionary, Circuits, and Set Constructional details. Any lucky members who have kept the complete 10 issues of the Annual would have a very useful Radio reference library.

Photographic Record.—The Club keeps a Photographic Record. Members are invited to send photographs or snaps of themselves, their equipment or their homes. All photographs should have particulars written on the back, so that they can be recorded in the Album.

While many photographs have already been received, many others have been promised when films are again easily procurable. The Photographic Record should prove an interesting survey of Club members, and their activities. Members are invited to inspect the record at the office of the Lamphouse.

Club Stationery.—Good quality Writing Pads and Envelopes, suitably headed with the Club's name, are available to members as follows:—

Writing Pads .. .. 1/3 each

Packets of Envelopes .. 10d.

Concessions on Purchases.—The Lamphouse allows a special discount of 10 per cent. on practically all purchases of Radio goods (a few proprietary lines excepted). Although most lines have been in short supply and all stocks could have been sold at full price, the Lamphouse has stuck by Club members and has continued to allow this concession right throughout the war. Members must put their registration number on all orders.

New Members.—There is one way where all members can help the Club, and that is by obtaining new members. Show the "Radiogram" and the "Lamphouse Annual" to your friends, and try to get them to join up. There is a subscription form in most "Radiograms," or you can just write a letter introducing the new member, and enclosing a remittance for subscription.

Local Clubs.—Radio Hobbies' Clubs have been formed in various centres throughout the country, and members interested in going to meetings and taking part in the activities of a local club should write to Rahob 1 for the name and address of the Secretary of the nearest club, To give an idea of the activities of these clubs, the following is an extract from a report of the activities of the Auckland Radio Hobbies' Club:

"Meetings are held once a fortnight at the club rooms. Activities at meetings consist of minutes and correspondence; general business connected with the club; questions and answers, when any member can have his problems thrashed out; Radio Instruction talk by an experienced member; Auction of Radio Parts between members; supper; general discussion. Competitions are also held for the Auckland Radio Hobbies' Club members."

Suggestions for the Formation of Radio Hobbies' Clubs—

1. Contact a number of members and **get from four to six names who are** willing to become foundation members of the Local Club, and to attend the first meeting.

2. Call a meeting of those members and decide the following:

(a) Name of Club.

(b) Objects and activities (see below).

(c) Elect Officers. We suggest President, Vice-President, Secretary, Treasurer (or Secretary-Treasurer), and one or two others.

(d) Whether or not a subscription will be levied on members for expenses, and amount of same.

(e) Make any rules that may be necessary.

(f) Appoint sub-committees to deal with the various activities.

(g) How often meetings are to be held. We suggest at not longer periods than every four weeks.

3. Drop a line to Rahob One for further information.

Suggestions for Local Club Activities—

1. Regular monthly meetings, usually held at members' houses.
2. Radio or general Competitions.
3. Exhibition of Sets, Amplifiers, etc., made by members.
4. Visits to important Radio installations such as Hospitals, Broadcasting Stations, Factories, etc.
5. Lectures by prominent radio men or club members.
6. Library to be started by donation of Radio Books by Club members, or a Book Exchange Department of the Club.
7. Call on sick members.
8. Radio Exchange for swapping parts between members.
9. DX Logging Competitions and the collection of DX Cards by the Club as a whole.
10. Literature section to contribute articles to the Club's journal, the "N.Z. Radiogram."
11. Auctions of Radio parts (between members only).
12. Radio Instruction Classes.
13. Visits from prominent Radio personalities.

Besides the above, you could arrange for social events outside the scope of Radio, such as:

(1) Social Evenings; (2) Card Evenings; (3) Picnics and Outings, including Car-rides and Cycle Tours, etc.; (4) Picture Evenings (the Club takes a block of seats at a show). (5) Sports and Games (indoor and outdoor).

Postage Stamps.—Rahobs are requested to send any surplus used postage stamps from parcels, etc., to Rahob One. After the war it is proposed to establish a stamp exchange for club members, but at present we want to build up a reserve of N.Z. used stamps, so that later we will be able to exchange them for stamps of other countries for the benefit of club members.

You want to help the Club? Here's how you can do it, and at the same time obtain a year's free subscription for yourself.

All you have to do is to obtain five new members. Each time you obtain a new member, send his or her name and address, together with the subscription. Don't forget to put your own name and number. In return, the Secretary will send you a Certificate stating that you have obtained a new member. As soon as you have obtained five certificates, send them along to the Secretary, and you will be given a year's free subscription.

Instead of advertising, we are calling this plan "Rahobising." Come on, Rahobs, help yourself by helping the Club. Show your "Radiograms," your "Lamphouse Annual," and your Badge to your friends and get them to join.—Rahob 1.

HOW TO JOIN

To become a Member all you have to do is to fill in this form and post it with a remittance to cover subscription.

N.Z. Radio Hobbies Club,
11 Manners Street,
Wellington, C.1.

I want to join your Club, and enclose a 6/- Postal Note for a year's subscription.

Name .....

Address .....

Town .....

(Annual)

❖ ❖ ❖

Subscription Rates

NEW ZEALAND .. 6/-

AUSTRALIA 7/6

HOW TO BUILD A WAVE TRAP

(By Philip A. G. Howell.)

A wave trap is a hook-up of parts made so that it will trap out or block out all unwanted waves that are getting into a set. This means that if the local station takes up too much of the dial on a set, as for instance 2YA often interferes with 1YA in the Wellington district, it can be tuned out and the weaker station brought in. And as most receivers operating with sufficient aerial to give good short-wave reception suffer more or less with a certain amount of local station interference, a wave trap is a useful addition to almost any set. It may also be used to improve reception from weak stations, and sometimes the improvement obtained is equal to that of adding an extra valve, while in locations suffering from a high noise level a wave trap will help to reduce interference.

The parts required are:—

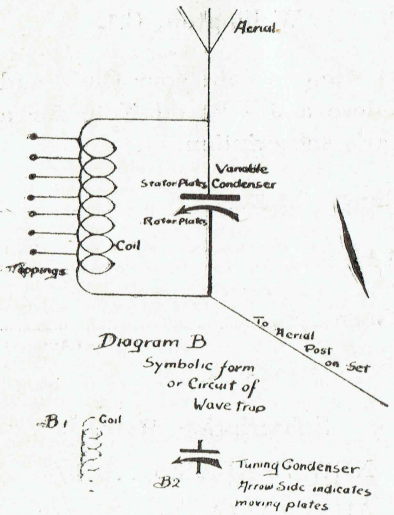
(1) One piece of bakelite, abonite, or cardboard tubing about 4 inches long and 3 inches in diameter to wind the coil on.

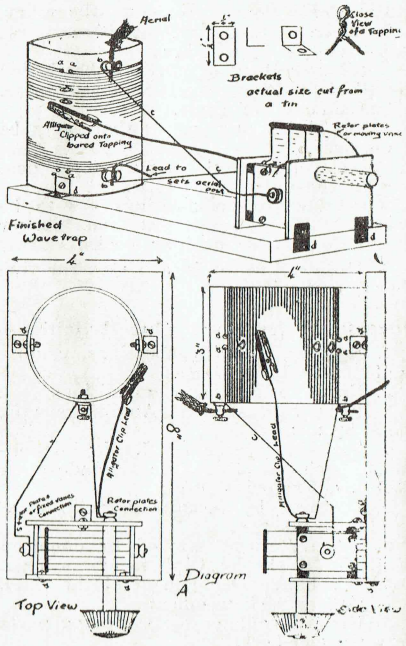
(2) 40 feet of 20 to 24 S.W.G. (Standard Wire Gauge) d.c.c. or d.s.c. (double cotton or silk covered) wire and an alligator clip.

(3) A variable tuning condenser from 350 to 500 mfds. (microfarads) maximum capacity, to tune the coil.

(4) A piece of dry wood about 5 inches by 8 inches, one-half to one and a half inches thick, to mount the parts on.

(5) Two terminals, fitted with nuts, 5 nuts and bolts, and 5 wood screws.





After having obtained these parts we have first to wind the coil. To make this clear, diagrams are given, but even at this early stage it will be seen that it would be quite impossible to give drawings showing each part of a large multi-tube set, so that after one has learned the essential beginning operations of coil winding and mounting it is customary to stop giving pictures and to draw a series of symbols representing the various parts in a large set which show the connections and circuit. Just as £ is the symbol for pounds and $ for dollars, the line of loops shown in Fig. B.1. represents a coil. The word circuit means the method or way in which the parts are hooked together in a piece of wireless apparatus.

First drill two small holes in the piece of tube about half an inch from one end and about one-quarter of an inch apart, as shown in Diagram A at a. a. and another for the terminal b. a little above and some distance away. Next thread one end of the 20 to 24 S.W.G. wire through the holes a. a., to stop it from slipping while the coil is wound, leaving about 6 inches of slack for connecting up the coil later. Part of this slack is scraped bare of insulation and threaded under the terminal b. It is important that the terminal touch the bare wire. Then the wire is wound round the tube with each turn close against the turn before it so that there is no gap between the turns, until five have been wound on. Now the first tapping is made by baring about half an inch of the wire and twisting it about itself into a loop, as shown, without breaking it. Five more turns are wound on and another tapping made, and this repeated until 50 turns are in place, then three more holes, a., a. and b., to correspond with those drilled at the top, are made and the wire threaded through and fixed under the bottom terminal in the same way as before, and the coil is finished, when two more holes to mount the fastening brackets d. d. have been made.

Two of the five half by quarter inch brackets cut from an old tin are drilled (with the point of a bradawl or pair of old scissors if nothing better is handy) to take the screws and nuts and bolts, and bent at right angles. They are then bolted to the coil, which is screwed on to one end of the wood or baseboard, as it is called.

Next the tuning condenser is mounted in the same way, using the other three brackets. As can be seen, two of the brackets are not used bent, but left straight, since they are screwed into the front edge of the board. The symbol for a variable tuning condenser is shown in Fig. B.2.

Wiring.

After the knob has been screwed on to the shaft of the condenser the wave trap is ready for wiring. The end of the slack from the bottom of the coil is bared and connected to the moving plates of the condenser. If this connection is not provided with a screw or terminal, as is the case with most modern condensers, the first soldering has to be done. To this connection the five-inch lead of bared wire to the alligator clip is fastened. By moving the alligator from tapping to tapping, more or less, as the case may be, of the coil is shorted out. The slack from the top has its end bared and connected to the fixed plates, and this completes the wiring up.

Operation.

If it is desired to trap out some interfering station, it (the interfering one) should be tuned in on the receiver, then the aerial detached and screwed into the top terminal while a wire with its ends scraped clean is connected between the bottom terminal of the wavetrap and the aerial terminal or lead on the set. Then the knob is turned until a point is reached where the interfering station will fade right out or be greatly diminished in strength, allowing the station or stations that one wishes to hear to be tuned in in the usual way on the set. If the interfering station is higher in frequency than 850 kilocycles, that is between 2YC and 3ZB, the alligator should be connected to a tapping near the centre of the coil, while if it is lower than 850 kilocycles, that is between 2YA and 2YC, the alligator is not connected to any of the tappings, but left loose.

But if it is desired to improve the volume of some weak station, the trap is connected as described above first, and the knob turned until the plates are wide open or at their farthest apart, then the set is switched on and tuned to the desired station. When this is coming in the wavetrap knob is rotated slowly until the volume and clearness reaches its best.

The process for lowering noise level or interference from static, etc., is the same as for the weak station except that the set itself is tuned off all stations while the knob on the trap is turned until the noise reaches its weakest, when the desired stations may be brought in.

The resultant combination of coil and condenser in a wave trap is shown in symbolic form in Diagram B.

And lastly the idea must not be had that because the set crackles and makes a few bangs and noises while the trap is being connected, etc., while it is going, that any damage is being done or is likely to be done, because everything is perfectly safe.

A NOVEL INDOOR AERIAL

This novel indoor aerial can be completed in less than half an hour and will be found to give excellent results. Underneath a hearthrug of the usual size stitch a zig-zag of flex to form a border of wire, about two inches from the edges and about three inches wide, all the way round. The wire must not be joined upon the completion of the zig-zag border, but the free end taken for the lead-in. Light rubber-covered flex is the best wire to use.

For the ordinary-sized rug measuring about five feet by three feet, about twenty-five yards will be required to make a three-inch zig-zag border underneath the rug. The stitches which secure the wire in place need not, of course, go right through the rug, and so there is no disfigurement of the latter.

Used in connection with a medium-powered receiver, an aerial of this type will give splendid reception, and many interesting experiments can be performed with it. Alternatively, the rug aerial could be used as a counter-poise earth for the usual type of indoor aerial, strung around the picture-rail.

TYPES OF DOUBLET AERIALS AND TUNING UNITS TO USE IN IMPROVING YOUR RADIO RECEPTION

For the present day multi-valve receiver almost any type of aerial will do for many owners. An all-wave high-powered set and just any aerial is compared to a train on a loop line. No matter how good either is their distance-reaching is very limited, but connect either to suitable line and there is no limit to results. With the present day, electrical power apparatus is a prolific noise-creator, such as can be received on any radio set. The noise interference is sometimes so loud as to interfere with even local reception. It becomes a very troublesome factor in short-wave reception because the received signal strength is lower than that from local broadcast stations. Two general types of lead-ins are widely used with noise-reducing aerial systems. The shielded lead-in is effective in the broadcast range, but due to the high capacity between the shield and the lead-in conductor inside the shield it is not often used for short-wave reception. For short-wave reception a balanced transformer line is more efficient, as shown in fig. 1.

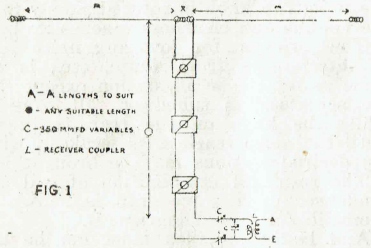


FIG. 1

Balanced lines consist of twisted-pair feeders or two-wire lines with transposition blocks. The latter can be tuned by means of a coil and variable condensers at the receiver in order to increase the signal energy for a comparatively wide range of frequencies. Twisted pair cannot be so easily tuned because standing wave effect will cause excessive dielectric losses. In order to cover a wide range of frequencies with the twisted-pair feeders, combination **doublet** aerials are connected through impedance matching transformers to form an efficient all-wave aerial system. A single **doublet** with a twisted-pair feeder and without special transformers is suitable for operation over a very limited band of a few hundred kilocycles on the fundamental and third harmonic. The design of feeder transformers depends upon the impedance of the twisted-pair feeder, length of line, and type of doublet aerial connected to the line. Many complications enter in construction of these feeder transformers and the home constructor cannot build them without he is prepared to do a bit of experimenting. The following is a general description of the different makes and types also some tried doublets and tuning couplers. To design an aerial to peak at any set wave-length is merely a matter of a few simple lines of arithmetic, using the following formula:—I will put it as an example: Say you wished to erect a doublet to peak in the centre of 31 metre band, then you would require a total length of top (that is total length of the two halves as in fig. 1 A-A) to be 15.5 metres as it is a ½ wave aerial. There are 3.28 feet in 1 metre; the total length will be 15.5 times 3.28 or 50.84 feet. This will give you 25.42 feet for each half A-A or in practice 25ft. 6in. This doublet is suitable for short-wave or broadcast reception but without tuning coupler it will give a limited coverage as it peaks at the designed wave-length of 31 metres. In practice the above method will give the means of designing a doublet for any wave-length. In fig. 2 it

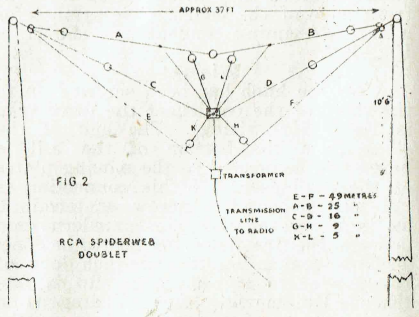


FIG 2

shows a rather more complicated type of aerial system. The action of this aerial is like that of a "T type" over the range from 140 to 4000 k.c. Above 4000 k.c. the system automatically operates as an efficient multiple doublet up to 70,000 k.c. with good noise reduction between 4000 and 70,000 k.c. Several doublets of different lengths can be connected to the same transmission line without affecting the performance of the other, resulting in good signal pick-up in several bands of frequency. If the selected resonant frequencies are not too far apart, the overlapping of their characteristics will tend to give uniform response. Five doublets are utilised in the R.C.A. Spider-web Aerial System. In fig. 2 the bottom wires E and F resonate to 6 m.c. (49 metres) by means of a small loading coil; A and B at 12 m.c. (25 metres), C and D at 18 m.c. (16 metres); G and H at 35 m.c.

(9 metres), K and L at 60 m.c. (5 metres). Loading coils are used in the G and H doublet, as well as in the E and F doublet. The transmission line requires 75 feet of twisted-pair wire, although 45ft. lengths can be added if 75ft. length is not enough. These lengths must not be changed, because the receiver coupling transformer is matched to the line for these lengths. The transformer has a balanced primary and an electrostatic shield which prevents capacitive coupling. This is necessary for noise elimination. No noise reduction is secured for frequencies below 5000 k.c. because the aerials act as a T type on the lower frequencies. The space required for this aerial system is a span of 38 feet and at least a 12ft. vertical clearance. Fig 3

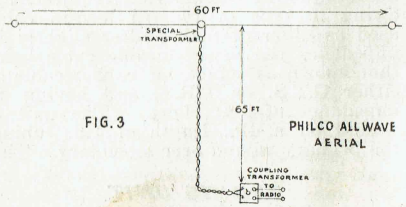


FIG. 3 PHILCO ALLWAVE AERIAL

shows a different type using also aerial and receiver matching transformers. This doublet is approximately 60 feet long and is coupled through aerial transformer and 65ft. of twisted-pair feeders to receiver transformer. This Philco doublet gives all-wave reception from 540 k.c. to 23,000 k.c. Receivers having a low impedance aerial coil circuits designed for doublet do not require the receiver matching transformer. This transformer has a switch mounted which permits reception of broadcast or short-wave at will. The twisted-pair feeder can be altered in length to suit any installation without change in results. Noise reduction in both standard and short-wave reception.

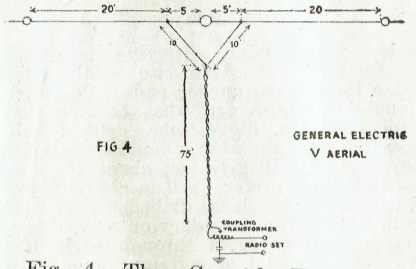


FIG 4 GENERAL ELECTRIC V AERIAL

Fig. 4.—The General Electric "V" Doublet is still a different type, in that it uses a V at top of twisted pair to effect the matching without transformer. This aerial is the only one that I know of that uses such a large dimension V, though many other makers use smaller sizes according to the type of twisted pairs feeders and receiver transformers. Standing waves exist on the twisted pair feeder, as is the case in almost every type of all-wave aerial. The arrangement shown in fig. 4 provides good efficiency on broadcast and short-wave bands, a condition which is not possible with a simple doublet where the twisted pair is connected into the centre of aerial. The matching receiver transformer covers the necessary coupling for all-wave reception.

Fig. 5—The Belder Off Centre Doublet shows still another type which claims to have a very uniform response over short-

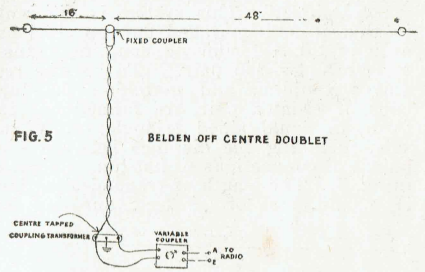


FIG. 5 BELDEN OFF CENTRE DOUBLET

wave and broadcast frequencies and not any sharp resonant peaks. The flat top portion consists of two lengths, 16ft. and 48ft. respectively, of 7 strand No. 24 enamelled aerial wire. A fixed coupler is used to connect the twisted feeders to the flat top. The surge impedance is of a value which spreads the responsive characteristics of the system. At the receiving end, a centre-tapped coupling transformer is employed to divert unwanted in-phase signals picked up by the lead-in to ground. The secondary of this coupler is in series with a small variable capacitator, which may be adjusted to match the input impedance of receiver and lead-in. The aerial system may be erected either horizontally or vertically and has practically no directional effect and the length of lead-in is not critical. The receiver coupler has a switch to convert aerial to "T" type for broadcast reception.

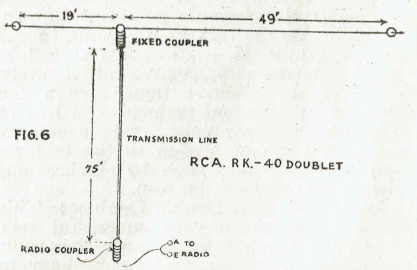


FIG. 6 RCA. RK.-40 DOUBLET

Fig. 6.—R.C.A. R.K.40 Doublet: The R.C.A. R.K.40 Doublet is a simplified aerial system designed to act as an efficient pick-up medium giving high signal strength over an extremely wide fre-

quency range. The flat top portion is 68ft. long with an R.C.A. transformer coupled 19ft. from one end, as shown in sketch. The transmission line is a special two wire cable 75ft. long, which terminates in a sealed junction box in which the receiver coupling unit is housed. This coupling unit matches the transmission line to input receiver circuits. Adequate coverage of all short-wave and long-wave-broadcast bands is secured with a minimum of installation work. This aerial could be erected either vertically or horizontally.

Fig. 7.—"McMurdo-Silver" R9+ "All-wave Doublet": This system is different in that it uses matched flat-top sections each of 25 feet and no coupling transformer to twisted pair. To get the required coupling and matching the top ends of twisted pair are fanned out to form an equal sided triangle of 10½in. side, including the distance between the points of connections to flat-top as shown in fig. 7. The length of transmission line is a minimum of 78 feet, but can be

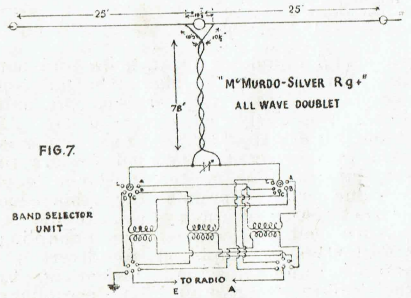


FIG.7

added to in any number of 78 foot lengths. The receiving end of lead-in is connected to a tuning coupler housing three balanced non-reactive coupling transformers, an aerial tuning condenser and five position, four-pole switch. Three positions of switch select three balanced coupling transformers for different wave bands, the fourth feeds the doublet transmission line to receiver, and the fifth converts to a standard L broadcast aerial. By using the formula of total flat-top length in feet ÷ 1.56 = Resonant (min.) wave-length = 25 + 25 = 50, 50 ÷ 1.56 = 32.5 metres or 9,200k.c. approximately. To effect the effective impedance match between flat top and transmission line at this resonant frequency, it is necessary to fan the top of lead-in to the triangle forming three sides each 10½ inches long when connected to flat top.

Fig. 8.—R.C.A. Double Doublet: This doublet has had a very successful trial in short-wave reception and the radio enthusiast requiring a simple, easy to erect, and maximum signal getter could not do better than to use this type of all-wave aerial. The connection between the twisted pair transmission and the double-doublet is clearly shown in sketch,

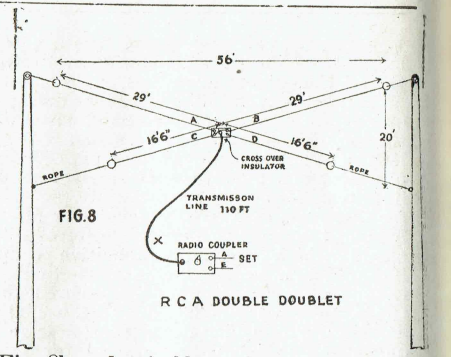


FIG.8

Fig. 8b and suitable tuning unit is given in fig. 8a. To construct this tuning unit it is necessary to be prepared to do a little adjusting to suit your requirements owing to type of twisted lead-in cable used as different makes alter slightly in impedance the most suitable cable being that known as submarine rubber cable or either C.T.S. or T.R.S. and having an impedance of 180 ohms. The unit is wound on a 4in. length of 1in. tubing, the primary wound over secondary. This

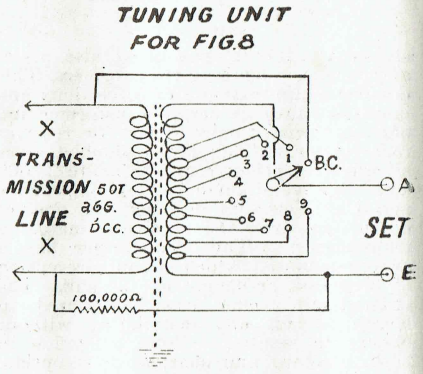


FIG.8A.

is how I made mine. Starting at one end of former, first make two small holes close together to anchor end of 26 gauge double cotton-covered wire, then at distances of ¼in. along tube, drill a hole large enough to take a doubled loop for taps. This will give you about 10 taps, more if your prefer. All is ready if you have the anchor holes drilled at finish of coil. Wind the secondary on now, bringing a tapping down through each hole and out one end of coil long enough to connect to tap switch. When secondary is wound, wrap round two turns of oiled silk or varnished paper or even grease-proof paper will do. Now take a piece of copper foil 4in. x 4in. and solder a flexible lead for earthing shield. Now wrap copper foil round secondary, but insulate end where it overlaps so that the turn is

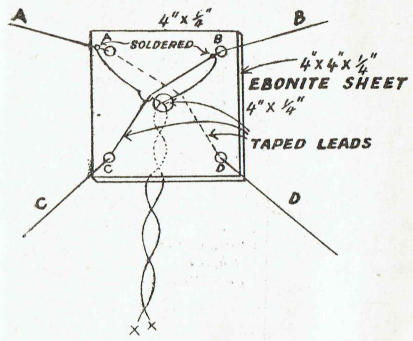


FIG.8B.

open, next cover with two thicknesses of oiled silk or paper and commence the winding of primary. This winding can be tapped also to get best match between twisted lead-in. To start primary, first cut two lengths of tape two inches long, now place loop over wire about 6 inches from end, and start winding on wire, first turn will be over both ends of tape, wind first 5 turns over tape then pull tape tight and start will be held tight; now cut off spare tape ends. Taps to be taken out each 5 or 10 turns whichever is preferred. When 5 turns from finish of coil, place the second tape loop under wire, leaving one inch of loop loose; now wind last turns over tape till last turn, now cut wire off, leaving 6 inches free end, and poke through tape loop and draw tape end tight and trim off. This will make a neat strong coil. Primary should be wound over centre of secondary though very little difference was noticed when wound at one end. Now for assembling and testing: First, connect up lead-in to one end of primary, leaving one end free; next connect up tapping switch to correct leads, taking a lead from switch arm to one end of coil as in sketch. By connecting the taps as shown, the required number of turns can be cut in to suit received wave-length, then to switch to broadcast position converting doublet "T" type aerial. The 100,000 ohm resistor shown connected is to prevent aerial accumulating charges which would cause periodic clicks in receiver.

Now for final test: Tune in a good strong short-wave station and adjust lead-in free wire to primary tap, giving the best pick-up. Some constructors may prefer to use tap switches in both primary and secondary. Turn the secondary tap switch to best position and you now have a very good all-wave aerial system. The whole unit can be mounted in a shielded box then earthed, but make sure you solder the wire from electrostatic shield to frame of shielded box as this shield is very important in the reduction of strange noises picked up. This Double Doublet is of uniform response from 6-24 megacycles. The smaller doublet resonates at 14m.c. and the larger doublet peaks near 7½ m.c. and the third harmonic is 22 m.c. The material required to make up complete outfit is as follows: 100 feet of aerial wire, 110 feet of twin-twisted rubber lead-in cable, 4in. x 4in x ¼in. piece of bakelite for crossover; 4in. of 1in. tubing; 35 feet of 26G. D.C.C. wire; 4in. x 4in. copper foil; 2 lightning arrestors; 10-12 point tapping switch.

Insulators, pulleys, rope halyards, stays, 4 terminals for aerial connections, one for earth; small quantity insulation tape for crossover; solder and shield box for coil. This will prove a great station getter. The directional effect of a doublet aerial is at right angles to lay of installation, whereas the ordinary T aerial directional effect lies in line of installation.

The tuning units shown in figs. 9, 10, 12, 13 can also be used with all-wave doublet aerials, and figs. 9, 10, and 13 have the added advantages in having tuning condensers included. Always remember to include a lightning arrester in each lead-in.

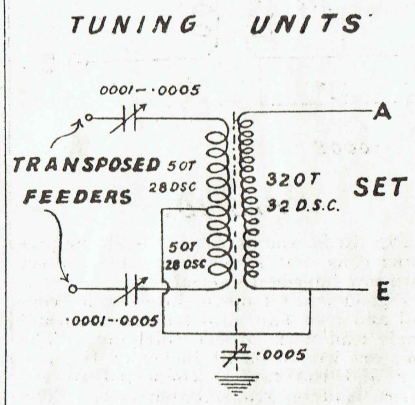


FIG 9

Figs. 9 and 10 are self-explanatory, and are wound on 1¼in. formers. Fig. 9 calls for a bigger effort on the part of the novice owing to the large number of turns on the secondary. There will be two layers on secondary taking up approximately 2¼ inches on former, which needs to be 3 inches long. Place a layer of waxed paper between each layer, connect start of winding to A terminal and finish of winding to E terminal on radio. Now place a layer of waxed paper over windings, then put on the electrostatic shield, being sure that ends of shield are insulated from each other by waxed paper. Have a lead soldered to shield (copper foil) for earthing. Wrap waxed paper over shield and wind on primaries in two halves. Measure centre of coil on paper

then start winding on primary from here to outside edge 50 turns of 28g. D.S.C. wire to each half. Anchor ends of coil by inserting tape as described for fig. 8a. After first half of primary is wound and anchored the second half can be wound by starting again in centre, but separate from other helf by 3-16 inch. First turn round former so that winding runs in same direction as if the two were wound on continuous from end to end. The two starts are converted to earth condenser. The reason for not connecting this directly to earth is to give a variable coupling. If earthed direct the screening may prove too drastic and cut signals too much. This tuner can be used with either doublet or twisted lead-in connected to ordinary end fed aerial to cut down electrical interference.

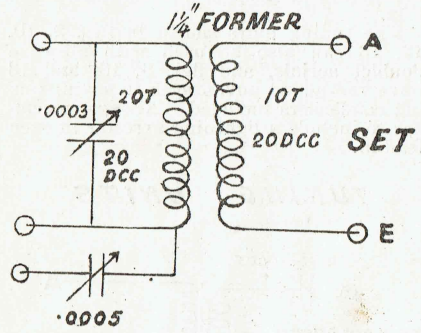


FIG 10.

Fig. 10 is wound in same style as previous coils, but is more suitable for set with low impedance aerial coil.

Fig. 11 is a set up for interference control and uses two auto transformers and single lead with outside shielding. The coils are wound on 2½ inches of 1in. former and the tap is connected to the centre lead on transmission line. The signal is then converted to low impedance for transmission to radio set where the other transformer again steps the signal up to former strength for receiver. This type of aerial transmission hook-up has proved very satisfactory in localities where electrical interference is troublesome. The size of wire used on coil is not very critical, but 32 gauge D.S.C. has proved very satisfactory with my set up. Constructors can vary size and number of turns to suit gear on hand. I give winding lengths as this makes it easy to drill formers for tap and end connections.

Fig. 12 shows two double wound transformers and shielded lead-in or transmission line. The set-up can either be used for doublet aerials or interference aerial, which is erected at considerable distance from house. The feeders then can be run along on low poles like two telephone lines at a few inches apart. If used for

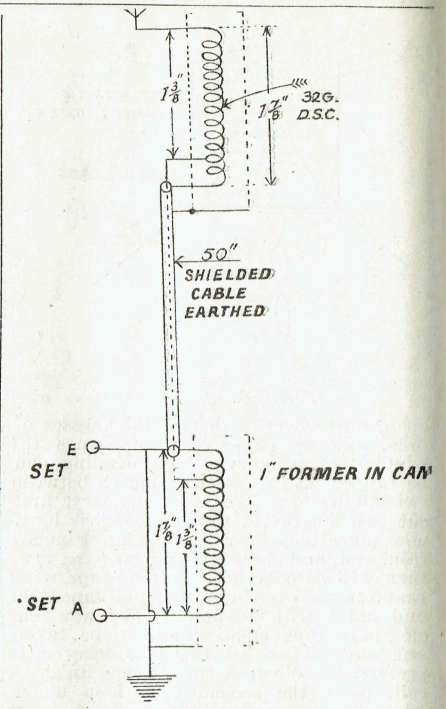


FIG. 11

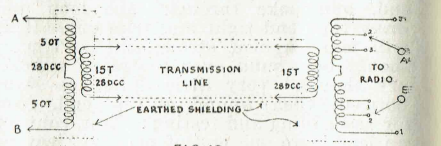


FIG 12

this purpose the feeders will not need to be shielded, but ordinary aerial wire run on insulators from the aerial transformer to receiver transformer at house. One line can be earthed and the aerial shielded can then be connected to this line, also receiver transformer is earthed. The receiver transformer secondary is tapped to give better atchming and also has 28 gauge D.C.C. wire wound in two halves of 50 turns tapped. Wind on 1-inch formers.

Fig. 13 is rather a more elaborate set-up but is very effective on short-wave doublet. The doublet that is made to suit this tuning unit is made in the form of two cages, having a length of 20½ feet and using four lengths of wire each. Each cage has three cross spreaders and all wires are joined at each end, looking like two cigars end to end.

The twisted lead-in is joined in centre, one lead at each end of insulator and cage. This tuning unit could also be

used with a standard single wire doublet instead of the cage type. The Faraday screen between coils can be made by soldering straight short lengths looped on to

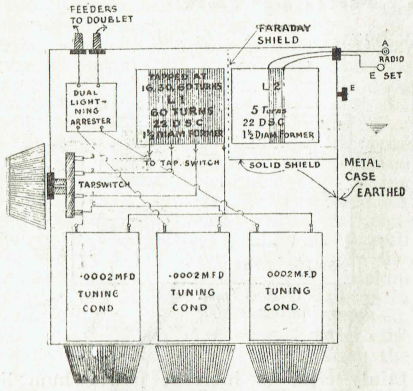


FIG 13

one supporting wire held in vice, then square up and trim to required size. The screened box can be made to suit own material and taste. The secondary coil could be wound with several taps then the most suitable tap used, as receivers of different makes have different impedance aerial coils.

Fig. 14 is a simple slider type tuner, which is very effective in tuning a very long aerial when it is connected across the A and E terminals of radio set and is effective both on short-wave and broadcast, but more especially on the 500 k.c. and of broadcast band, where it will bring up strength of stations from just audible to good room volume. If wound on a tapered former it is more effective on short-wave bands. The former can be ½in. at one end 1½in. at other end, and wound with almost any insulated wire that can be cleared along a track for slider.

These aerials and tuners here described will prove very effective and any constructor will find that effective power of receiver has increased beyond expectations.

N. H. White, 5049.

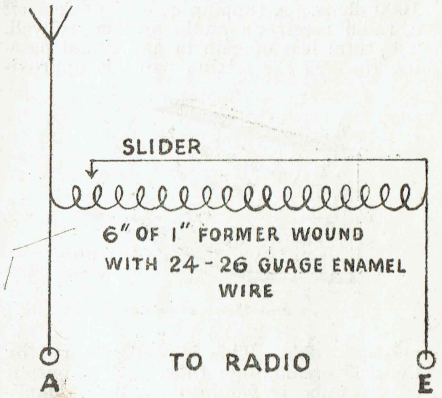


FIG. 14

MICROFARADS

A farad is the unit of capacity, but as it is too large for ordinary use the millionth part, or microfarad (mfd.), is used as the practical unit, and this again is divided into a millionth part, or micro-microfarad (mmfd.), useful for stating small capacities. For ease in translating the latter into the former, a few leading capacities are given:—

Mfd.		Mmfd.	Mfd.		Mmfd.
.001	=	1000	.00008	=	80
.0005	=	500	.00005	=	50
.0003	=	300	.000025	=	25
.00015	=	150	.00001	=	10
.0001	=	100			

Some periodicals term micro-micro-farads "pico-farads."

CELLULOID CEMENT

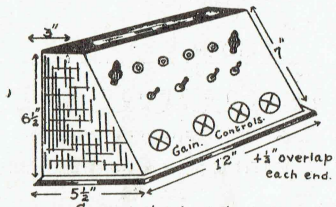
Celluloid cement is very useful in radio work for keeping short-wave coil turns in place, "doping" coils and formers, etc. It is made by dissolving small chips of celluloid in acetone, or, better still, a mixture of one part of amyl-acetate to two of acetone. The amyl-acetate is a better solvent than acetone, but more expensive. For thinning purposes the "thinner" sold for duco enamel can be used, but it will not do for the initial solvent.

A COMPLETE AUDIO MIXER AND PROGRAMME AMPLIFIER

(By Rahob 9275)

1. General Particulars.

This mixing panel includes four inputs. One is for a permag. 5 in. speaker-microphone (Rola 5in. P.M. speaker used as a mike) and the remaining three are for medium impedance sources of input such as magnetic pickups of impedance 4000-1000 ohms. A tapping could be taken off a radio receiver's audio system as well. The total loss of gain in any signal passing through the mixing panel is approxi-



General Sketch of finished panel.

mately 6 db's. This is well restored by the 6C5 preamplifier tube V_1. The output of this tube is fed into the main amplifier for additional amplification and conversion into power output. (The amplifier I use is the "Belltone Dynamic.")

It will be noticed that the extra two valves, V_2 and V_3, form a complete amplifying unit. This is the "programme amplifier." Its use is to enable the announcer, who should be in another room for best results, to listen to the programme he is compering, and so know when to announce the items.

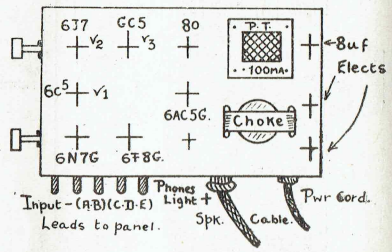
The theoretical working of the mixer is perfectly straightforward, and anyone who understands the operation of a tube can well understand this. But enough of theory. Now for the practical side.

Constructional Details.

A diagram which shows the placing of components and general layout is given. The materials I used came mostly from an apple case, but the front panel was made of three-ply.

The plan of amplifier layout is given only as a model; hence no measurements are given. I got very good results from a similar layout, but each constructor may have the amplifier made on a different chasis.

Control knobs on the mixer are all symmetrically arranged, and the picture shows some indicator lamps included as well. The main circuit diagram does not show the lamps connected with the switches, as they are only frills and cer-



tainly tend to increase power hum by induction. To eliminate this I used a separate shielded wire for the lamp circuit with reasonable success. The way to wire up lamps, if one is keen to do so, is to obtain some single pole, double throw toggle switches and wire them so that when the input is "live," i.e. a signal is passing through it, the circuit of the lamp is connected and the input is left free. The circuit diagram marked (3) shows how this is done.

The question of shielding now crops up. One can use yards of shielding braid on a job like this. Yes, yards! It is obvious that, when so many A.C. carrying leads are going round above earth potential as in this circuit, a high impedance grid circuit must pick them up, and the only two ways of preventing this are, (a) to short out the A.C., (b) to shield the grid leads. (b) is the obvious choice here, so hence the yards of braid! Also, since the panel is made of wood, all the metal parts on potentiometers, switches, jacks and transformers that would normally be earthed should definitely be earthed. Of course, the ideal panel would be made of sheet metal, and in commercial apparatus it is. However, wood will serve, provided one care-

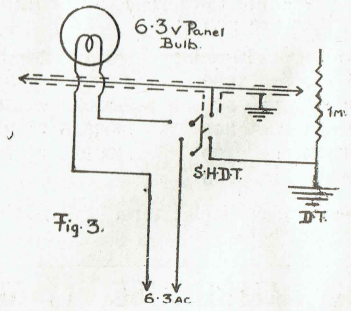


Fig. 3.

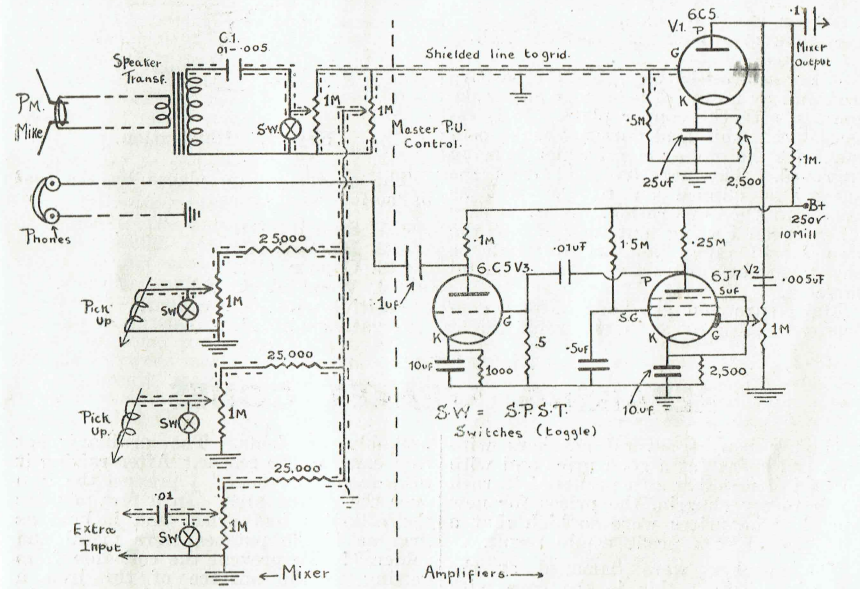
fully earths all switch-shells and transformer laminations to a common grounded busbar.

A useful addition at this stage is a tone control. We will deal with the microphone first. In the case of a P.M. mike, where bass is the predominant feature of output, one would more likely be concerned in bass-reducing. This is done by putting small condensers, about .01 mfd., in series with the one marked "C_1." This reduces the amount of bass response from the mike by offering an increased reactance to the bass notes and letting all the "highs" go past little affected. A capacity of .005 is best suited for condenser C_1, then the tone is very well balanced indeed. Now for the more important tone compensator—the pickup control. A 30,000 ohm potentiometer in series with a .02 mfd. condenser is ideal. This combination is connected with the potentiometer nearest the earth, from the rotor of the master pickup control to earth. Effective control is given and ranges from full on when nearly all the "highs" are bypassed and all one hears is the "woof, woof, woof" of the bass, to screechy, ear-splitting, crowd penetrating trebles!

Now for a little advice on the studio lines and layout. The microphone line, since it terminates in an impedance of 2.3 ohms, should have as low a resistance as possible. Good grade power flex is just about as good as can be got for the purpose of transmission line, but even then twenty-foot long mike lines would make a difference to the output. The 'phone leads can be of any wire available that doesn't short.

The studio itself should be small, sound-proof and easily got to. All that is really required is a sound-proof compartment to prevent acoustic feedback.

All that is needed now to make an efficient programme is an operator and an announcer. I cannot supply details of these, so thus ends the description of the "Audio Mixer."



ENGRAVING PROCESS

INTERESTING AND USEFUL EXPERIMENT.

Here is how you can engrave your name on a metal surface, such as your saws and other tools, by an electro process.

Obtain some stencil paper as used in duplicating machines and lay it perfectly flat on a clean, flat surface. With a sharp instrument cut your name or design in the stencil. Obtain some copper sulphate (ordinary blue-stone) and mix with water, making a strong solution. You also require two pieces of heavy blotting paper and a piece of copper sheet, all the same size as the stencil. Soak the blotting paper in the solution and then assemble the parts as shown in the diagram.

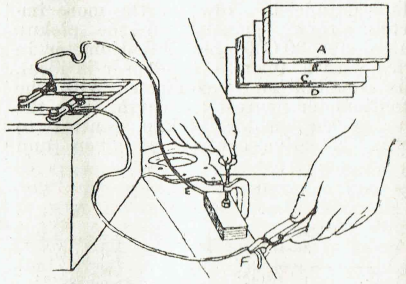
1st—the stencil (D) on the tool or metal being processed;
2nd—the blotters (C);
3rd—the sheet of copper;
4th—a block of wood.

Use a clamp to hold the electrodes tightly on the tool.

Using a 6-volt battery, take the positive lead and by means of a battery clip make contact with the copper plate. It is essential that this lead **does not** make contact with the tool or metal which is being engraved. The negative lead from the battery is clipped on to the tool as shown in the illustration. A little care taken when cutting out design on the stencil will repay you, as you will be able to produce attractive work on metal surfaces.

Make sure you get your battery connections right, as a short circuit might damage your battery. Watch out that the leads do not foul the holding clamp or any other object which would cause a short circuit. Leave connected for five or ten minutes and the design will show on the tool in a bright copper colour which cannot easily be removed.

It is suggested that you should try on a piece of scrap metal first, so as to make sure you are following the instructions correctly.



Key to Illustration.

The electrodes are placed on the tool in the following order:

1. Stencil (D).
2. Blotters (C).
3. Copper (B).
4. Wood Block (A).

Positive wire E to copper.
Negative wire F to tool.

REPAIRING SPEAKER CONES

Having bought several speakers with damaged cones (at a good price and with an idea of reselling at a profit), I learned much to my chagrin, the prices for new cones! The prices were so high that a loss instead of a profit would result.

The speakers were damaged at the centering device; this is the case with nearly all damaged cones. I tried repairs, and with good success, after several attempts.

Cutting out the damaged area, I sandpapered the edges of the cut to a rough finish. Cutting a piece of paper from an old cone, I pasted the patch to the damaged area, with white collodion.

It takes a while to dry, and the patch must be held in place all that while, probably an hour. The ordinary hot iron came to the rescue. After raising it to a good, hot "heat," I pressed the iron over the pasted area. In a few minutes the collodion had dried, and it held as firm as if the patches were metal and soldered! To prevent the collodion from getting to the surface of the iron, a piece of paper is laid over the area to be heated.

A new centering device should be installed and the cone replaced on the speaker. The cone is then as good as new, and no fear should be entertained that the pasted patch will come loose.

This idea also works very well with dynamic speakers which have been punctured by accidental means; in this case, ordinary type-writer paper is used.

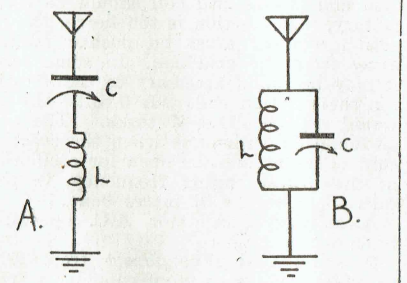
TUNING COILS—THEIR USE AND DESIGN

By F. H. ADAMS.

SECTION I.

The operation of selecting the signal we require and rejecting others is known as tuning. It must be realised that the atmosphere is crammed with radio waves of differing frequencies radiated by dozens of transmitters. If we require reception of one transmission only at a time, some method of tuning becomes necessary. The tuning part of a receiver is interposed between the aerial and the detector, and consists of an arrangement of coils, or of an arrangement of coils and condensers. The selectivity of a receiver, therefore, depends upon the efficiency of the tuned circuit or of the series of tuned circuits employed. To be more exact, the operation of a tuned circuit is that of discrimination against the signal frequencies not required. It follows accordingly, that, if a number of such tuned circuits follow one another, unwanted signals are progressively weakened until only the desired frequency is present in the detector circuit. The principle is the basis of all modern receiver design. We shall see later, however, that selectivity may be improved without resorting to big and expensive receivers of many stages.

To understand the theory of tuning, it is necessary to commence with the aerial. If an aerial were connected directly to earth, radio-frequency currents would flow in it due to the oncoming waves. These currents would, however, be very small, and no tuning would be possible. Because of these disadvantages, we place a coil in the aerial circuit so that a voltage is developed across the coil by the variations in the radio-frequency currents flowing between aerial and earth. The aerial circuit may now be turned by using a variable condenser in series (A) or in parallel (B).

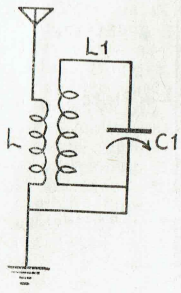


The design of A constitutes an Acceptor Circuit, and current flow is maximum at the resonant frequency of the coil-condenser combination. The circuit may, therefore, be used to favour reception of a particular transmission.

The second circuit represents a Rejector design and operates so that current flow is minimum at the resonant frequency of the coil-condenser assembly. The circuit, accordingly, functions to weaken one particular station. When used for this purpose the combination is sometimes referred to as a Wave Trap. Its function, however, is to weaken the offending station and it does not operate as a trap in any sense of the word.

All tuned circuits are of either the series or the parallel type. The series design is now seldom used, except in the case of small receivers where the utmost sensitivity is required. Nevertheless an aerial series condenser is a well-worthwhile adjunct for short-wave reception, particularly when a long aerial is used. The parallel coil-condenser circuit is used freely in almost every type of radio apparatus. The important property of a coil is inductance, and that of a condenser is capacity. These terms are abbreviated to L for inductance, and to C for capacity, and a tuned circuit is commonly referred to as an LC circuit. Every LC circuit has a resonant frequency at which current flow is maximum. At other frequencies the flow of current is less. Thus a transmitter radiating at the same frequency as the resonant frequency of an LC circuit is received more strongly than other stations operating at different frequencies. Tuning depends upon this principle. So if we wind or buy a coil with a certain number of turns, we have a non-variable inductance. If we connect a variable condenser across or in parallel with the coil, we then have a certain value of inductance, and an amount of capacity that may be varied from minimum to maximum according to the rating of the condenser employed. Then, for every setting of the condenser we have a different LC circuit, and the resonant frequency alters as we vary the amount of capacity by means of the rotating shaft.

We may now consider a typical aerial-coupling, tuning system.

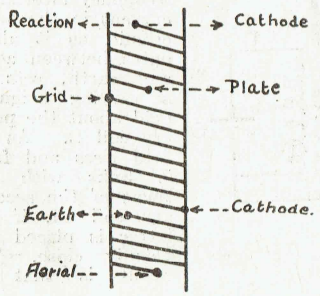


The flow of radio-frequency alternating current in the aerial circuit, as it alternates between aerial and earth, sets up a varying magnetic field about the primary coil L. As the field rises and falls, it links with the turns of the secondary coil Li, if the latter is placed sufficiently close. The result is that an

alternating voltage is induced in the secondary and alternating current circulates in the tuned circuit LiCi, current flow being strongest at the resonant frequency of the LC circuit. Some measure of selectivity has been gained, and the alternating signal voltages may be applied to the grid of an R.F. amplifier, or to a detector circuit for rectification and de-modulation.

In practice it will be found that one tuned circuit is not sufficiently selective. Also the signal voltages are so minute that reception is not likely to be satisfactory except, perhaps, in the case of a powerful nearby transmitter. To increase efficiency, we may amplify the R.F. signals tuned in, and follow up with another LC circuit tuned to the same frequency. The resultant R.F. signal voltages may be applied to a further amplifying stage or stages, or to a detector stage. However we go about it, the general scheme becomes a number of tuned circuits between aerial and detector. It is apparent, therefore, that if a number of stages are to operate simultaneously at the same frequency, each L.C circuit should have the same resonant frequency for every tuning adjustment. Where two or more stages are concerned, home-wound coils are hardly likely to prove suitable unless one has experience in coil winding and adjustment. The novice would be better advised to use factory-wound coils, and balance the tuned circuits by adjustment of the usual trimming condensers. This process consists of slightly altering the capacity of each LC circuit to compensate for slight difference in inductance and/or capacity.

So far, we have considered multi-stage receivers, but the same principles apply to the tuning circuits of small regenerative receivers. Regeneration consists of feeding back R.F. energy from the output circuit of a valve to the input. The general idea is that the R.F. fed back is re-amplified at the resonant frequency of the LC circuit. If intelligently used, re-action improves sensitivity and selectivity enormously. However, the basic requirements of a tuned circuit remain the same whether regeneration is used or not used. The first essential is that the tuned coil have the correct number of



turns to enable the desired band of frequencies to be tuned in by adjustment of the associated condenser. A widely used Reinartz type coil assembly is shown.

Most published data concerning the number of turns refers to 1¼ in. or 1½ in. coil formers. If these are not available, 1¼in. former may be fitted to a valve base, or factory-wound coils such as the Hobbies Duplex may be used with adjustment of the number of turns where necessary.

If it is desired to tune the 16-19-25-31 metre bands, the grid coil should have 7 turns of bell-wire or of 20 gauge enamelled. The turns should be spaced so that the grid end and the cathode end are 1¼in. apart. That is the winding length on the former should be about the same measurement as the diameter of the former. Generally speaking, primaries should have about 3-5 the number of turns on the secondary, for maximum transfer of energy. In this case, 4 turns for the aerial is sufficient. If the primary is inter-wound with the bottom turns of the secondary, the aerial is tightly coupled for maximum sensitivity and minimum selectivity. Close-winding the primary about ⅛ in. from the bottom end of the secondary loosens the coupling for a slight improvement in selectivity and a slight drop in sensitivity. Moving the primary farther away from the secondary further loosens the coupling. In general it will be found that a regenerative detector performs best when the aerial is fairly loosely coupled, and the aerial coil should be spaced ¼in. away from the grid coil.

The number of turns for the reaction winding will differ according to the type of valve, the positive voltage, the filament voltage, the method of reaction control, the method of wiring, the placement of components, etc. With normal voltages 5 turns close-wound about ⅛ in. from the grid end of the grid coil should be satisfactory. If reaction is too fierce, the reaction winding must be pushed farther away from the grid coil. In some cases it may be found necessary to use 8 turns for the reaction coil. A 9-volt Hiker's would require about 12 turns. The best all-round adjustment is when the reaction control is nearly wide open for oscillation at the lowest tuning frequency, in this case when on the 31 metre band.

A suitable design for A.C. operation is shown.

A small tuning condenser from .0001 to .0002 mfds. maximum capacity is preferable on the short-waves, but a full-sized condenser may be used if it is desired to use the receiver for broadcast reception as well. In the latter case a vernier dial would be indispensible when on the short-waves. Another proposition is to reduce the capacity of a big condenser by connecting a .00025 mica

condenser between the grid end of the grid coil and the fixed plates of the tuning condenser. It is also possible to devise a means of switching the mica condenser in or out of circuit as desired, provided that there is at all times either direct or capacitative coupling between the grid end of the coil and the stator (fixed plates) of the tuning condenser.

Valves suitable for the circuit shown are:—6J7, 6S7, 6K7, 77, 78, 6C6, 6D6, 57, 58. The straight pentodes will probably prove more efficient in this application, but the R.F. tubes may be used successfully, usually provided the reaction turns are increased.

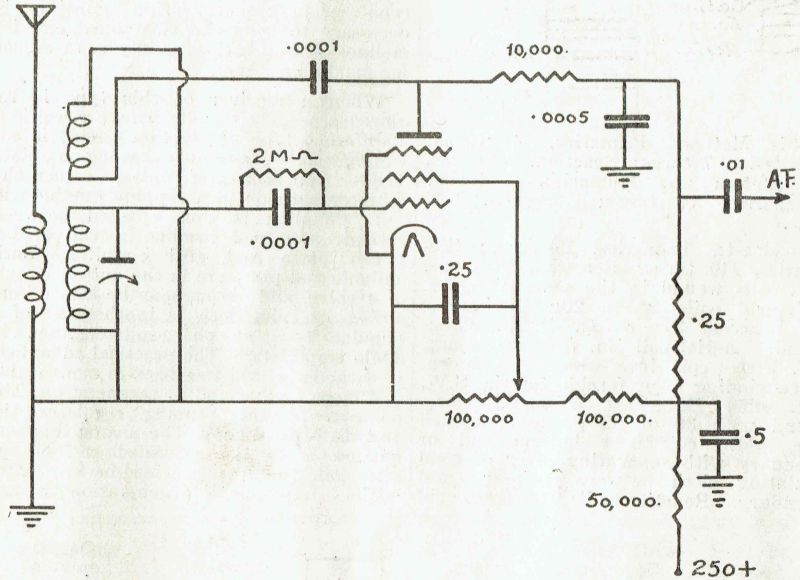
COIL DATA	Aerial	Grid	Reaction
16-31 metres	4	7	5-8
31 metres up	8	14	8-10
Broadcast	15	110	25

All coils wound in the same direction. Plate condenser connects to end of reaction coil nearer to grid end of grid coil.

Short Wave Grid Coils 22g. bell-wire or 20g. enamelled.

Primaries and Re-action 30g. or 32g. D.S.C. enamelled.

Broadcast Coil All windings 30g. or 32g. enamelled.

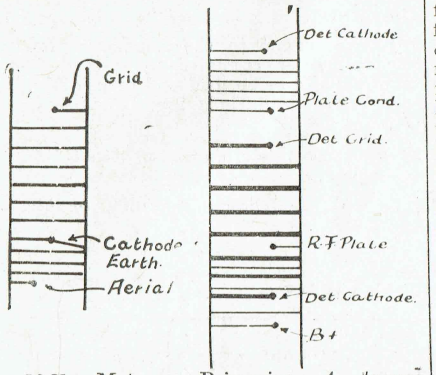


SECTION 2.

If it is desired to employ a stage of R.F. amplification and a regenerative Detector, it is feasible to use the R.F. tube as either a tuned or as an untuned amplifier. The use of even an untuned stage is preferable to no R.F. stage at all, and improves the efficiency of the detector. Any R.F. pentode may be used and operated with the steady bias provided by a 500 ohms Cathode resistor bypassed by .1 mfds. The aerial should be coupled to the R.F. amplifier grid through a variable condenser which may be used as an additional tuning condenser for maximum signal from any station tuned in. A grid leak of 50,000 ohms between grid and the grounded end of the cathode resistor provides a suitable grid return. The plate of the R.F. tube receives its positive voltage through the primary of the detector coil, and signal transfer from the R.F. stage to the detector grid circuit is effected by mutual induction between primary and secondary just the same as when the serial is connected to the primary.

To change the untuned R.F. amplifier to a tuned stage, it is necessary to tune the grid circuit and couple the aerial to the tuned circuit. As it is customary and convenient to tune both amplifier and detector circuits with a ganged two-section tuning condenser, it becomes necessary to provide a coil for each grid circuit which will have the same tuning range. The grid coils should, therefore, be identical. The other necessary windings may be designed according to cir-

cuit requirements. For all-wave reception, the separate plate reaction coil is probably the easiest method. Suitable coils are shown:—



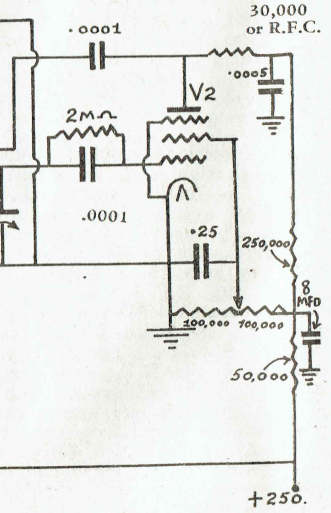
16-31 Metres: Primaries, 4 turns; Secondaries, 7 turns; Reaction, 5-8 turns.
30 Metres up: Primaries, 8 turns; Secondaries, 14 turns; Reaction, 8-10 turns.

Broadcast: Primaries, 15 turns; Secondaries, 110 turns; Reaction, 25 turns.
All coils wound in the same direction. S.W. grid coils 24 to 20g.; Primaries and Reaction 30 or 32g. D.S.C., close-wound. Aerial coil ⅛in. from secondary, R.F. Plate coil inter-wound as shown. Space-winding is preferable for the S.W. grid coils. Broadcast coils all close-wound with 30 or 32 guage enamelled wire, plate coil over bottom end of secondary with separating layer of good insulating cloth between primary and secondary. Reaction coils ¼in. from grid end of grid coil, and aerial coil ¼in. from ground end.

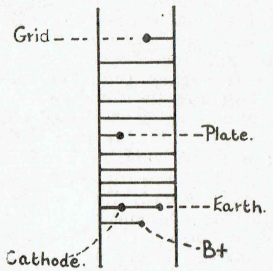
The usual adjustment process applies to the reaction coils. If reaction is too fierce, the reaction coil may be spaced farther away from the grid coil. In extreme cases it may be necessary to remove one turn. With some tubes the number of turns may have to be increased. For smooth regeneration it is preferable to interwind one-half of the detector primary with the secondary, at the bottom end of the secondary.

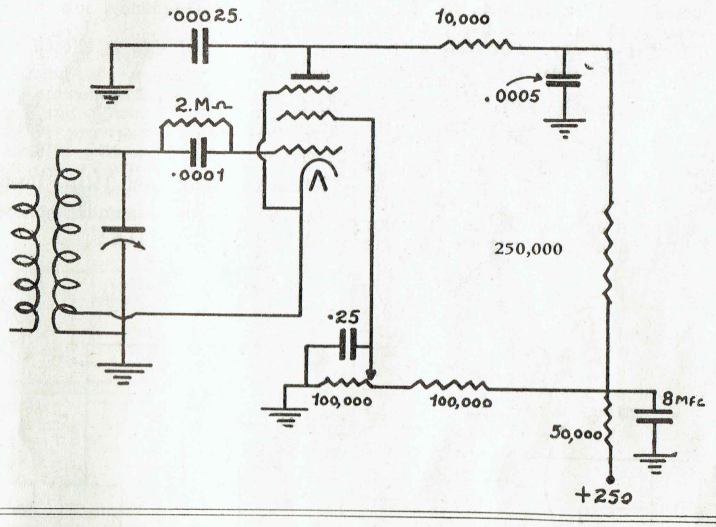
In the following circuit an additional tuning condenser is shown connected across the main condenser in the R. F. tube grid circuit. This control is necessary to keep the two tuned circuits in line. Its operation usually is to adjust for maximum signal.

When a receiver of this type is required especially for short-wave reception, a different type of reaction circuit is advantageous. Instead of using a plate Tickler Coil, it is preferable to return the detector cathode to a tapping on the grid coil. Coupling is thus effected between cathode and grid circuits instead of between plate and grid circuits. Both cathode and plate are in the output circuit of a valve, and output may be taken from either, or from both as in the case of a popular type of phase-splitter used in audio amplifiers. The practical advantage of cathode to grid feed-back is more stable and more easily handled regeneration. The position of the tapping regulates the amount of feed back. The nearer this connection is to the grounded end of the grid coil, the less the feed-back. After initial adjustment, regeneration is controlled by regulation of the screen voltage in both this and the former detector circuits. Coil details and a suitable circuit are shown, the R.F. circuit requiring no alteration.



It is often assumed that superheterodyne design is too complicated to permit amateur coil-winding and adjustment. It is true that good quality I.F. transformers are essential, but the front-end tuning circuits can be managed without great difficulty, if the object is straight short-wave reception. For a dual-wave outfit, a commercial coil-switch assembly is preferable unless one has had considerable experience in this class of work.





Coil Details	Aerial	R.F. Grid	R.F. Plate	Det. Grid	Tap
8 — 16	3	3½	2½	3½ (¾in)	1-3rd turn
15 — 32	5	7	3	7 (1¼in)	½ turn
29 — 62	8	16	6	16 (1½in)	¾ turn

All coils 24 g. D.S.C. or D.C.C. Winding length of grid coils on former as shown in brackets. All formers 1¼in. or 1½in.

To design suitable coils for a mixer-oscillator circuit it is necessary to have some knowledge of the particular valve employed. The fundamental principles of tuning apply just as much as in a T.R.F. receiver, but the correct amount of feed-back from oscillator plate to grid must be established. This has been taken into consideration in the coil data given below, the most commonly used valve being the 6K8, with the ECH35 a direct replacement except for screen and oscillator plate voltages.

The first consideration is that the mixer grid should be tuned to the incoming signal. The second essential is that there should be a difference of frequency between the mixer and oscillator grid circuits. This difference in frequency must be the same as the frequency of the I.F. transformers employed. In other words, the mixer grid and the oscillator grid tune to different frequencies which both affect the electron stream within the valve. The result is that a third frequency is produced and this is the Intermediate Frequency.

There are several simple methods of arranging the tuning circuits. Probably the most straightforward solution is to wind the two tune coils so that there is a slight difference of inductance. If each is then connected across its section of the gang, the resonant frequency in each cir-

cuit will be different. Usually the oscillator grid circuit tunes to a higher frequency than the mixer grid circuit. If, then, the oscillator is operating at a slightly higher frequency than the mixer, the mixer circuit may be tuned to a lower frequency by adding capacity to the mixer circuit. If the added capacity takes the form of a small variable condenser connected across the main tuning condenser in the mixer circuit, then adjustment of this trimming condenser will enable the operator to control the difference of frequency between mixer and oscillator circuits. It would be possible, also, to control the oscillator frequency by using the small variable condenser as a padder, that is, connected between the ground end of the oscillator grid coil and ground, to raise the oscillator frequency. For simplicity it is proposed to deal with the first method only.

With the appropriate coils it should be possible to tune the 16 metre band with the plates nearly right out of mesh. With the gang set in this position, the trimmer condenser should be varied for a signal. The main condenser may also be gently moved backward and forward at the same time. If it is found necessary to use more than a fraction of the trimming condenser on the highest tuning frequency for each coil, the inductance of the mixer coil may be increased by pushing the grid turns more closely together, so that only a slight variation of the trimming condenser is needed to tune in stations. If necessary, the oscillator grid turns may be pushed slightly further away from each other. In the first case the Inductance is increased, and in the second it is lowered. Once the bands are located, and dial readings noted, the amateur accustomed to handling a regenerative receiver will soon get the hang of the controls. The trimmer condenser will need to be varied on each band, lower frequency bands requiring more capacity than the high-frequency, low wave-length bands.

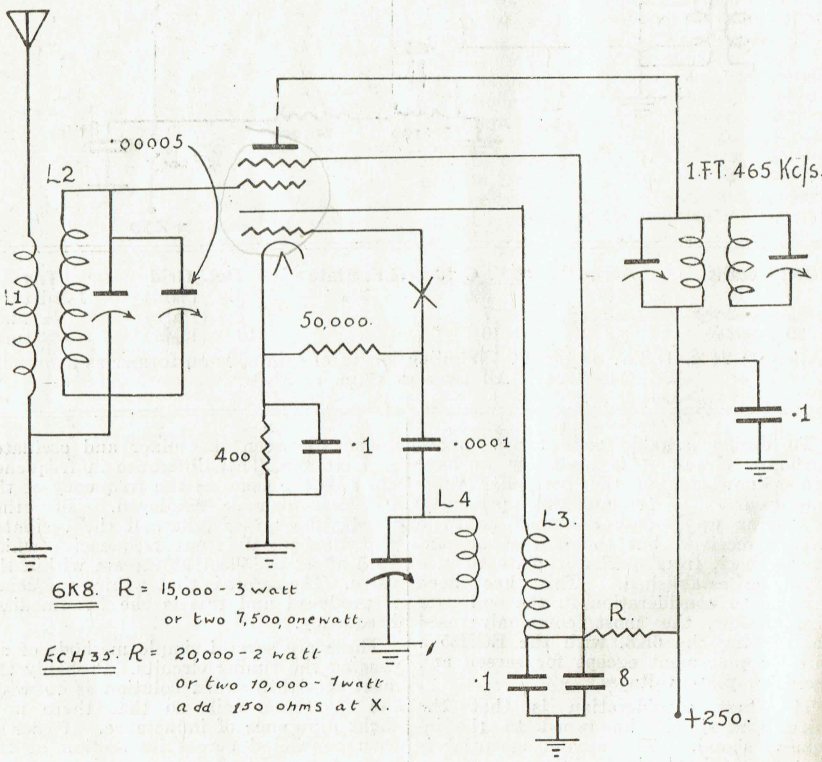
An orthodox design is shown with coil details.

COIL DETAIL	L1	L2	L3	L4
16—31 metres ..	4	7	3½	7
30 metres up ..	7	15	6	13¾

All coils wound on 1¼in. formers.

L2 and L4—20g. enamelled spaced 1½in.

L1 and L3—30g., D.S.C.



L3 interwound between bottom turns of L4, the first turn commencing below first turn of L4.

L1 wound ¼in. from ground end of L2.

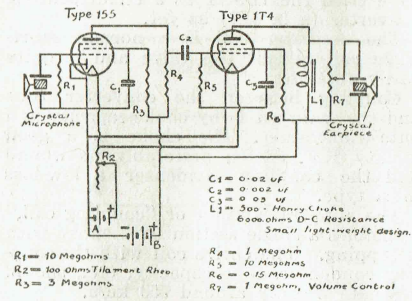
It has been endeavoured to explain the fundamentals of tuning. Once these have been grasped, the radio beginner may proceed intelligently with the design, winding and use of tuning coils. Adjustment is generally required for individual cases when using published data, but this is no hardship, if one understands the why and the wherefore. Complete receivers have not been shown as each would need a detailed description. It is hoped that enough information has been given to warrant any beginner setting about the fascinating work of coil winding with a certain amount of confidence.

DEAF AID AMPLIFIER

(From "Service," U.S.A.)

The recently introduced spen-pin miniature tubes are well suited for use in a hearing-aid amplifier which employs an air-conduction earpiece; sufficient gain and power output for such a unit can be provided by two miniature voltage-amplifier tubes drawing a total filament current of 100 ma.[1]

Tests have shown that the best miniature-tube complement for an air-conduction hearing aid is a 1S5 followed by a 1T4. The 1T4 is desirable for use in the second stage because it can provide more power output than the 1S5; the 1S5 is desirable in the first stage because it can provide more gain than the 1T4. A circuit using this tube complement is shown in Fig. 1.



It was found desirable to use choke coupling, rather than resistance coupling, for the output of the 1T4 in this circuit. With resistance coupling, the voltage at the plate of the 1T4 was so low that the gain and output of the 1T4 were inadequate. Suitable chokes, small enough and light enough for use in a wearable hearing aid, are commercially available.

The filament rheostat (R_2) is the battery saver frequently used in hearing aids. This rheostat should be set so that filament current is at the lowest value providing adequate signal output. It is possible to use the rheostat as the volume control and thus to eliminate potentiometer R_7. However, volume can be controlled more smoothly by means of R_7 than by means of R_2. It is not advisable to insert a volume-control potentiometer in place of R_1 or R_5 because suitable potentiometers having a resistance as high as 10 megohms are not generally available. A resistance of less than 10 megohms for R_1 or R_5 would reduce the circuit's sensitivity.

CONVERSION TABLE—Kilo-Cycles to Metres.

Freq. in K.C.		Wave-length Metres.	Freq. in K.C.		Wave-length Metres.	Freq. in K.C.		Wave-length Metres.	Freq. in K.C.		Wave-length Metres.
1000	=	299.8	880	=	340.7	770	=	389.4	650	=	461.3
990	=	302.8	870	=	344.6	760	=	394.5	640	=	468.5
980	=	305.9	860	=	348.6	750	=	399.8	630	=	475.9
970	=	309.1	850	=	352.7	740	=	405.2	620	=	483.6
960	=	312.3	840	=	356.9	730	=	410.8	610	=	491.5
950	=	315.6	833	=	360.1	720	=	416.4	600	=	499.7
940	=	319.0	830	=	361.2	710	=	422.3	590	=	508.2
930	=	322.4	820	=	365.6	700	=	428.3	580	=	516.9
920	=	325.9	810	=	370.2	690	=	434.6	570	=	526.0
910	=	329.4	800	=	374.8	680	=	440.9	560	=	535.4
900	=	333.1	790	=	379.5	670	=	447.5	550	=	545.1
890	=	336.9	780	=	384.4	660	=	454.3			

S.W. CONVERTER FOR BATTERY SETS

(Rahob 8411).

Fitted to any broadcast battery set, this unit converts it to a dual-waver. The parts are not expensive.

Some time ago we gave the circuit and details of a modern version of the type of short-wave converter which enjoyed such popularity until the time when dual-wave receivers became more or less universal.

Apparently there are still thousands of ordinary broadcast receivers in operation, judging by the popularity of this circuit, and the many requests we receive for short-wave converters and short-wave adaptors.

Fortunately it is a simple matter to build a battery-operated converter and it is easier than an A.C. model when it comes to attaching it to the receiver, for leads can be run direct to the batteries.

Use:—

The short-wave converter here described can be fitted to any sensitive broadcast receiver and makes it capable of receiving short-wave stations direct.

The performance when used with a set having plenty of gain is equal to, or in some cases superior to, a dual-wave receiver. The reason is, of course, that an extra valve is added.

Some of the smaller dual-wave receivers, especially those employing only four valves, are not especially sensitive on the short-wave bands. We tested our original converter with a set of this type, and we found that the short-wave results with the converter attached to the set were infinitely better than those obtained on the short-wave band using the dual-wave switch. It seems, in fact, that this converter can serve a very useful purpose in this matter of boosting up the performance of a small dual-waver.

What it is:—

A short-wave converter consists of a frequency changer valve, which, when operating ahead of a T.R.F. set, makes it into a superheterodyne with the "intermediate frequency" amplification being carried out at a frequency at the end of the broadcast band (around 550 kc/s.), the radio-frequency stages becoming the I.F. stages.

When the converter is used with a superheterodyne receiver, it converts it to a "double super," the frequency at which amplification is performed being changed twice before detection. The first I.F. is about 550 kc/s. and the second I.F. (or intermediate frequency) is the normal 465 kc/s.

The Circuit:—

The circuit design follows the same lines as the A.C. and battery versions previously described, except that we now give some alternatives in case parts are scarce.

The aerial is aperiodically coupled to the converter valve ("aperiodic" means "untuned") so that only one variable condenser is required.

This eliminates the difficulty of aligning a two-gang condenser and also reduces the cost.

If you want the utmost in sensitivity, then a two-gang condenser and a normal short-wave aerial coil can be employed.

The valve shown is the 1C7G, a two-volt octal-based pentagrid converter. A six-pin equivalent is the 1C6. We selected this valve as most of the coils available work best with it.

Other battery converters are the 1A7G in the 1.4 volt class and the 1A6 and 1D7G in the 2-volt series. No one seems to have tried the 1D8GT as a triode-pentode converter (a la 6F7) as yet.

The oscillator coil is a normal short-wave coil to suit the valve and is quite easily obtained.

Coupling between the converter tube and the main set is by choke-capacity and auto-transformer. The choke is a good quality R.F. choke, preferably pie-wound and the coupling condenser a low-loss mica type.

The auto-transformer or "coupling coil," resembles a single section R.F. choke with a tapping. The entire coil with the coupling condenser, tube capacity, etc., should resonate broadly around 550 kc/s.

Substitutes:—

For the aerial coil, an ordinary short-wave choke (say, 100 turns on a lin. former) may be substituted and the shunt resistor omitted or replaced by a 30,000 ohm. resistor. The size of the aerial series condenser is not critical—it may vary from .0005 mfd. to a pair of insulated wires twisted together. Experimenting here is valuable.

The oscillator coil is easily obtained or may consist of a pair of windings on a cylindrical former about ¾in. diameter. The grid winding is 6 turns and the plate winding 8 turns, both of 26 or 28 gauge enamelled wire and separated about 1/20in.

Aerial Type:—

For satisfactory short-wave reception, a good aerial and earth are necessary. Luckily, battery sets are not usually subject to the crackling and man-made static that exists around all A.C. operated receivers.

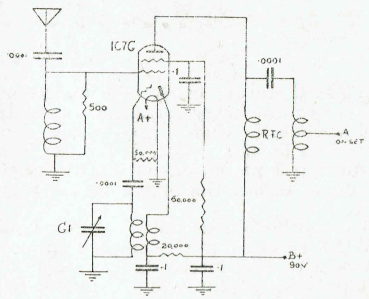
An aerial of the inverted-L type is generally quite satisfactory.

Attention should be paid to careful insulation and to good connections between sections of the aerial, the "lead-in" and the converter.

Refinements:—

Useful additions are band-spread condenser (a low-capacity midget condenser shunted across the main tuning condenser), a senstivity control and a double-throw switch for switching from short-wave to broadcast band.

One set of contacts would be used for the filament of the valve and the other set for the aerial.



Circuit of the short-wave converter suitable for fitting to any battery set.

PARTS LIST.

1—chassis of wood, masonite, or metal, approx. 6 x 6 x 2in.
1—good quality variable condenser
1—slow-motion dial
1—coil kit and R.F. choke
1—20,000 ohm. resistor
1—50,000 ohm. resistor
1—60,000 ohm. resistor
1—500 ohm. resistor
3—.0001 mfd. mica condensers
3—.1 mfd. condensers
1—6C7G valve
1—Octal socket
2—Insulated terminals.

Output Ratios for Dynamic Speakers

Any Valve Arrangement

Total Output Valve Load Resistance	Speaker Impedance (ohms)																		
	1	2	3	4	4·5	5	5·5	6	6·5	7	7·5	10	12	15	20	25	30	40	50
500	22·4	15·9	13·0	11·2	10·6	10·0	9·56	9·1	8·7	8·4	8·1	7	6·4	5·7	5	4·4	4	3·5	3·1
1000	31·7	22·4	18·3	15·8	14·9	14·2	13·5	12·9	12·4	12·0	11·5	10	9·1	8·1	7	6·3	5·7	5	4·4
2000	44·8	31·7	25·9	22·4	21·1	20·0	19·1	18·0	17·6	17·0	16·3	14·1	12·8	11·5	10	8·9	8·1	7	6·3
3000	54·8	38·9	31·7	27·4	25·9	24·5	23·7	22·2	21·6	20·7	20	17·4	15·9	14·1	12·2	10·9	10	8·6	7·7
4000	63·3	44·8	36·6	31·7	29·9	28·3	27·0	26·0	24·9	22·9	23·1	20	18·3	16·3	14·1	12·6	11·5	10	8·9
5000	70·8	50·0	40·9	35·0	33·4	31·7	30·1	28·0	27·8	26·8	25·8	22·4	20·4	18·2	15·9	14·1	12·8	11·1	10
6000	77·5	54·8	44·8	38·7	36·9	34·3	33·0	31·0	30·4	29·3	28·3	24·5	22·4	20	17·4	15·5	14·1	12·2	10·9
7000	83·7	59·2	48·2	41·9	39·5	37·5	35·7	34·2	32·9	31·7	30·5	26·5	24·2	21·6	18·7	16·7	15·2	13·2	11·8
8000	89·5	63·3	51·7	44·8	42·2	40·0	38·2	36·6	35·2	33·8	32·7	28·3	25·8	23·1	20	17·9	16·3	14·1	12·6
9000	94·9	67·1	54·8	47·4	44·8	42·5	40·5	38·8	37·2	35·7	34·7	30	27·4	24·5	21·3	19	17·4	15	13·4
10,000	100	70·8	57·8	50·0	47·2	44·8	42·7	40·9	39·3	37·9	36·5	31·7	28·9	25·8	22·4	20	18·2	15·9	14·1
11,000	105	74·4	60·6	52·5	49·4	47·0	44·8	42·8	41·2	39·7	38·3	33·2	30	27·1	23·5	21	19·1	16·6	14·8
12,000	108·7	77·5	63·3	54·8	51·7	49·0	46·7	44·8	43·1	41·5	40	34·7	31·7	28·3	24·5	22	20	17·4	15·5
13,000	114·5	80·7	65·9	57·0	53·7	51·0	48·7	46·5	44·8	43·2	41·3	36·1	33	29·4	25·5	22·9	20·8	18	16·2
14,000	118·5	83·7	68·4	59·2	55·8	53·0	50·4	48·3	46·5	44·8	43·2	37·5	34·1	30·6	26·5	23·7	21·6	18·8	16·8
20,000	141·5	100	81·8	70·8	66·7	63·3	60·4	57·8	55·5	53·5	51·7	44·8	40·8	36·5	31·7	28·3	25·8	22·4	20

Exact Ratios are given, but a small deviation either way is permissible

A.V.C. IN SIMPLE TERMS

(By RAHOB 7854)

While there are many who understand the "whys and wherefores" of automatic-volume-control there are many, many more who do not, and it is for the latter group that I am endeavouring to explain, in simple terms, the action of these systems.

Automatic-volume-control (abbreviated A.V.C.) systems were designed in order to reduce the necessity for repeated manipulation of the volume control knob of radio receivers, and to prevent overloading of the amplifier tubes on strong signals. The A.V.C. continuously and automatically adjusts the sensitivity of the receiver, so that the signal input to the audio amplifier remains fairly constant, within certain limits over a wide range of received signal strengths. In other words the fundamental purpose of the A.V.C. system is to vary the amplification produced by the R.F. and I.F. amplifiers of a receiver in inverse proportion to the strength of signals received. Loud signals are amplified proportionately less than weak signals. Distortion is also less likely to occur in receivers equipped with good A.V.C. systems as the input to the audio system is kept at a nearly constant level for a fixed setting of the manual volume control, and so overloading of the audio tubes is prevented under normal operating conditions. Another advantage of the A.V.C. system is its ability to maintain the level of fading signals fairly constant. As a signal fades out the sensitivity of the receiver is automatically increased, and the signal is amplified more; the reverse takes place when the signal strength builds up to more than its average value. From this it must not be assumed that A.V.C. is a complete cure for fading, because it is not, and, as a matter of fact, its use has certain drawbacks. For example, when "selective fading" occurs the carrier and sideband frequencies do not fade out simultaneously. During a period when the carrier may be very weak the sidebands may be relatively much stronger and would be passed through the receiver (owing to the dependence of A.V.C. on the carrier) at a greater strength than when the carrier frequency is present. When this takes place periodic blasts of harsh reproduction are heard, and it may be sometimes preferable to limit the action of the A.V.C. device so that fading occurs after the signal strength drops below a certain value. Another drawback with A.V.C. is the fact that, when bad fading occurs, the intensity of the background noise will be increased until it is as loud as the original signal.

There are numerous varieties of A.V.C. circuits, including circuits using multi-element tubes which include diode elements, but all are basically the same. Refer now to Fig. 1. In this drawing

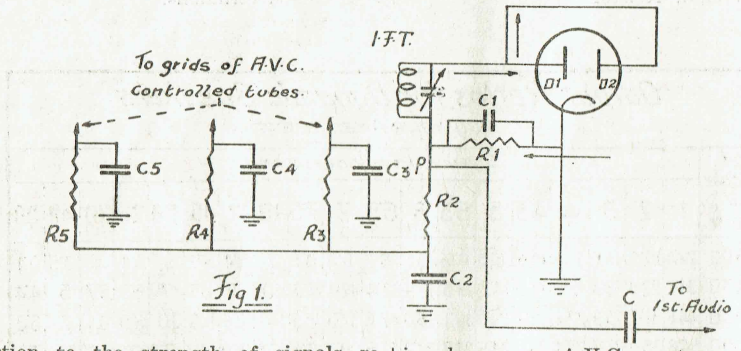


Fig 1.

is shown an A.V.C. system which is sometimes used, and is perhaps the easiest to explain. Forgetting for a moment the grid-return resistors in the R.F. and I.F. circuits, let us begin with the detector.

THE "A.V.C." DETECTOR"

The two diode plates D1 and D2 are connected together and to one side of the last I.F. transformer coil. The signal voltage is rectified because current can flow only when the diode becomes positive and the coil must then be considered as the generator. This will perhaps help to explain why the resistor R1 will carry a current in the direction of the arrow, making the point P negative with respect to the cathode and the chassis.

The current flowing between P and the chassis consists of a D.C. component, an R.F. component and an A.F. component. The condenser C1 has been placed across the resistor to pass most of the R.F. currents, and the A.F. component is, of course, taken off to be applied to the grid of the 1st audio amplifier by means of coupling condenser C. The steady negative voltage developed across resistor R1 is applied as a bias, to the grids of the R.F. and I.F. tubes through the filtering resistors in the grid-return circuits. Now, if the signal starts to fall off, the negative bias developed across R1 would be less, the bias on the R.F. and I.F. tubes would therefore be less and their amplification will be greater, thus compensating for the tendency of the signal to drop in strength.

THE "A.V.C. NETWORK"

Some means must be provided to filter out the A.F. component, and precautions against interstage coupling should be taken. This is accomplished by the network of resistors and condensers of Fig. 1. Since the grids of the amplifying tubes are never drawing current, it does not matter, within limits, how much resistance there is between the point P and the individual grids. No voltage drop can take place across them because there is no current except in the case of overloading where very high values of resistance may cause tube blocking. Resistor R2 and Condenser C2 form a resistance-capacity filter which smoothes out most of the A.F. fluctuations. That it does so is best seen from a consideration of the laws of alternating currents.

Since the condenser which is in series with the resistor R2 forms a path for alternating currents, a great part of the A.F. signal will pass through C2 in preference to following the paths through R3-C3, R4-C4, R5-C5. The percentage of the original A.F. voltage appearing across C2 is found as follows:— Supposing R2 to be 1 meg. and C2 .05 mf., which are popular values, the impedance of the condenser at 50 cycles would be 64,000 ohms. Adding this value vectorially to the 1 meg., we have

$$Z = \sqrt{1{,}000{,}000^2 + 64{,}000^2}$$
$$= 1{,}002{,}000 \text{ ohms (approx.)}$$

The percentage of the original A.F. voltage appearing across C2 is then $100 \times 64/1\,002 = 6.2$ per cent. At higher frequencies the percentage is lower. This is the first filtering stage.

The resistor-condenser combinations in the grid-returns each from a second filtering stage which again may reduce the A.F. voltage to a few per cent. of the remaining 6 per cent., thus bringing the final audio voltage down to 0.1 per cent. of the original, or even less. The question is: how much resistance and capacity are required; and, is there such a thing as having too much of it? Yes, there is.

Looking again at the calculation of the filter above, it will be seen that halving the value of resistor R2 and doubling the value of condenser C2 would have given exactly the same degree of filtering. Consequently, it is the product of C and R which determines the filtering efficiency, and any two values of C and R whose product is the same will give the same degree of filtering. Also the larger the product CR, the better the filtering.

TIME CONSTANT

The product CR is called the "time constant" of the resistor-condenser combination and is the time required to discharge the condenser through the resistor down to 37 per cent. of the original charge (or to charge it to 63 per cent. of the voltage of the source). In a circuit containing only capacitance and resistance, the time required for the potential difference between the charged plates of a condenser to fall to a definite percentage of its initial value is determined by the capacitance of the condenser and the value of the resistance. For the voltage to fall to 37 per cent. of its initial value,

$$t = \frac{RC}{1{,}000{,}000}$$

where t is the time in seconds, R is the resistance in ohms, and C is the capacitance in microfarads.

Returning now to the A.V.C. circuit of Fig. 1, if the strength of the incoming signal is suddenly changed, the negative voltage at the point P will change immediately, but it will take some time before the condensers have been charged or discharged, and it will take that long before the R.F. and I.F. stages have adjusted their sensitivity. When this this period is too long it becomes extremely difficult to tune the receiver, because tuning past a strong station to a neighbouring weak one, the sensitivity of the receiver is still lowered due to the strong carrier, and the weak station will not be heard unless extremely slow tuning is practised. Similarly, when tuning to a strong station it will take some time before the receiver adjusts itself, and during that time the set will overload.

The correct time constant is a compromise between the best filtering and the desired speed of following signal strength variations. The best values are between 1/10 and 1/20 second. For this circuit the time constant is equal to the product of R2 plus R3 and C2 plus C3. When the resistance is given in megohms and capacitance in microfarads the following equation is used:

$$t = CR$$

where t is the time in seconds.

Slight variations of the circuit of Fig. 1 will be found in most of the

present-day receivers, but, as mentioned before, they all work on the same principle. As no amplification is derived from any sort of diode detector, dual-purpose tubes were developed, and the diode tube is now generally a double-diode-triode or a double-diode-pentode as shown in Fig. 2. These tubes can be

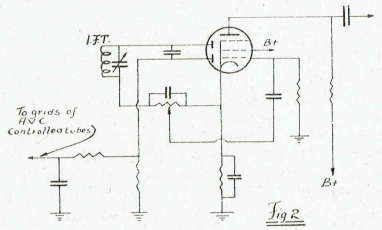


Fig 2

made to perform as detector, A.V.C. rectifier, and audio amplifier as the diodes and the pentode (or triode) portion are independent of each other. The pentode (or triode) portion of the tube is generally used as an audio amplifier, but in some cases the tube is worked "backwards," that is, the pentode or triode portion is used as an I.F. amplifier. Sometimes a separate diode is employed for the detector. The two diodes are then coupled by a small condenser as shown in Fig. 2. It will also be found that some of the resistors, R3, R4, and R5, may be absent. It depends on how much filtering the designer found necessary. These filters, of course, also serve to isolate the grid circuits of the different stages. But when the stages work at different frequencies (R.F. and I.F.) by-pass condensers seem to be sufficient. Fig. 3 shows a typical circuit arrangement employing a 6H6 double diode as second detector and A.V.C. rectifier.

Before the advent of the double-purpose tubes, a separate tube was used for the A.V.C. circuit. Sometimes this tube required a voltage supply delivering up to 70 volts negative with respect to the chassis. The signal is picked up from either the plate or the control-grid circuit of one of the I.F. stages, and coupled to the control-grid of the A.V.C. tube through a small condenser. The tube rectifies the signal because the grid bias is adjusted to practically cut-off of the plate current. This will cause plate current to flow through, and develop a negative voltage across a resistor provided for that purpose. This negative voltage is passed along through the usual filter to the amplifying tubes. As there are so very few receivers employing this system still in use in New Zealand, I will not go further into detail.

In conclusion I would like to point out the fact that the term "automatic volume control" is really a misnomer. The volume is not kept constant, because this depends on the percentage of modulation at the transmitter and is being varied in accordance with the volume of the transmitted sound and music. The arrangement really controls the gain by varying the sensitivity of the R.F. and I.F. amplifiers and consequently the proper name should be "automatic sensitivity control" or "automatic gain control." I have used the term "automatic volume control" (A.V.C.) throughout this article because it is by far the more popular.

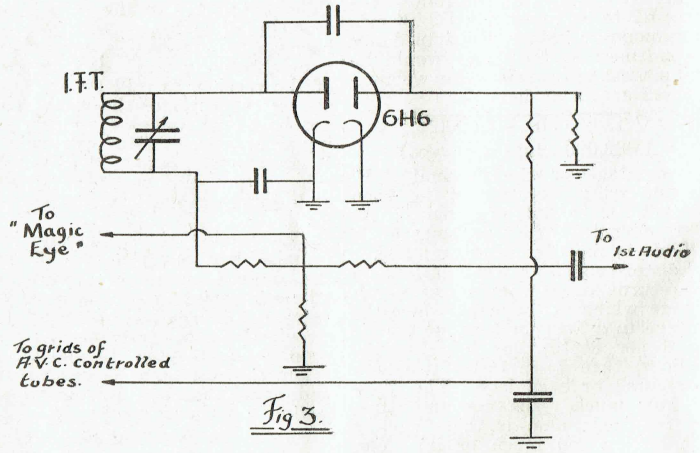


Fig 3.

A HOME-MADE HELIOGRAPH

J. R. Burch.

No doubt many of your readers are familiar with the Morse Code, and the instrument about to be described should give them the opportunity of indulging in a little practice in the sunshine in addition to providing a good deal of interest and instructive amusement. The materials required are quite inexpensive, and in the writer's case were picked up round about the house. This heliograph is quite efficient and the writer's signals have been copied without the aid of binoculars at about 10 or 12 miles, which happened to be the horizon at the time. The "sighting" of a helio is extremely important in order to obtain satisfactory results at reasonably long range but if care is taken with the constructional details below, no difficulty should be encountered in this respect.

Materials required are:—

2 5in. circular shaving mirrors (or similar) on stands.

1 baseboard, about 10in x 5in. x ⅝in.

1 Cigar box or photo printing frame, about 6½in. x 5in.

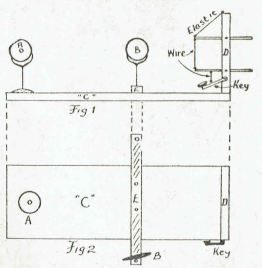
1 piece wood, 1in. x 1in. x 1ft. 6in.

A few screws and small elastic bands.

The principle employed is the reflection from a mirror of the sun's rays on to a shutter which is always in the "closed" position until keyed so that the manner of operation is similar to any ordinary Morse telegraph instrument, that is, a "signal" is emitted as soon as the key is pressed, and ceases on allowing the key to rise. A second (or duplex) mirror is incorporated so as to permit the operator, by utilisation of reflection of rays from this mirror into the sighting mirror, to transmit signals due east when the sun is low down in the west. This would not be possible without the duplex mirror which, however, could be dispensed with for a start and added later as an important refinement. It should be understood, however, that without this second mirror the angle of effective operation is necessarily limited.

Construction is very simple and the diagrams below should be found self-explanatory.

Fig. 1 is side elevation which shows key pressed and shutters open. It will be noticed that elastic pulls them back to their closed position when key is released. Fig. 2 is a plan with shutters in the closed position. "D" is the cigar-box (or printing frame) with bottom and lid removed, which houses the shutter assembly. If a cigar box is used the bottom and lid suitably cut can be used for the two shutters; these overlap in the manner of a venetian blind, to the exclusion of the rays, and are pivoted on 2 small brads. "C" is the baseboard, "B" the duplex mirror, "E" the 1in x 1in. x 1ft. 6in. wooden mounting for the duplex mirror, and "A" the main or sighting mirror. It should be observed that both these mirrors, being of the portable shaving variety, have the ability of being swung both from side to side and from horizontal to vertical, a very necessary property in order that the sun may be "caught" from any angle with respect to the shutters and target or objective. Now just a final word on mirror "A" and the sighting of same. This is prepared by scraping off the back at dead centre a little of the quicksilver to form an aperture of about one-sixteenth inch in diameter. Next, gum a piece of paper about 1in. diameter by ½in. broad (i.e., a "ring" of paper) evenly around the aperture on the **front** (or reflecting) side of the mirror. This piece of paper will be reflected on to the shutters and when peeping through the aperture the operator will be able to find "centre" rapidly. Sighting is effected by peering through the aperture, through the shadow of the paper ring and, by opening and closing the shutters rapidly, on to the receiving station. The shadow of the paper ring is virtually the foresight and thus the operator can, even whilst keying, keep on to the objective and cater for the apparent movement of the sun at the same time. **Important:** The instrument **must** be kept steady whilst keying.



To those interested in the art of communication by means of visual signalling the writer can recommend these little outfits with the greatest confidence, and considers that the time expended in their construction is really worth while.

RADIOTRON VALVE CHART

Radiotron Characteristic Valve Chart published by kind permission of the Amalgamated Wireless Valve Co. Pty. Ltd., of Sydney.

On the following pages you will find a complete Valve Chart of Radiotron Valves.

We wish to express the Radio Hobbies' Club and the Lamphouse's appreciation of the Amalgamated Wireless Valve Co. Pty. Ltd., of Sydney, in allowing us to reproduce this Valve Chart for the benefit of our readers.

TYPE	NAME	DIMENSIONS SOCKET CONNECTIONS: DIMEN.	S.C.	CATHODE TYPE AND RATING: C.T.	VOLTS	AMP.	USE (Values to right give operating conditions and characteristics for indicated typical use)	PLATE SUPPLY VOLTS	GRID BIAS ■ VOLTS	SCREEN SUPPLY VOLTS	SCREEN CURRENT MA.	PLATE CURRENT MA.	A-C PLATE RESISTANCE OHMS	TRANS-CONDUCTANCE (GRID-PLATE) UMHOS	AMPLIFICATION FACTOR	LOAD FOR STATED POWER OUTPUT OHMS	POWER OUTPUT WATTS	TYPE
SUPPLEMENTARY AUSTRALIAN TYPES																		
IC4	SUPER-CONTROL R-F AMPLIFIER PENTODE	D13	4M	D.C. F	2.0	0.12	CLASS A AMPLIFIER	135 135 180	{ 0 min. }	45 67.5 67.5	0.5 0.9 0.9	1.25 2.5 2.5	1,560,000 800,000 1,000,000	780 1000 1000	1220 800 1000	—	—	IC4
ID4	POWER AMPLIFIER PENTODE	D12	5K	D.C. F	2.0	0.24	AMPLIFIER	For other characteristics, refer to Type 1L5-G.										ID4
IK4	R-F AMPLIFIER PENTODE	D13	4M	D.C. F	2.0	0.12	AMPLIFIER	For other characteristics, refer to Type 1K5-G.										IK4
1K5-G	R-F AMPLIFIER PENTODE	D8	6-B7	D.C. F	2.0	0.12	R.F. AMPLIFIER	135 135 180	{ 0 min. }	45 67.5 67.5	0.5 0.9 0.9	1.25 2.5 2.5	1,750,000 1,000,000 1,240,000	820 1050 1050	1430 1350 1300	—	—	1K5-G
							A.F. AMPLIFIER	135 ■ 135 ■ 160 ■ 180 ■	—1.5	{Screen Supply, 135 volts applied through 0.75 megohm resistor. Screen Supply, 180 volts applied through 1.0 megohm resistor.			{Grid Resistor** 0.5 megohm. Grid Resistor** 1.0 megohm. Grid Resistor** 0.5 megohm. Grid Resistor** 1.0 megohm.					Voltage Gain, 62.5. Voltage Gain, 75.0. Voltage Gain, 74.0. Voltage Gain, 88.5.
							TRIODE □ CLASS A AMPLIFIER	135 180	—4.5 —6.0	—	—	3.5 6.0	10,700 8,600	1400 1700	15 15.3	20,000 15,000	0.07 0.11	
1K6	DUPLEX-DIODE PENTODE	D13	6WA	D.C. F	2.0	0.12	PENTODE UNIT AS AMPLIFIER	For other characteristics, refer to Type 1K7-G.										1K6
1K7-G	DUPLEX-DIODE PENTODE	D8	6-7AE	D.C. F	2.0	0.12	PENTODE UNIT AS R.F. AMPLIFIER	135 135 135	~0 0 —3.0	45 67.5 90	0.35 0.7 0.35	0.9 1.8 0.9	2,000,000 1,250,000 2,000,000	620 800 600	1250 1000 1250	—	—	1K7-G
							PENTODE UNIT AS A.F. AMPLIFIER	135 ■ 135 ■ 180 ■ 180 ■	—1.5	{Screen Supply, 135 volts applied through 0.5 megohm resistor. Screen Supply, 180 volts applied through 1.0 megohm resistor.			{Grid Resistor** 0.5 megohm. Grid Resistor** 1.0 megohm. Grid Resistor** 0.5 megohm. Grid Resistor** 1.0 megohm.					Voltage Gain, 63.0. Voltage Gain, 76.0. Voltage Gain, 69.0. Voltage Gain, 83.0.	
							PENTODE UNIT AS TRIODE □ CLASS A AMPLIFIER	135 180	—4.5 —6.0	—	—	2.0 3.5	16,500 15,000	900 1000	15 15	30,000 40,000	0.038 0.060	
1L5-G	POWER AMPLIFIER PENTODE	D10	6-6X	D.C. F	2.0	0.24	CLASS A AMPLIFIER	135 157.5 180	—4.5 —4.5 —6.0	135 157.5 180	1.5 2.2 2.3	6.0 9.0 9.5	150,000 125,000 137,000	2150 2400 2400	330 300 330	15,000 15,000 15,000	0.35 0.55 0.75	1L5-G
1M5-G	SUPER-CONTROL R-F AMPLIFIER PENTODE	D8	6-5Y	D.C. F	2.0	0.12	CLASS A AMPLIFIER	135 135 180	{ 0 min. }	45 67.5 67.5	0.5 0.9 0.9	1.25 2.5 2.5	1,800,000 1,000,000 1,450,000	780 1000 1000	1400 1000 1450	—	—	1M5-G
6B7S	DUPLEX-DIODE SUPER-CONTROL PENTODE	D9	7D	H	6.3	0.3	PENTODE UNIT AS AMPLIFIER	For other characteristics, refer to Type 6G8-G.										6B7S
6G8-G	DUPLEX-DIODE SUPER-CONTROL PENTODE	D8	6-8‡‡	H	6.3	0.3	PENTODE UNIT AS R.F. AMPLIFIER	250 250	{—3.0 min. }	100 125	1.5 2.2	6.5 9.3	850,000 510,000	1100 1210	900 600	—	—	6G8-G
							PENTODE UNIT AS A.F. AMPLIFIER	135 ■ 250 ■	{Self-bias 2000 ohms, Screen Supply from Voltage Divider 1.0 and 0.25 meg.}			Gain per Stage = 63.5 ⊠, 75⊛. Gain per Stage = 77 ⊠, 93⊛.					
6K8-G	TRIODE-HEXODE CONVERTER	D8	6-9K‡	H	6.3	0.3	TRIODE UNIT AS OSCILLATOR	100□□	Triode-Grid Resistor ⊛			3.8	Triode-Grid & Hexode-Grid Current, 0.15 ma.					6K8-G
							HEXODE UNIT AS MIXER	100 250	{—3.0 min. }	100 100□□	6.2 6.0	2.3 2.5	400,000 600,000	Conversion Conductance, 325 micromhos Conversion Conductance, 350 micromhos				6K8-G

GENERAL TYPES

TYPE	NAME	DIMENSIONS SOCKET CONNECTIONS DIMEN.	S.C.	CATHODE TYPE AND RATING C.T.	VOLTS	AMP.	USE (Values to right give operating conditions and characteristics for indicated typical use)	PLATE SUPPLY VOLTS	GRID BIAS ■ VOLTS	SCREEN SUPPLY VOLTS	SCREEN CURRENT MA.	PLATE CURRENT MA.	A-C PLATE RESISTANCE OHMS	TRANSCONDUCTANCE (GRID-PLATE) μMHOS	AMPLIFICATION FACTOR	LOAD FOR STATED POWER OUTPUT OHMS	POWER OUTPUT WATTS	TYPE
00-A	DETECTOR TRIODE	D12	4D	D.C. F	5.0	0.25	GRID-LEAK DETECTOR	45	Grid Return to (−) Filament			1.5	30000	666	20	——	——	00-A
01-A	DETECTOR★ AMPLIFIER	D12	4D	D.C. F	5.0	0.25	CLASS A AMPLIFIER	90 135	− 4.5 − 9.0	——	——	2.5 3.0	11000 10000	725 800	8.0 8.0	——	——	01-A
0A4-G	GAS-TRIODE	D3	G-4V	Cold	——	——	RELAY SERVICE	Peak Cathode Current, 100 max. ma. D-C Cathode Current, 25 max. ma. Starter-Anode Drop, 60 approx. volts. Anode Drop, 70 approx. volts.										0A4-G
0Z4	FULL-WAVE GAS RECTIFIER	B3	4R	Cold	——	——	RECTIFIER	Starting-Supply Voltage per Plate, 300 min. peak volts. Peak Plate Current, 200 max. ma. D-C Output Current, 75 max., 30 min. ma. D-C Output Voltage, 300 max. volts.										0Z4
0Z4-G	FULL-WAVE GAS RECTIFIER	B1	G-4R◆	Cold	——	——	RECTIFIER											0Z4-G
1A4-P	SUPER-CONTROL R-F AMPLIFIER PENTODE	D8	4M	D.C. F	2.0	0.06	AMPLIFIER	For other characteristics, refer to Type 1DS-GP.										1A4-P
1A5-G	POWER AMPLIFIER PENTODE	D1	G-6X	D.C. F	1.4	0.05	CLASS A AMPLIFIER	85 90	− 4.5 − 4.5	85 90	0.7 0.8	3.5 4.0	300000 300000	800 850	240 255	25000 25000	0.100 0.115	1A5-G
1A6	PENTAGRID CONVERTER●	D9	6L	D.C. F	2.0	0.06	CONVERTER	For other characteristics, refer to Type 1D7-G.										1A6
1A7-G	PENTAGRID CONVERTER●	D6	G-7Z	D.C. F	1.4	0.05	CONVERTER	90	0	45◆	0.6	0.55	600000	Anode-Grid (#2): 90 max. volts, 1.2 ma. Oscillator-Grid (#1) Resistor, 0.2 meg. Conversion Conductance, 250 micromhos.				1A7-G
1B4-P	R-F AMPLIFIER PENTODE	D9	4M	D.C. F	2.0	0.06	AMPLIFIER	For other characteristics, refer to Type 1E5-GP.										1B4-P
1B5/25S	DUPLEX-DIODE TRIODE	D5	6M	D.C. F	2.0	0.06	TRIODE UNIT AS AMPLIFIER	For other characteristics, refer to Type 1H6-G.										1B5/25S
1C5-G	POWER AMPLIFIER PENTODE	D1	G-6X	D.C. F	1.4	0.10	CLASS A AMPLIFIER	83 90	− 7.0 − 7.5	83 90	1.6 1.6	7.0 7.5	110000 115000	1500 1550	165 180	9000 8000	0.20 0.24	1C5-G
1C6	PENTAGRID CONVERTER●	D9	6L	D.C. F	2.0	0.12	CONVERTER	For other characteristics, refer to Type 1C7-G.										1C6
1C7-G	PENTAGRID CONVERTER●	D8	G-7Z	D.C. F	2.0	0.12	CONVERTER	135 180	− 3.0 min. − 3.0 min.	67.5 67.5	2.0 2.0	1.3 1.5	550000 750000	Anode-Grid (#2): 180▲ max. volts, 3.3 ma. Oscillator-Grid (#1) Resistor●, Conversion Conductance, 325 micromhos.				1C7-G
1D5-GP	SUPER-CONTROL R-F AMPLIFIER PENTODE	D8	G-5Y	D.C. F	2.0	0.06	CLASS A AMPLIFIER	90 180	− 3.0 min. − 3.0 min.	67.5 67.5	0.9 0.8	2.2 2.3	600000 1000000	720 750	425 750	——	——	1D5-GP
1D7-G	PENTAGRID CONVERTER●	D8	G-7Z	D.C. F	2.0	0.06	CONVERTER	135 180	− 3.0 min. − 3.0 min.	67.5 67.5	2.5 2.4	1.2 1.3	400000 500000	Anode-Grid (#2): 180▲ max. volts, 2.3 ma. Oscillator-Grid (#1) Resistor●, Conversion Conductance, 300 micromhos.				1D7-G
1E5-GP	R-F AMPLIFIER PENTODE	D8	G-5Y	D.C. F	2.0	0.06	CLASS A AMPLIFIER	90 180	− 3.0 − 3.0	67.5 67.5	0.7 0.6	1.6 1.7	1000000 1500000	600 650	550 1000	——	——	1E5-GP
1E7-G	TWIN PENTODE POWER AMPLIFIER	D3	G-8C	D.C. F	2.0	0.24	CLASS A AMPLIFIER	135	− 7.5	135	——	Power Output is for one tube at stated plate-to-plate load.				24000	0.65	1E7-G
1F4	POWER AMPLIFIER PENTODE	D12	5K	D.C. F	2.0	0.12	AMPLIFIER	For other characteristics, refer to Type 1F5-G.										1F4
1F5-G	POWER AMPLIFIER PENTODE	D10	G-6X	D.C. F	2.0	0.12	CLASS A AMPLIFIER	90 135	− 3.0 − 4.5	90 135	1.3 2.6	4.0 8.0	240000 200000	1400 1700	340 340	20000 16000	0.12 0.34	1F5-G

1F6	DUPLEX-DIODE PENTODE	D9	6W	D.C. F	2.0	0.06	PENTODE UNIT AS AMPLIFIER	For other characteristics, refer to Type 1F7-GV.										1F6
1F7-GV	DUPLEX-DIODE PENTODE	D8	G-7AD	D.C. F	2.0	0.06	PENTODE UNIT AS R-F AMPLIFIER	180	− 1.5	67.5	0.6	2.0	1000000	650	650	——	——	1F7-GV
							PENTODE UNIT AS A-F AMPLIFIER	135✕	− 2.0	Screen Supply, 135 volts applied through 0.8-megohm resistor. Grid Resistor,** 1.0 megohm. Voltage Gain, 46.								
1G5-G	POWER AMPLIFIER PENTODE	D10	G-6X	D.C. F	2.0	0.12	CLASS A AMPLIFIER	90 135	− 6.0 −13.5	90 135	2.5 2.5	8.5 8.7	133000 160000	1500 1550	200 250	8500 9000	0.25 0.55	1G5-G
1G6-G	TWIN TRIODE AMPLIFIER	D1	G-7AB	D.C. F	1.4	0.10	CLASS B AMPLIFIER	90	0	——	——	Power Output is for one tube at stated plate-to-plate load.				12000	0.45	1G6-G
1H4-G	DETECTOR★ AMPLIFIER	D3	G-5S	D.C. F	2.0	0.06	CLASS A AMPLIFIER	90 135 180	− 4.5 − 9.0 −13.5	——	——	2.5 3.0 3.1	11000 10300 10300	850 900 900	9.3 9.3 9.3	——	——	1H4-G
							CLASS B AMPLIFIER	157.5	−15.0	——	——	1.0◆	——	——	——	8000	2.1†	
1H5-G	DIODE HIGH-MU TRIODE	D6	G-5Z	D.C. F	1.4	0.05	TRIODE UNIT AS CLASS A AMPLIFIER	90	0	——	——	0.14	240000	275	65	——	——	1H5-G
1H6-G	DUPLEX-DIODE TRIODE	D3	G-7AA	D.C. F	2.0	0.06	TRIODE UNIT AS CLASS A AMPLIFIER	135	− 3.0	——	——	0.8	35000	575	20	——	——	1H6-G
1J6-G	TWIN TRIODE AMPLIFIER	D3	G-7AB	D.C. F	2.0	0.24	CLASS B AMPLIFIER	135 135	0 − 3.0	——	——	Power Output is for one tube at stated plate-to-plate load.				10000 10000	2.1 1.9	1J6-G
1N5-G	R-F AMPLIFIER PENTODE	D8	G-5Y	D.C. F	1.4	0.05	CLASS A AMPLIFIER	90	0	90	0.3	1.2	1500000	750	1160	——	——	1N5-G
1-V	HALF-WAVE RECTIFIER	D5	4G	H	6.3	0.3	Maximum A-C Plate Voltage.....350 Volts, RMS Maximum D-C Output Current.....50 Milliamperes											1-V
2A3	POWER AMPLIFIER TRIODE	E3	4D	F	2.5	2.5	CLASS A AMPLIFIER	250	−45.0	——	——	60.0	800	5250	4.2	2500	3.5	2A3
							PUSH-PULL CLASS AB1 AMPLIFIER	300 300	Self-bias, 780 ohms◆ −62 volts, fixed bias			80.0◆ 80.0◆	——	——	——	5000 3000	10.0† 15.0†	
2A5	POWER AMPLIFIER PENTODE	D12	6B	H	2.5	1.75	AMPLIFIER	For other characteristics, refer to Type 6F6.										2A5
2A6	DUPLEX-DIODE HIGH-MU TRIODE	D9	6Q	H	2.5	0.8	TRIODE UNIT AS AMPLIFIER	For other characteristics, refer to Type 6SQ7.										2A6
2A7	PENTAGRID CONVERTER●	D9	7C	H	2.5	0.8	CONVERTER	For other characteristics, refer to Type 6A7.										2A7
2B7	DUPLEX-DIODE PENTODE	D9	7D	H	2.5	0.8	PENTODE UNIT AS AMPLIFIER	For other characteristics, refer to Type 6B8-G.										2B7
5T4	FULL-WAVE RECTIFIER	D7	5T	F	5.0	2.0	A-C Voltage per Plate (Volts RMS).....450 550 The 550-volt rating applies to filter circuits having an input choke of at least 10 henries. D-C Output Current (Maximum Ma.).....250 250											5T4
5U4-G	FULL-WAVE RECTIFIER	E2	G-5T‡	F	5.0	3.0	Maximum A-C Voltage per Plate.....500 Volts, RMS Maximum D-C Output Current.....250 Milliamperes											5U4-G
5V4-G	FULL-WAVE RECTIFIER	D10	G-5L‡	H	5.0	2.0	Maximum A-C Voltage per Plate.....400 Volts, RMS Maximum D-C Output Current.....200 Milliamperes											5V4-G
5W4	FULL-WAVE RECTIFIER	C2	5T	F	5.0	1.5	A-C Voltage per Plate (Volts, RMS).....350 400 D-C Output Current (Maximum Ma.).....110 90											5W4
5X4-G	FULL-WAVE RECTIFIER	E2	G-5Q	F	5.0	3.0	For other ratings, refer to Type 5U4-G.											5X4-G
5Y3-G	FULL-WAVE RECTIFIER	D10	G-5T‡	F	5.0	2.0	Maximum A-C Voltage per Plate.....400 Volts, RMS Maximum D-C Output Current.....125 Milliamperes											5Y3-G
5Y4-G	FULL-WAVE RECTIFIER	D10	G-5Q	F	5.0	2.0	A-C Voltage per Plate (Volts RMS).....350 400 550 The 550-volt rating applies to filter circuits having an input choke of at least 20 henries. D-C Output Current (Maximum Ma.).....125 110 135											5Y4-G
5Z3	FULL-WAVE RECTIFIER	E3	4C	F	5.0	3.0	For other ratings, refer to Type 5U4-G.											5Z3

TYPE	NAME	DIMENSIONS SOCKET CONNECTIONS DIMEN.	S.C.	CATHODE TYPE AND RATING C.T.	VOLTS	AMP.	USE Values to right give operating conditions and characteristics for indicated typical use	PLATE SUPPLY VOLTS	GRID BIAS ■ VOLTS	SCREEN SUPPLY VOLTS	SCREEN CURRENT MA.	PLATE CURRENT MA.	A-C PLATE RESISTANCE OHMS	TRANSCONDUCTANCE (GRID-PLATE) μMHOS	AMPLIFICATION FACTOR	LOAD FOR STATED POWER OUTPUT OHMS	POWER OUTPUT WATTS	TYPE
5Z4	FULL-WAVE RECTIFIER	C2	5L	H	5.0	2.0	Maximum A-C Voltage per Plate ..... 400 Volts, RMS Maximum D-C Output Current ..... 125 Milliamperes											5Z4
6A4/LA	POWER AMPLIFIER PENTODE	D12	8B	F	6.3	0.3	CLASS A AMPLIFIER	100 180	− 6.5 −12.0	100 180	1.6 3.9	9.0 22.0	83250 45500	1200 2200	100 100	11000 8000	0.31 1.40	6A4/LA
6A6	TWIN TRIODE AMPLIFIER	D12	7B	H	6.3	0.8	AMPLIFIER	For other characteristics, refer to Type 6N7.										6A6
6A7	PENTAGRID CONVERTER●	D9	7C	H	6.3	0.3	CONVERTER	100 250	−1.5 min. −3.0 min.	50 100	1.3 2.7	1.1 3.5	600000 360000	Anode-Grid (#2): 250▲ max. volts, 4.0 ma. Oscillator-Grid (#1) Resistor◆, Conversion Conductance, 520 micromhos.				6A7
6A8	PENTAGRID CONVERTER●	C1	8A	H	6.3	0.3	CONVERTER	100 250	−1.5 min −3.0 min	50 100	1.5 3.2	1.2 3.3	600000 360000	Anode-Grid (#2): 250▲ max. volts, 4.0 ma. Oscillator-Grid (#1) Resistor◆, Conversion Conductance, 500 micromhos.				6A8
6A8-G	PENTAGRID CONVERTER●	D8	G-8A‡	H	6.3	0.3	CONVERTER	100 250	−1.5 min. −3.0 min.	50 100	1.3 2.7	1.1 3.5	600000 360000	Anode-Grid (#2): 250▲ max. volts, 4.0 ma. Oscillator-Grid (#1) Resistor◆, Conversion Conductance, 550 micromhos.				6A8-G
6A8-GT	PENTAGRID CONVERTER●	C3	G-8A‡	H	6.3	0.3	CONVERTER	For other characteristics, refer to Type 6A8.										6A8-GT
6AC5-G	HIGH-MU POWER AMPLIFIER TRIODE	D3	G-6Q‡	H	6.3	0.4	CLASS B AMPLIFIER	250	0	——	——	5.0◆	——	——	——	10000	8.0†	6AC5-G
							DYNAMIC COUPLED AMPLIFIER WITH TYPE 76 DRIVER	250	Bias for both 6AC5-G and 76 is developed in coupling circuit. Average Plate Current of Driver = 5.5 milliamperes. Average Plate Current of 6AC5-G = 32 milliamperes.							7000	3.7	
6AF6-G	ELECTRON-RAY TUBE Twin Indicator Type	B7	G-7AG	H	6.3	0.15	VISUAL INDICATOR●	Target Voltage 100 volts Control Electrode Voltage, 0 volts; Shadow Angle, 100°; Target Current, 0.9 ma Control Electrode Voltage, 60 volts, Angle, 0°.										6AF6-G
								Target Voltage 135 volts Control Electrode Voltage, 0 volts; Shadow Angle, 100°; Target Current, 1.5 ma Control Electrode Voltage, 81 volts, Angle, 0°.								
6B6-G	DUPLEX-DIODE HIGH-MU TRIODE	D8	G-7V‡	H	6.3	0.3	TRIODE UNIT AS CLASS A AMPLIFIER	250	− 2.0	——	——	1.0	91000	1100	100	——	——	6B6-G
6B7	DUPLEX-DIODE PENTODE	D9	7D	H	6.3	0.3	PENTODE UNIT AS AMPLIFIER	For other characteristics, refer to Type 6B8-G.										6B7
6B8	DUPLEX-DIODE PENTODE	C1	8E	H	6.3	0.3	PENTODE UNIT AS R.F. AMPLIFIER	250	− 3.0	125	2.3	10.0	600000	1325	800	——	——	6B8
							PENTODE UNIT AS A.F. AMPLIFIER	90▼ Self bias, 3500 ohms Screen Resistor = 1.1 meg 300▼ Self-bias, 1600 ohms Screen Resistor = 1.2 meg.					Grid Resistor,** 0.5 megohm.		Gain per stage = 55 Gain per stage = 79		
6B8-G	DUPLEX-DIODE PENTODE	D8	G-8E‡	H	6.3	0.3	PENTODE UNIT AS R.F. AMPLIFIER	100 250	− 3.0 − 3.0	100 125	1.7 2.3	5.8 9.0	300000 650000	950 1125	285 730	——	——	6B8-G
							PENTODE UNIT AS A.F. AMPLIFIER	90▼ Self bias, 3500 ohms Screen Resistor = 1.1 meg. 300▼ Self bias, 1600 ohms Screen Resistor = 1.2 meg.					Grid Resistor,** 0.5 megohm.		Gain per stage = 55 Gain per stage = 79		
6C5	DETECTOR★ AMPLIFIER TRIODE	B3	6Q	H	6.3	0.3	CLASS A AMPLIFIER	250	− 8.0	——	——	8.0	10000	2000	20	——	——	6C5
								90▼ Self bias, 6400 ohms. 300▼ Self bias, 5300 ohms					Grid Resistor,** 0.25 megohm		Gain per stage = 11 Gain per stage = 13		
							BIAS DETECTOR	250	−17.0 approx	Plate current to be adjusted to 0.2 milliampere with no signal.							

6C5-G	DETECTOR★ AMPLIFIER TRIODE	D3	G-6Q‡‡	H	6.3	0.3	AMPLIFIER DETECTOR	For other characteristics, refer to Type 6C5.										6C5-G
6C6	TRIPLE-GRID DETECTOR AMPLIFIER	D13	6F	H	6.3	0.3	AMPLIFIER DETECTOR	For other characteristics, refer to Type 6J7.										6C6
6C8-G	TWIN TRIODE AMPLIFIER	D8	G-8G	H	6.3	0.3	EACH UNIT AS AMPLIFIER	250	− 4.5	——	——	3.2	22500	1600	36	——	——	6C8-G
6D6	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	D13	6F	H	6.3	0.3	AMPLIFIER MIXER	For other characteristics, refer to Type 6U7-G.										6D6
6D8-G	PENTAGRID CONVERTER●	D8	G-8A‡	H	6.3	0.15	CONVERTER	135 250	− 3.0 min.	67.5 100	——	——	400000 320000	Anode-Grid (#2): 250▲ max. volts. Oscillator-Grid (#1) Resistor◆. Conversion Conductance, 500 micromhos.				6D8-G
6E5	ELECTRON-RAY TUBE	D5	6R	H	6.3	0.3	VISUAL INDICATOR	Plate & Target Supply = 100 volts. Triode Plate Resistor = 0.5 meg. Target Current = 1.0 ma. Grid Bias, −3.3 volts; Shadow Angle, 0°. Bias, 0 volts; Angle, 90°; Plate Current, 0.19 ma.										6E5
								Plate & Target Supply = 250 volts. Triode Plate Resistor = 1.0 meg. Target Current = 4.0 ma. Grid Bias, −8.0 volts; Shadow Angle, 0°. Bias, 0 volts; Angle, 90°; Plate Current, 0.24 ma.									
6F5	HIGH-MU TRIODE	C1	5M	H	6.3	0.3	AMPLIFIER	For other characteristics, refer to Type 6SF5.										6F5
6F5-G	HIGH-MU TRIODE	D8	G-5M‡‡	H	6.3	0.3	AMPLIFIER	For other characteristics, refer to Type 6SF5.										6F5-G
6F6	POWER AMPLIFIER PENTODE	C2	7S	H	6.3	0.7	PENTODE CLASS A AMPLIFIER	250 315	−16.5 −22.0	250 315	6.5 8.0	34.0 42.0	80000 75000	2500 2650	200 200	7000 7000	3.0 5.0	6F6
							TRIODE □ CLASS A AMPLIFIER	250	−20.0	——	——	31.0	2600	2600	6.8	4000	0.85	
							PENTODE PUSH-PULL CLASS A AMPLIFIER	315 315	Self-bias −22.0	315 315	16.0◆ 16.0◆	84.0◆ 84.0◆	Self-Bias Resistor, 220 ohms◆			10000 10000	13.0† 13.0†	
							PENTODE PUSH-PULL CLASS AB1 AMPLIFIER	375 375	Self-bias −26.0	250 250	8.0◆ 5.0◆	54.0◆ 34.0◆	Self-Bias Resistor, 340 ohms◆			10000 10000	19.0† 19.0†	
							TRIODE PUSH-PULL □ CLASS AB2 AMPLIFIER	350 350	Self-bias −38.0	——	——	50.0◆ 45.0◆	Self-Bias Resistor, 730 ohms◆			10000 6000	14.0† 18.0†	
6F6-G	POWER AMPLIFIER PENTODE	D10	G-7S‡	H	6.3	0.7	AMPLIFIER	For other characteristics, refer to Type 6F6.										6F6-G
6F7	TRIODE-PENTODE	D9	7E	H	6.3	0.3	TRIODE UNIT AS CLASS A AMPLIFIER	100	− 3.0	——	——	3.5	16000	500	8	——	——	6F7
							PENTODE UNIT AS CLASS A AMPLIFIER	100 250	− 3.0 min.	100 100	1.6 1.5	6.3 6.5	290000 850000	1050 1100	300 900	——	——	
							PENTODE UNIT AS MIXER	250	−10.0	100	0.6	2.8	Oscillator Peak Volts = 7.0. Conversion Conductance = 300 micromhos.					
6F8-G	TWIN TRIODE AMPLIFIER	D8	G-8G	H	6.3	0.6	EACH UNIT AS AMPLIFIER	250	− 8.0	——	——	9.0	7700	2600	20	——	——	6F8-G
6G6-G	POWER AMPLIFIER PENTODE	D3	G-7S‡	H	6.3	0.15	CLASS A AMPLIFIER	135 180	− 6.0 − 9.0	135 180	2.0 2.5	11.5 15.0	170000 175000	2100 2300	360 400	12000 10000	0.6 1.1	6G6-G
6H6	TWIN DIODE	A1	7Q	H	6.3	0.3	DETECTOR RECTIFIER	Maximum A-C Voltage per Plate ..... 100 Volts, RMS Maximum D-C Output Current ..... 4 Milliamperes										6H6
6H6-G	TWIN DIODE	D3	G-7Q‡‡	H	6.3	0.3	DETECTOR RECTIFIER	For other ratings, refer to Type 6H6.										6H6-G
6J5	DETECTOR AMPLIFIER TRIODE	B3	6Q	H	6.3	0.3	CLASS A AMPLIFIER	250	− 8.0	——	——	9.0	7700	2600	20	——	——	6J5
6J5-G	DETECTOR AMPLIFIER TRIODE	D3	G-6Q‡	H	6.3	0.3	AMPLIFIER	For other characteristics, refer to Type 6J5.										6J5-G

TYPE	NAME	DIMENSIONS SOCKET CONNECTIONS DIMEN.	S. C.	CATHODE TYPE AND RATING C. T.	VOLTS	AMP.	USE Values to right give operating conditions and characteristics for indicated typical use	PLATE SUPPLY VOLTS	GRID BIAS ▣ VOLTS	SCREEN SUPPLY VOLTS	SCREEN CURRENT MA.	PLATE CURRENT MA.	A-C PLATE RESISTANCE OHMS	TRANSCONDUCTANCE (GRID-PLATE) μMHOS	AMPLIFICATION FACTOR	LOAD FOR STATED POWER OUTPUT OHMS	POWER OUTPUT WATTS	TYPE
6J7	TRIPLE-GRID DETECTOR AMPLIFIER	C1	7R	H	6.3	0.3	CLASS A R-F AMPLIFIER	100 250	− 3.0 − 3.0	100 100	0.5 0.5	2.0 2.0	1000000 1.5 + §	1185 1225	1185 1500+	——	——	6J7
							CLASS A A-F AMPLIFIER	90 ✖ 300 ✖	Self-bias, 2600 ohms. Screen Resistor = 1.2 meg. Self-bias, 1200 ohms. Screen Resistor = 1.2 meg.				Grid Resistor,** 0.5 megohm.		Gain per stage = 85 Gain per stage = 140		
							BIAS DETECTOR	250	− 4.3	100	Cathode current 0.43 ma.	——	Plate Resistor, 500000 ohms. Grid Resistor,** 250000 ohms.				
6J7-G	TRIPLE-GRID DETECTOR AMPLIFIER	D8	G-7R‡‡	H	6.3	0.3	AMPLIFIER DETECTOR	For other characteristics, refer to Type 6J7.										6J7-G
6K5-G	HIGH-MU TRIODE	D8	G-5U	H	6.3	0.3	CLASS A AMPLIFIER	100 250	− 1.5 − 3.0	——	——	0.35 1.1	78000 50000	900 1400	70 70	——	——	6K5-G
6K6-G	POWER AMPLIFIER PENTODE	D3	G-7S‡	H	6.3	0.4	CLASS A AMPLIFIER	100 250	− 7.0 −18.0	100 250	1.6 5.5	9.0 32.0	103500 68000	1450 2200	150 150	12000 7600	0.33 3.40	6K6-G
6K7	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	C1	7R	H	6.3	0.3	CLASS A AMPLIFIER	90 250	− 3.0 min.	90 125	1.3 2.6	5.4 10.5	315000 600000	1275 1650	400 990	——	——	6K7
							MIXER IN SUPERHETERODYNE	250	−10.0	100	——	——	Oscillator Peak Volts = 7.0					
6K7-G	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	D8	G-7R‡	H	6.3	0.3	AMPLIFIER MIXER	For other characteristics, refer to Type 6K7.										6K7-G
6K7-GT	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	C3	G-7R‡	H	6.3	0.3	CLASS A AMPLIFIER	100 250	− 3.0 min.	100 100	1.6 1.7	6.5 7.0	250000 800000	1325 1450	350 1160	——	——	6K7-GT
6K8	TRIODE-HEXODE CONVERTER	C1	8K	H	6.3	0.3	TRIODE UNIT AS OSCILLATOR	100	Triode-Grid Resistor▪			3.8	Triode-Grid & Hexode-Grid Current, 0.15 ma.					6K8
							HEXODE UNIT AS MIXER	100 250	− 3.0 min.	100 100	6.2 6.0	2.3 2.5	400000 600000	Conversion Conductance, 325 micromhos. Conversion Conductance, 350 micromhos.				
6L5-G	DETECTOR AMPLIFIER TRIODE	D3	G-6Q‡	H	6.3	0.15	CLASS A AMPLIFIER	135 250	− 5.0 − 9.0	——	——	3.5 8.0	11300 9000	1500 1900	17 17	——	——	6L5-G
6L6	BEAM POWER AMPLIFIER	D7	7AC	H	6.3	0.9	SINGLE-TUBE CLASS A_1 AMPLIFIER	250 250	−14.0 Self-bias	250 250	5.0 5.4	72.0 75.0	——	——	——	2500 2500	6.5 6.5	6L6
							PUSH-PULL CLASS A_1 AMPLIFIER	250 250	−16.0 Self-bias	250 250	10.0♣ 10.0♣	120.0♣ 120.0♣	——	——	——	5000 5000	14.5† 13.8†	
							PUSH-PULL CLASS AB_1 AMPLIFIER	400 400	−25.0 Self-bias	300 300	6.0♣ 7.0♣	102.0♣ 112.0♣	——	——	——	6600 6600	34.0† 32.0†	
							PUSH-PULL CLASS AB_2 AMPLIFIER	400 400	−20.0 −25.0	250 300	4.0♣ 6.0♣	88.0♣ 102.0♣	——	——	——	6000 3800	40.0† 60.0†	
							Self-Bias Resistor, 125 ohms.♣											
							Self-Bias Resistor, 200 ohms.♣											
6L6-G	BEAM POWER AMPLIFIER	E2	G-7AC‡	H	6.3	0.9	AMPLIFIER	For other characteristics, refer to Type 6L6.										6L6-G
6L7	PENTAGRID MIXER▲ AMPLIFIER	C1	7T	H	6.3	0.3	MIXER IN SUPERHETERODYNE	250	− 3.0	100	7.1	2.4	Oscillator-Grid (✖3) Bias, −10 volts. Grid ✖3 Peak Swing, 12 volts minimum. Conversion Conductance, 350 micromhos.					6L7
							CLASS A AMPLIFIER	250	− 3.0 min.¶	100	6.5	5.3	800000	1100	880	——	——	

6L7-G	PENTAGRID MIXER▲ AMPLIFIER	D8	G-7T‡	H	6.3	0.3	MIXER AMPLIFIER	For other characteristics, refer to Type 6L7.										6L7-G
6N5	ELECTRON-RAY TUBE	D5	6R	H	6.3	0.15	VISUAL INDICATOR	Plate & Target Supply = 135 volts. Triode Plate Resistor = 0.25 meg. Target Current = 2.0 ma. Grid Bias, − 12.0 volts; Shadow Angle, 0°. Bias, 0 volts; Angle, 90°. Plate Current, 0.5 ma.										6N5
6N7	TWIN TRIODE AMPLIFIER	C2	8B	H	6.3	0.8	CLASS A AMPLIFIER (As Driver)○	250 294	− 5.0 − 6.0	——	——	6.0 7.0	11300 11000	3100 3200	35 35	20000 or more	exceeds 0.4	6N7
							CLASS B AMPLIFIER	250 300	0 0	——	——	Power Output is for one tube at stated plate-to-plate load.				8000 10000	8.0 10.0	
6N7-G	TWIN TRIODE AMPLIFIER	D10	G-8B‡	H	6.3	0.8	AMPLIFIER	For other characteristics, refer to Type 6N7										6N7-G
6Q7	DUPLEX-DIODE HIGH-MU TRIODE	C1	7V	H	6.3	0.3	TRIODE UNIT AS CLASS A AMPLIFIER	100 250	− 1.5 − 3.0	——	——	0.35 1.1	87500 58000	800 1200	70 70	——	——	6Q7
								90✖ 300✖	Self-bias, 7600 ohms. Self-bias, 3000 ohms.				Grid Resistor,** 0.5 megohm.			Gain per stage = 32 Gain per stage = 45		
6Q7-G	DUPLEX-DIODE HIGH-MU TRIODE	D8	G-7V‡	H	6.3	0.3	TRIODE UNIT AS AMPLIFIER	For other characteristics, refer to Type 6Q7.										6Q7-G
6Q7-GT	DUPLEX-DIODE HIGH-MU TRIODE	C3	G-7V‡	H	6.3	0.3	TRIODE UNIT AS CLASS A AMPLIFIER	100 250	0 − 3.0	——	——	2.3 1.1	43000 58000	1400 1200	60 70	——	——	6Q7-GT
6R7	DUPLEX-DIODE TRIODE	C1	7V	H	6.3	0.3		250	− 9.0	——	——	9.5	8500	1900	16	——	——	6R7
							TRIODE UNIT AS CLASS A AMPLIFIER	90♥ 300♥	Self-bias, 4400 ohms. Self-bias, 3800 ohms.				Grid Resistor,** 0.25 megohm.			Gain per stage = 10 Gain per stage = 10		
6R7-G	DUPLEX-DIODE TRIODE	D8	G-7V‡	H	6.3	0.3	TRIODE UNIT AS AMPLIFIER	For other characteristics, refer to Type 6R7										6R7-G
6S7	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	C1	7R	H	6.3	0.15	CLASS A AMPLIFIER	135 250	− 3.0 min.	67.5 100	0.9 2.0	3.7 8.5	—— 1000000	1250 1750	—— 1750	——	——	6S7
6S7-G	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	D8	G-7R‡	H	6.3	0.15	AMPLIFIER	For other characteristics, refer to Type 6S7.										6S7-G
6SA7	PENTAGRID CONVERTER▲	B3	8R	H	6.3	0.3	MIXER	100 250	− 2.0 − 2.0	100 100	8.0 8.0	3.2 3.4	500000 800000	Grid ✖1 Resistor, 20000 ohms. Conversion Conductance, 450 micromhos.				6SA7
6SC7	TWIN TRIODE AMPLIFIER	B3	8S	H	6.3	0.3	EACH UNIT AS AMPLIFIER	250	− 2.0	——	——	2.0	53000	1325	70	——	——	6SC7
6SF5	HIGH-MU TRIODE	B3	6AB	H	6.3	0.3		250	− 2.0	——	——	0.9	66000	1500	100	——	——	6SF5
							CLASS A AMPLIFIER	90 ✖ 300 ✖	Self-bias, 8800 ohms. Self-bias, 3200 ohms.				Grid Resistor,** 0.5 megohm.			Gain per stage = 43 Gain per stage = 63		
6SJ7	TRIPLE-GRID DETECTOR AMPLIFIER	B3	8N	H	6.3	0.3	CLASS A AMPLIFIER	100 250	− 3.0 − 3.0	100 100	0.9 0.8	2.9 3.0	700000 1500000	1575 1650	1100 2500	——	——	6SJ7
								90 ✖ 300 ✖	Self-bias, 1700 ohms. Self-bias, 860 ohms.				Grid Resistor,** 0.5 megohm.			Gain per stage = 93 Gain per stage = 167		
6SK7	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	B3	8N	H	6.3	0.3	CLASS A AMPLIFIER	100 250	− 3.0 min.	100 100	2.6 2.4	8.9 9.2	250000 800000	1900 2000	475 1600	——	——	6SK7
6SQ7	DUPLEX-DIODE HIGH-MU TRIODE	B3	8Q	H	6.3	0.3		250	− 2.0	——	——	0.8	91000	1100	100	——	——	6SQ7
							TRIODE UNIT AS CLASS A AMPLIFIER	90 ✖ 300 ✖	Self-bias, 11000 ohms. Self-bias, 3900 ohms.				Grid Resistor, ** 0.5 megohm.			Gain per stage = 40 Gain per stage = 53		
6T7-G	DUPLEX-DIODE HIGH-MU TRIODE	D8	G-7V‡	H	6.3	0.15	TRIODE UNIT AS CLASS A AMPLIFIER	135 250	− 1.5 − 3.0	——	——	0.9 1.2	65000 62000	1000 1050	65 65	——	——	6T7-G

TYPE	NAME	DIMENSIONS SOCKET CONNECTIONS DIMEN.	S. C.	CATHODE TYPE AND RATING C. T.	VOLTS	AMP.	USE Values to right give operating conditions and characteristics for indicated typical use	PLATE SUPPLY VOLTS	GRID BIAS ■ VOLTS	SCREEN SUPPLY VOLTS	SCREEN CURRENT MA.	PLATE CURRENT MA.	A-C PLATE RESISTANCE OHMS	TRANSCONDUCTANCE (GRID-PLATE) μMHOS	AMPLIFICATION FACTOR	LOAD FOR STATED POWER OUTPUT OHMS	POWER OUTPUT WATTS	TYPE
6U5/6G5	ELECTRON-RAY TUBE	D4	6R	H	6.3	0.3	VISUAL INDICATOR	Plate & Target Supply = 100 volts. Triode Plate Resistor = 0.5 meg. Target Current = 1.0 ma. Grid Bias, −8 volts; Shadow Angle, 0°. Bias, 0 volts; Angle, 90°; Plate Current, 0.19 ma.										6U5/6G5
								Plate & Target Supply = 250 volts. Triode Plate Resistor = 1.0 meg. Target Current = 4.0 ma. Grid Bias, −22 volts; Shadow Angle, 0°. Bias, 0 volts; Angle, 90°; Plate Current, 0.24 ma.										
6U7-G	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	D8	G-7R‡	H	6.3	0.3	CLASS A AMPLIFIER	100 250	−3.0 min.	100 100	2.2 2.0	8.0 8.2	250000 800000	1500 1600	375 1280	——	——	6U7-G
							MIXER IN SUPERHETERODYNE	100 250	−10.0 −10.0	100 100	——	——	Oscillator Peak Volts = 7.0					
6V6	BEAM POWER AMPLIFIER	C2	7AC	H	6.3	0.45	SINGLE-TUBE CLASS A1 AMPLIFIER	180 250	− 8.5 −12.5	180 250	3.0 4.5	29.0 45.0	——	——	——	5500 5000	2.00 4.25	6V6
							PUSH-PULL CLASS AB1 AMPLIFIER	250 300	−15.0 −20.0	250 300	5.0♠ 5.0♠	70.0♠ 78.0♠	——	——	——	10000 8000	8.5† 13.0†	
6V6-G	BEAM POWER AMPLIFIER	D10	G-7AC‡	H	6.3	0.45	AMPLIFIER	For other characteristics, refer to Type 6V6.										6V6-G
6W7-G	TRIPLE-GRID DETECTOR AMPLIFIER	D8	G-7R‡	H	6.3	0.15	CLASS A AMPLIFIER	250	− 3.0	100	0.5	2.0	1500000	1225	1850	——	——	6W7-G
6X5	FULL-WAVE RECTIFIER	C2	6S	H	6.3	0.6	Maximum A-C Voltage per Plate.....350 Volts, RMS Maximum D-C Output Current..... 75 Milliamperes											6X5
6X5-G	FULL-WAVE RECTIFIER	D3	G-6S‡	H	6.3	0.6	For other ratings, refer to Type 6X5.											6X5-G
6Y6-G	BEAM POWER AMPLIFIER	D10	G-7AC‡	H	6.3	1.25	SINGLE-TUBE CLASS A1 AMPLIFIER	135 200	−13.5 −14.0	135 135	3.0 2.2	58.0 60.0	——	——	——	2000 2600	3.6 6.0	6Y6-G
6Z7-G	TWIN TRIODE AMPLIFIER	D3	G-8B‡	H	6.3	0.3	CLASS B AMPLIFIER	135 180	0 0	——	——	Power Output is for one tube at stated plate-to-plate load.				9000 12000	2.5 4.2	6Z7-G
6ZY5-G	FULL-WAVE RECTIFIER	D3	G-6S‡	H	6.3	0.3	Maximum A-C Voltage per Plate.....350 Volts, RMS Maximum D-C Output Current..... 35 Milliamperes											6ZY5-G
10	POWER AMPLIFIER TRIODE	E4	4D	F	7.5	1.25	CLASS A AMPLIFIER	350 425	−32.0 −40.0	——	——	16.0 18.0	5150 5000	1550 1600	8.0 8.0	11000 10200	0.9 1.6	10
11 12	DETECTOR★ AMPLIFIER TRIODE	D2 D11	4F 4D	D.C. F	1.1	0.25	CLASS A AMPLIFIER	90 135	− 4.5 −10.5	——	——	2.5 3.0	15500 15000	425 440	6.6 6.6	——	——	11 12
12A8-GT	PENTAGRID CONVERTER●	C3	G-8A‡	H	12.6	0.15	CONVERTER	For other characteristics, refer to Type 6A8.										12A8-GT
12C8	DUPLEX-DIODE PENTODE	C1	8E	H	12.6	0.15	PENTODE UNIT AS AMPLIFIER	For other characteristics, refer to Type 6B8.										12C8
12K7-GT	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	C3	G-7R‡	H	12.6	0.15	AMPLIFIER	For other characteristics, refer to Type 6K7-GT.										12K7-GT
12Q7-GT	DUPLEX-DIODE HIGH-MU TRIODE	C3	G-7V‡	H	12.6	0.15	TRIODE UNIT AS AMPLIFIER	For other characteristics, refer to Type 6Q7-GT.										12Q7-GT
12SA7	PENTAGRID CONVERTER▲	B3	8R	H	12.6	0.15	MIXER	For other characteristics, refer to Type 6SA7.										12SA7
12SC7	TWIN TRIODE AMPLIFIER	B3	8S	H	12.6	0.15	AMPLIFIER	For other characteristics, refer to Type 6SC7.										12SC7
12SJ7	TRIPLE-GRID DETECTOR AMPLIFIER	B3	8N	H	12.6	0.15	AMPLIFIER	For other characteristics, refer to Type 6SJ7.										12SJ7

12SK7	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	B3	8N	H	12.6	0.15	AMPLIFIER	For other characteristics, refer to Type 6SK7.										12SK7
12SQ7	DUPLEX-DIODE HIGH-MU TRIODE	B3	8Q	H	12.6	0.15	TRIODE UNIT AS AMPLIFIER	For other characteristics, refer to Type 6SQ7.										12SQ7
12Z3	HALF-WAVE RECTIFIER	D5	4G	H	12.6	0.3	Maximum A-C Plate Voltage.....250 Volts, RMS Maximum D-C Output Current..... 60 Milliamperes											12Z3
15	R-F AMPLIFIER PENTODE	D9	5F	D.C. H	2.0	0.22	CLASS A AMPLIFIER	67.5 135	− 1.5 − 1.5	67.5 67.5	0.3 0.3	1.85 1.85	630000 800000	710 750	450 600	——	——	15
19	TWIN TRIODE AMPLIFIER	D5	6C	D.C. F	2.0	0.26	AMPLIFIER	For other characteristics, refer to Type 1J6-G.										19
20	POWER AMPLIFIER TRIODE	D2	4D	D.C. F	3.3	0.132	CLASS A AMPLIFIER	90 135	−16.5 −22.5	——	——	3.0 6.5	8000 6300	415 525	3.3 3.3	9600 6500	0.045 0.110	20
22	R-F AMPLIFIER TETRODE	E1	4K	D.C. F	3.3	0.132	SCREEN-GRID R-F AMPLIFIER	135 135	− 1.5 − 1.5	45 67.5	0.6* 1.3*	1.7 3.7	725000 325000	375 500	270 160	——	——	22
24-A	R-F AMPLIFIER TETRODE	E1	5E	H	2.5	1.75	SCREEN-GRID R-F AMPLIFIER	180 250	− 3.0 − 3.0	90 90	1.7* 1.7*	4.0 4.0	400000 600000	1000 1050	400 630	——	——	24-A
							BIAS DETECTOR	· 250●	−5.0 approx.	20 to 45	——	Plate current to be adjusted to 0.1 milliampere with no signal.						
25A6	POWER AMPLIFIER PENTODE	C2	7S	H	25.0	0.3	CLASS A AMPLIFIER	95 180	−15.0 −20.0	95 135	4.0 7.5	20.0 38.0	45000 40000	2000 2500	90 100	4500 5000	0.9 2.75	25A6
25A6-G	POWER AMPLIFIER PENTODE	D10	G-7S‡	H	25.0	0.3	AMPLIFIER	For other characteristics, refer to Type 25A6.										25A6-G
25A7-G	RECTIFIER-PENTODE	D10	8F	H	25.0	0.3	PENTODE UNIT AS CLASS A AMPLIFIER	100	−15.0	100	4.0	20.5	50000	1800	90	4500	0.77	25A7-G
							HALF-WAVE RECTIFIER	Maximum A-C Voltage .....125 Volts, RMS Maximum D-C Output Current..... 75 Milliamperes										
25B6-G	POWER AMPLIFIER PENTODE	D10	G-7S‡	H	25.0	0.3	CLASS A AMPLIFIER	95 135	−15.0 −22.0	95 135	1.5 2.5	41.0 61.0	——	4600 5000	75 75	2000 1700	1.9 4.3	25B6-G
25L6	BEAM POWER AMPLIFIER	C2	7AC	H	25.0	0.3	SINGLE-TUBE CLASS A1 AMPLIFIER	110 110	− 7.5 − 7.5	110 110	4.0 4.0	49.0 49.0	10000 10000	8200 8200	82 82	1500 2000	2.1 2.2	25L6
25L6-G	BEAM POWER AMPLIFIER	D10	G-7AC‡	H	25.0	0.3	AMPLIFIER	For other characteristics, refer to Type 25L6.										25L6-G
25L6-GT	BEAM POWER AMPLIFIER	C3	G-7AC‡	H	25.0	0.3	AMPLIFIER	For other characteristics, refer to Type 25L6.										25L6-GT
25Z5	RECTIFIER-DOUBLER	D5	6E	H	25.0	0.3	VOLTAGE DOUBLER	Maximum A-C Voltage per Plate.....125 Volts, RMS Maximum D-C Output Current.....100 Milliamperes										25Z5
							HALF-WAVE RECTIFIER	Maximum A-C Voltage per Plate♦.....250 Volts, RMS Maximum D-C Output Current per Plate..... 85 Milliamperes										
25Z6	RECTIFIER-DOUBLER	C2	7Q	H	25.0	0.3	VOLTAGE DOUBLER	Maximum A-C Voltage per Plate.....125 Volts, RMS Maximum D-C Output Current..... 85 Milliamperes										25Z6
							HALF-WAVE RECTIFIER	Maximum A-C Voltage per Plate♦.....250 Volts, RMS Maximum D-C Output Current per Plate..... 85 Milliamperes										
25Z6-G	RECTIFIER-DOUBLER	D3	G-7Q‡	H	25.0	0.3	RECTIFIER-DOUBLER	For other ratings, refer to Type 25Z6.										25Z6-G
25Z6-GT	RECTIFIER-DOUBLER	C3	G-7Q‡	H	25.0	0.3	VOLTAGE DOUBLER	Maximum A-C Voltage per Plate.....125 Volts, RMS Maximum D-C Output Current..... 85 Milliamperes										25Z6-GT
							HALF-WAVE RECTIFIER	Maximum A-C Voltage per Plate.....125 Volts, RMS Maximum D-C Output Current per Plate..... 85 Milliamperes										
26	AMPLIFIER TRIODE	D12	4D	F	1.5	1.05	CLASS A AMPLIFIER	90 180	− 7.0 −14.5	——	——	2.9 6.2	8900 7300	935 1150	8.3 8.3	——	——	26

TYPE	NAME	DIMENSIONS SOCKET CONNECTIONS		CATHODE TYPE AND RATING			USE Values to right give operating conditions and characteristics for indicated typical use	PLATE SUPPLY VOLTS	GRID BIAS ■ VOLTS	SCREEN SUPPLY VOLTS	SCREEN CURRENT MA.	PLATE CURRENT MA.	A-C PLATE RESISTANCE OHMS	TRANSCONDUCTANCE (GRID-PLATE) μMHOS	AMPLIFICATION FACTOR	LOAD FOR STATED POWER OUTPUT OHMS	POWER OUTPUT WATTS	TYPE
		DIMEN.	S.C.	C.T.	VOLTS	AMP.												
27	DETECTOR★ AMPLIFIER TRIODE	D5	5A	H	2.5	1.75	CLASS A AMPLIFIER	135 250	−9.0 −21.0	—	—	4.5 5.2	9000 9250	1000 975	9.0 9.0	—	—	27
							BIAS DETECTOR	250	−30.0 (approx.)	—	—	Plate current to be adjusted to 0.2 milliampere with no signal.						
30	DETECTOR★ AMPLIFIER TRIODE	D5	4D	F	2.0	0.06	AMPLIFIER	For other characteristics, refer to Type 1H4-G.										30
31	POWER AMPLIFIER TRIODE	D5	4D	F	2.0	0.13	CLASS A AMPLIFIER	135 180	−22.5 −30.0	—	—	8.0 12.3	4100 3600	925 1050	3.8 3.8	7000 5700	0.185 0.375	31
32	R-F AMPLIFIER TETRODE	E1	4K	F	2.0	0.06	SCREEN-GRID R-F AMPLIFIER	135 180	−3.0 −3.0	67.5 67.5	0.4* 0.4*	1.7 1.7	950000 1200000	640 650	610 780	—	—	32
							BIAS DETECTOR	180♥	−6.0 (approx.)	67.5	—	Plate current to be adjusted to 0.2 milliampere with no signal.						
33	POWER AMPLIFIER PENTODE	D12	5K	F	2.0	0.26	CLASS A AMPLIFIER	180	−18.0	180	5.0	22.0	55000	1700	90	6000	1.4	33
34	SUPER-CONTROL R-F AMPLIFIER PENTODE	E1	4M	D.C. F	2.0	0.06	SCREEN-GRID R-F AMPLIFIER	135 180	−3.0 min. −3.0 min.	67.5 67.5	1.0 1.0	2.8 2.8	600000 1000000	600 620	360 620	—	—	34
35	SUPER-CONTROL R-F AMPLIFIER TETRODE	E1	5E	H	2.5	1.75	SCREEN-GRID R-F AMPLIFIER	180 250	−3.0 min. −3.0 min.	90 90	2.5* 2.5*	6.3 6.5	300000 400000	1020 1050	305 420	—	—	35
35L6-GT	BEAM POWER AMPLIFIER	C3	G-7AC‡	H	35.0	0.15	SINGLE-TUBE CLASS A AMPLIFIER	110	−7.5	110	3.0	40.0	13800	5800	80	2500	1.5	35L6-GT
35Z4-GT	HALF-WAVE RECTIFIER	C3	G-5AA	H	35.0	0.15	A-C Plate Voltage (Volts, RMS) ..... 125 250♦ D-C Output Current (Maximum Ma.) 100 100											35Z4-GT
36	R-F AMPLIFIER TETRODE	D9	5E	H	6.3	0.3	SCREEN-GRID R-F AMPLIFIER	100 250	−1.5 −3.0	55 90	1.7*	1.8 3.2	550000 550000	850 1080	470 595	—	—	36
							BIAS DETECTOR	100● 250●	−5.0 −8.0	55 90	—	Grid-bias values are approximate. Plate current to be adjusted to 0.1 milliampere with no signal.						
37	DETECTOR★ AMPLIFIER TRIODE	D5	5A	H	6.3	0.3	CLASS A AMPLIFIER	90 250	−6.0 −18.0	—	—	2.5 7.5	11500 8400	800 1100	9.2 9.2	—	—	37
							BIAS DETECTOR	90 250	−10.0 −28.0	—	—	Grid-bias values are approximate. Plate current to be adjusted to 0.2 milliampere with no signal.						
38	POWER AMPLIFIER PENTODE	D9	5F	H	6.3	0.3	CLASS A AMPLIFIER	100 250	−9.0 −25.0	100 250	1.2 3.8	7.0 22.0	140000 100000	875 1200	120 120	15000 10000	0.27 2.50	38
39/44	SUPER-CONTROL R-F AMPLIFIER PENTODE	D9	5F	H	6.3	0.3	CLASS A AMPLIFIER	90 250	−3.0 min. −3.0 min.	90 90	1.6 1.4	5.6 5.8	375000 1000000	960 1050	360 1050	—	—	39/44
40	VOLTAGE AMPLIFIER TRIODE	D12	4D	D.C. F	5.0	0.25	CLASS A AMPLIFIER	135✕ 180✕	−1.5 −3.0	—	—	0.2 0.2	150000 150000	200 200	30 30	—	—	40
41	POWER AMPLIFIER PENTODE	D5	6B	H	6.3	0.4	AMPLIFIER	For other characteristics, refer to Type 6K6-G.										41
42	POWER AMPLIFIER PENTODE	D12	6B	H	6.3	0.7	AMPLIFIER	For other characteristics, refer to Type 6F6.										42

43	POWER AMPLIFIER PENTODE	D12	6B	H	25.0	0.3	AMPLIFIER	For other characteristics, refer to Type 25A6.										43
45	POWER AMPLIFIER TRIODE	D12	4D	F	2.5	1.5	CLASS A AMPLIFIER	180 275	−31.5 −56.0	—	—	31.0 36.0	1650 1700	2125 2050	3.5 3.5	2700 4600	0.82 2.00	45
							PUSH-PULL CLASS AB_2 AMPLIFIER	275 275	Self-bias, 775 ohms♠ −68.0 volts, fixed bias			36.0♠ 28.0♠	—	—	—	5060 3200	12.0† 18.0†	
46	DUAL-GRID POWER AMPLIFIER	E3	5C	F	2.5	1.75	CLASS A AMPLIFIER □	250	−33.0	—	—	22.0	2380	2350	5.6	6400	1.25	46
							CLASS B AMPLIFIER♦	300 400	0 0	—	—	8.0♠ 12.0♠	—	—	—	5200 5800	16.0† 20.0†	
47	POWER AMPLIFIER PENTODE	E3	5B	F	2.5	1.75	CLASS A AMPLIFIER	250	−16.5	250	6.0	31.0	60000	2500	150	7000	2.7	47
48	POWER AMPLIFIER TETRODE	E3	6A	D.C. H	30.0	0.4	TETRODE CLASS A AMPLIFIER	96 125	−19.0 −20.0	96 100	9.0 9.5	52.0 56.0	—	3800 3900	—	1500 1500	2.0 2.5	48
							TETRODE PUSH-PULL CLASS A AMPLIFIER	125	−20.0	100	—	100.0♠	—	—	—	3000	5.0†	
49	DUAL-GRID POWER AMPLIFIER	D12	5C	D.C. F	2.0	0.12	CLASS A AMPLIFIER □	135	−20.0	—	—	6.0	4175	1125	4.7	11000	0.17	49
							CLASS B AMPLIFIER♦	180	0	—	—	4.0♠	—	—	—	12000	3.5†	
50	POWER AMPLIFIER TRIODE	F1	4D	F	7.5	1.25	CLASS A AMPLIFIER	300 400 450	−54.0 −70.0 −84.0	— — —	— — —	35.0 55.0 55.0	2000 1800 1800	1900 2100 2100	3.8 3.8 3.8	4600 3670 4350	1.6 3.4 4.6	50
53	TWIN TRIODE AMPLIFIER	D12	7B	H	2.5	2.0	AMPLIFIER	For other characteristics, refer to Type 6N7.										53
55	DUPLEX-DIODE TRIODE	D9	6G	H	2.5	1.0	TRIODE UNIT AS AMPLIFIER	For other characteristics, refer to Type 85.										55
56	SUPER-TRIODE AMPLIFIER DETECTOR★	D5	5A	H	2.5	1.0	AMPLIFIER DETECTOR	For other characteristics, refer to Type 76.										56
57	TRIPLE-GRID DETECTOR AMPLIFIER	D13	6F	H	2.5	1.0	AMPLIFIER DETECTOR	For other characteristics, refer to Type 6J7										57
58	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	D13	6F	H	2.5	1.0	AMPLIFIER MIXER	For other characteristics, refer to Type 6U7-G.										58
59	TRIPLE-GRID POWER AMPLIFIER	E3	7A	H	2.5	2.0	TRIODE ¶ CLASS A AMPLIFIER	250	−28.0	—	—	26.0	2300	2600	6.0	5000	1.25	59
							PENTODE■■ CLASS A AMPLIFIER	250	−18.0	250	9.0	35.0	40000	2500	100	6000	3.0	
							TRIODE♥ CLASS B AMPLIFIER	300 400	0 0	—	—	20.0♠ 26.0♠	—	—	—	4600 6000	15.0† 20.0†	
71-A	POWER AMPLIFIER TRIODE	D12	4D	F	5.0	0.25	CLASS A AMPLIFIER	90 180	−19.0 −43.0	—	—	10.0 20.0	2170 1750	1400 1700	3.0 3.0	3000 4800	0.125 0.790	71-A
75	DUPLEX-DIODE HIGH-MU TRIODE	D9	6G	H	6.3	0.3	AMPLIFIER	For other characteristics, refer to Type 6SQ7										75
76	SUPER-TRIODE AMPLIFIER DETECTOR★	D5	5A	H	6.3	0.3	CLASS A AMPLIFIER	100 250	−5.0 −13.5	—	—	2.5 5.0	12000 9500	1150 1450	13.8 13.8	—	—	76
								90♥ 300♥	Self-bias, 6500 ohms Self-bias, 6400 ohms.	Grid Resistor, ** 0.25 megohm.						Gain per stage = 9 Gain per stage = 10		
							BIAS DETECTOR	250	−20.0 (approx.)	—	—	Plate current to be adjusted to 0.2 milliampere with no signal.						
77	TRIPLE-GRID DETECTOR AMPLIFIER	D9	6F	H	6.3	0.3	CLASS A AMPLIFIER	100 250	−1.5 −3.0	60 100	0.4 0.5	1.7 2.3	650000 1500000	1100 1250	715 1500	—	—	77
							BIAS DETECTOR	250	−1.95	50	Cathode current 0.65 ma.	—	Plate Resistor, 250000 ohms. Grid Resistor,** 250000 ohms.					

TYPE	NAME	DIMENSIONS SOCKET CONNECTIONS		CATHODE TYPE AND RATING			USE Values to right give operating conditions and characteristics for indicated typical use	PLATE SUPPLY VOLTS	GRID BIAS ■ VOLTS	SCREEN SUPPLY VOLTS	SCREEN CURRENT MA.	PLATE CURRENT MA.	A-C PLATE RESISTANCE OHMS	TRANSCONDUCTANCE (GRID-PLATE) UMHOS	AMPLIFICATION FACTOR	LOAD FOR STATED POWER OUTPUT OHMS	POWER OUTPUT WATTS	TYPE
		DIMEN.	S.C.	C.T.	VOLTS	AMP.												
78	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	D9	6F	H	6.3	0.3	AMPLIFIER MIXER	For other characteristics, refer to Type 6K7.										78
79	TWIN TRIODE AMPLIFIER	D9	6H	H	6.3	0.6	CLASS B AMPLIFIER	180 250	0 0	——	——	Power Output is for one tube at stated plate-to-plate load.				7000 14000	5.5 8.0	79
80	FULL-WAVE RECTIFIER	D12	4C	F	5.0	2.0	For other ratings, refer to Type 5Y4-G.											80
81	HALF-WAVE RECTIFIER	F1	4B	F	7.5	1.25	Maximum A-C Plate Voltage .....700 Volts, RMS Maximum D-C Output Current..... ..... 85 Milliamperes											81
82	FULL-WAVE ▶ RECTIFIER	D12	4C	F	2.5	3.0	Maximum A-C Voltage per Plate ....500 Volts, RMS Maximum D-C Output Current .... 125 Milliamperes					Maximum Peak Inverse Voltage .....1400 Volts Maximum Peak Plate Current ..... 400 Milliamperes						82
83	FULL-WAVE ▶ RECTIFIER	E3	4C	F	5.0	3.0	Maximum A-C Voltage per Plate..... 500 Volts, RMS Maximum D-C Output Current .... 250 Milliamperes					Maximum Peak Inverse Voltage .....1400 Volts Maximum Peak Plate Current ..... 800 Milliamperes						83
83-v	FULL-WAVE RECTIFIER	D12	4L	H	5.0	2.0	For other ratings, refer to Type 5V4-G											83-v
84/6Z4	FULL-WAVE RECTIFIER	D5	5D	H	6.3	0.5	Maximum A-C Voltage per Plate ....350 Volts, RMS Maximum D-C Output Current ....60 Milliamperes											84/6Z4
85	DUPLEX-DIODE TRIODE	D9	6G	H	6.3	0.3	TRIODE UNIT AS CLASS A AMPLIFIER	135 250	−10.5 −20.0	——	——	3.7 8.0	11000 7500	750 1100	8.3 8.3	25000 20000	0.075 0.350	85
89	TRIPLE-GRID POWER AMPLIFIER	D9	6F	H	6.3	0.4	AS TRIODE ¶ CLASS A AMPLIFIER	160 250	−20.0 −31.0	——	——	17.0 32.0	3300 2600	1425 1800	4.7 4.7	7000 5500	0.30 0.90	89
							AS PENTODE ●● CLASS A AMPLIFIER	100 250	−10.0 −25.0	100 250	1.6 5.5	9.5 32.0	104000 70000	1200 1800	125 125	10700 6750	0.33 3.40	
							AS TRIODE ● CLASS B AMPLIFIER	180	0	——	——	6.0◆	——	——	——	13600 9400	2.50† 3.50†	
V-99 X-99	DETECTOR★ AMPLIFIER TRIODE	C4 D1	4E 4D	D.C. F	3.3	0.063	CLASS A AMPLIFIER	90	− 4.5	——	——	2.5	15500	425	6.6	——	——	V-99 X-99
112-A	DETECTOR★ AMPLIFIER TRIODE	D12	4D	D.C. F	5.0	0.25	CLASS A AMPLIFIER	90 180	− 4.5 −13.5	——	——	5.0 7.7	5400 4700	1575 1800	8.5 8.5	——	——	112-A
874	VOLTAGE REGULATOR	E4	4S	—	—	—	Minimum D-C Starting Supply Voltage....125 Volts D-C Operating Voltage..... 90 Volts					D-C Operating Current .....10-50 Ma. Maximum Current (Continuous)..... 50 Ma.						874
876	CURRENT REGULATOR	G1	——	F	—	—	Voltage Range.....40 to 60 Volts					Operating Current.....1.7 Amperes						876
886	CURRENT REGULATOR	G1	——	F	—	—	Voltage Range.....40 to 60 Volts					Operating Current.....2.05 Amperes						886

For additional types refer to Supplementary Australian and Supplementary General Types.
NOTE.—.GT types not included in this Chart have electrical characteristics identical with equivalent .G types.

SUPPLEMENTARY GENERAL TYPES

1A7-GT	PENTAGRID CONVERTER✪	C3	G-7Z	D.C. F	1.4	0.05	CONVERTER	For other characteristics, refer to Type 1A7-G.										1A7-GT
1G4-G	DETECTOR AMPLIFIER TRIODE	D1	G-5S	D.C. F	1.4	0.05	CLASS A AMPLIFIER	90	—6.0	—	—	2.3	10,700	825	8.8	—	—	1G4-G
1H5-GT	DIODE HIGH-MU TRIODE	C3	G-5Z	D.C. F	1.4	0.05	AMPLIFIER	For other characteristics, refer to Type 1H5-G.										1H5-GT
1N5-GT	R-F AMPLIFIER PENTODE	C3	G-5Y	D.C. F	1.4	0.05	AMPLIFIER	For other characteristics, refer to Type 1N5-G.										1N5-GT
1Q5-GT	BEAM POWER AMPLIFIER	C3	G-6AF	D.C. F	1.4	0.10	CLASS A AMPLIFIER	90	—4.5	90	1.6	9.5	—	2100	—	8,000	0.27	1Q5-GT
6AB7/ 1853	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	B3	8N	H	6.3	0.45	CLASS A AMPLIFIER	300 300	{—3.0} min.	200 300 Δ	3.2 3.2	12.5 12.5	700,000 700,000	5000 5000	3500 3500	—	—	6AB7/ 1853
6AC7/ 1852	TRIPLE-GRID DETECTOR AMPLIFIER	B3	8N	H	6.3	0.45	CLASS A AMPLIFIER	300 300	{Self-bias 160 ohms min.}	150 300 ▽	2.5 2.5	10.0 10.0	750,000 750,000	9000 9000	6750 6750	—	—	6AC7/ 1852
6F5-GT	HIGH-MU TRIODE	C3	G-5M‡	H	6.3	0.3	AMPLIFIER	For other characteristics, refer to Type 6SF5.										6F5-GT
6J5-GT	DETECTOR AMPLIFIER TRIODE	C3	G-6Q‡	H	6.3	0.3	AMPLIFIER	For other characteristics, refer to Type 6J5.										6J5-GT
6J7-GT	TRIPLE-GRID DETECTOR AMPLIFIER	C3	G-7R‡‡∞	H	6.3	0.3	AMPLIFIER DETECTOR	For other characteristics, refer to Type 6J7.										6J7-GT
6J8-G	TRIODE-HEPTODE CONVERTER	C3	G-8H	H	6.3	0.3	TRIODE UNIT AS OSCILLATOR HEPTODE UNIT AS MIXER	250◆ 250	Triode-Grid Resistor ↻ —3	100	2.9	5.0 1.3	Triode-Grid & Heptode-Grid Current, 0.4 ma. 4,000,000	Conversion Conductance, 290 micromhos				6J8-G
6K6-GT	POWER AMPLIFIER PENTODE	C3	G-7S‡	H	6.3	0.4	AMPLIFIER	For other characteristics, refer to Type 6K6-G.										6K6-GT
6V6-GT	BEAM POWER AMPLIFIER	C3	G-7AC‡	H	6.3	0.45	AMPLIFIER	For other characteristics, refer to Type 6V6.										6V6-GT
12J7-GT	TRIPLE-GRID DETECTOR AMPLIFIER	C3	G-7R‡‡∞	H	12.6	0.15	AMPLIFIER DETECTOR	For other characteristics, refer to Type 6J7.										12J7-GT
35Z5-GT	HALF-WAVE RECTIFIER	C3	G-6AD△△	H	35.0	0.15	Maximum A-C Plate Voltage...125 Volts, RMS. Maximum D-C Output Current, without Pilot Lamp, Maximum D-C Output Current, with Type 40 Pilot Lamp (6.3V, 0.15A.), and Plate-to-Heater Connection, 50 Milliamps. and no Plate-to-Heater Connection, 100 Milliamps.										35Z5-GT
50L6-GT	BEAM POWER AMPLIFIER	D9	G-7AC‡	H	50.0	0.15	CLASS A AMPLIFIER	110	—7.5	110	4.0	43.0	10,000	6800	68	2,000	1.75	50L6-GT
VR105-30	VOLTAGE REGULATOR	D3	G-5AB	—	—	—	Minimum D-C Starting Supply Voltage...137 Volts. D-C Operating Voltage.....105 Volts.					Minimum D-C Operating Current....5 ma. Maximum D-C Operating Current....30 ma.						VR105-30
VR150-30	VOLTAGE REGULATOR	D3	G-5AB	—	—	—	Minimum D-C Starting Supply Voltage...180 Volts. D-C Operating Voltage.....150 Volts.					Minimum D-C Operating Current....5 ma. Maximum D-C Operating Current....30 ma.						VR150-30
302	CURRENT REGULATOR	E2A	▲▲	—	—	F	Voltage Range .....112—195 Volts.					Operating Current .....0.3 ampere						302

★ For Grid-leak Detection—plate volts 45, grid return to + filament or to cathode.

▣ Either A.C. or D.C. may be used on filament or heater, except as specifically noted. For use of D.C. on A.C filament types, decrease stated grid volts by ‡ (approx.) of filament voltage.

Supply voltage applied through 20000-ohm voltage-dropping resistor.

> Mercury-Vapour Type.

▪▪ Grid #1 is control grid. Grid #2 is screen. Grid #3 tied to cathode.

Grid #1 is control grid. Grids #2 and #3 tied to plate.

Grids #1 and #2 connected together. Grid #3 tied to plate.

Grids #3 and #5 are screen. Grid #4 is signal-input control grid.

Grids #2 and #4 are screen. Grid #1 is signal-input control grid.

** For grid of following tube.

Both grids connected together; likewise, both plates.

† Power output is for two tubes at stated plate-to-plate load.

For two tubes.

‡ This diagram is like the one having the same designation without the prefix G, except that Pin No. 1 has no connection.

This diagram is like the one having the same designation without the prefix G, except that Pin No. 2 is omitted and Pin No 1 has no connection.

Obtained preferably by using 70000-ohm voltage-dropping resistor in series with a 90-volt supply.

The diagram for this type is the same as that of the designation shown, except that Pin No. 1 is also connected to the Base Sleeve

△△ This type is fitted with a tapped heater for pilot lamp operation

▲▲ This type is fitted with Standard Edison Screw Base

‡‡ This diagram is like the one having the same designation without the prefix G, except that Pin No. 1 is connected to internal shield.

● Applied through plate resistor of 250000 ohms or 500-henry choke shunted by 0.25-megohm resistor.

Applied through plate resistor of 100000 ohms.

Applied through plate resistor of 250000 ohms.

50000 ohms.

*Maximum.

§Megohms.

Requires different socket from small 7-pin.

Grid #2 tied to plate. Grids #1 and #2 tied together

Plate voltages greater than 125 volts RMS require 100-ohm (minimum) series-plate resistor.

Applied through plate resistor of 150000 ohms.

For signal-input control-grid (#1); control-grid #3 bias, —3 volts.

▣ Applied through 200000-ohm plate resistor.

Note 1: Types with octal bases have **Miniature Metal Cap**; all others have **Small Metal Cap.**

Note 2: Subscript 1 on class of amplifier service (as AB_1) indicates that grid current does not flow during any part of input cycle. Subscript 2 on class of amplifier service (AB_2) indicates that grid current flows during some part of the input cycle.

▲ Grids #2 and #4 are screen. Grid #3 is signal-input control grid.

⊠ Following grid resistor 500000 ohms.

⊗ Following grid resistor 1000000 ohms.

△ Applied through 30000-ohm screen-dropping resistor

▽ Applied through 60000-ohm screen-dropping resistor.

□□ Hexode screen and triode plate supply voltage should be applied through common 15000-ohm voltage-dropping resistor from a 250 volt D.C. source.

KEY TO TUBE DIMENSIONS

Symbol	Maximum Overall Length x Diameter	Symbol	Maximum Overall Length x Diameter	Symbol	Maximum Overall Length x Diameter	Symbol	Maximum Overall Length x Diameter	Symbol	Maximum Overall Length x Diameter
A1	1¾" x 1 5/16"	C3	3 5/16" x 1 5/16"	D5	4 3/16" x 1 5/16"	D11	4 11/16" x 1 7/16"	E3	5⅜" x 2 1/16"
B1	2⅜" x 1 1/16"	C4	3½" x 1 1/16"	D6	4 5/16" x 1 5/16"	D12	4 11/16" x 1 13/16"	E4	5⅜" x 2 3/16"
B2	2 5/16" x 1 5/16"	D1	4" x 1 3/16"	D7	4 5/16" x 1⅝"	D13	4 15/16" x 1 5/16"	F1	6¼" x 2 7/16"
B3	2⅜" x 1 5/16"	D2	4⅛" x 1 5/16"	D8	4 13/32" x 1 5/16"	E1	5 1/32" x 1 13/16"	G1	8" x 2 1/16"
C1	3⅛" x 1 5/16"	D3	4⅛" x 1 5/16"	D9	4 13/32" x 1 5/16"	E2	5 5/16" x 2 1/16"		
C2	3¼" x 1 5/16"	D4	4 3/16" x 1 5/16"	D10	4⅝" x 1 13/16"	E2A	5 5/16" x 2 1/16"		

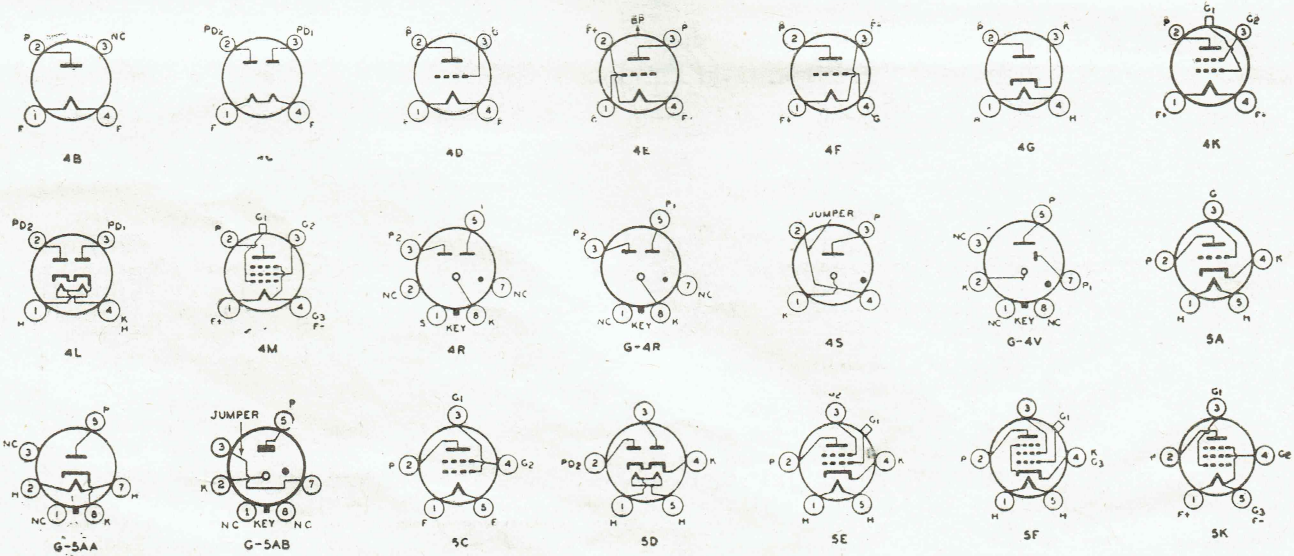
RADIOTRON SOCKET CONNECTIONS

Bottom Views

KEY TO TERMINAL DESIGNATIONS OF SOCKETS

Alphabetical subscripts D, P, T, and HX indicate, respectively, diode unit, pentode unit, triode unit, and hexode unit in multi-unit types.

BP = Bayonet Pin	H = Heater	P = Plate (Anode)	S = Shell
F = Filament	K = Cathode	P_1 = Starter-Anode	TA = Target
G = Grid	NC = No Connection	P_{BF} = Beam-Forming Plates	● = Gas-Type Tube
RC = Ray-Control Electrode	H_L = Heater Tap	BS = Base Sleeve	U = Unit



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** For grid of following tube.

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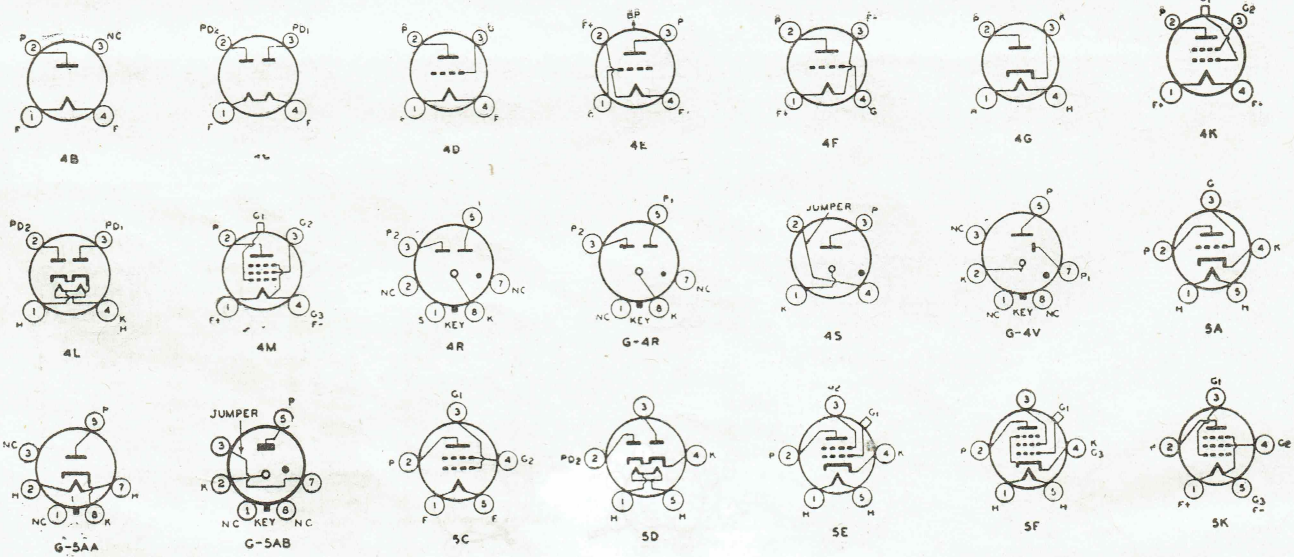

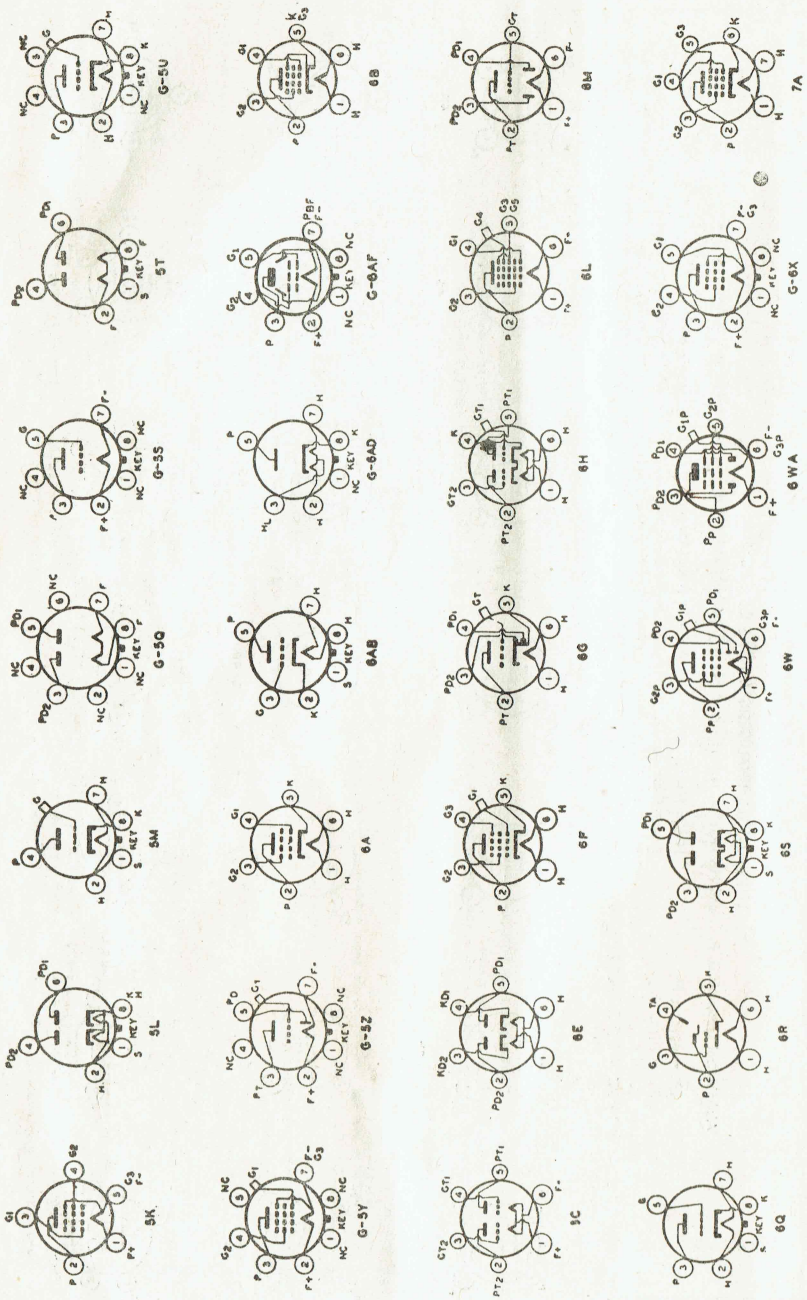
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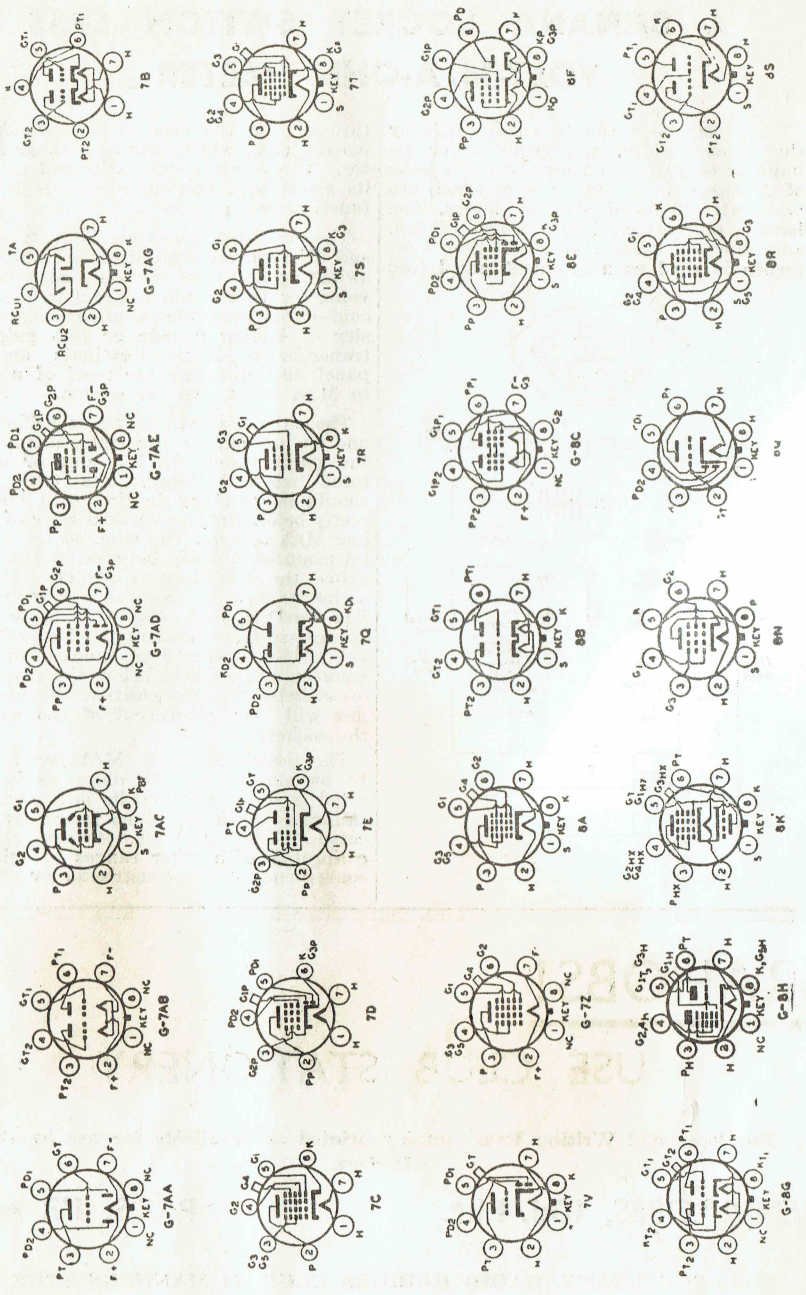
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7Q
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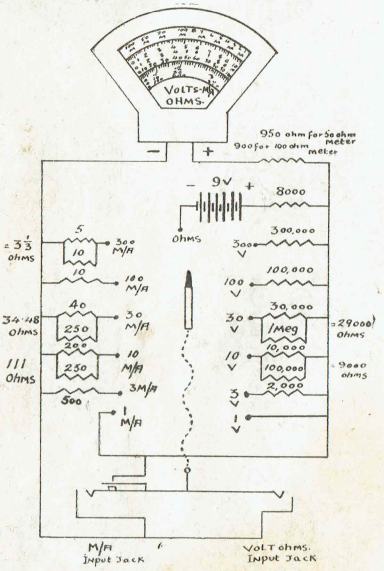
6N
7AC
7E
8A
8K
G-7AB
7D
G-7Z
G-8H
G-7AA
7C
7V
G-8G

A BANANA SOCKET SWITCH LESS VOLT-M/A-OHM METER

This instrument can be easily made by the home builder, and requires for its building only 17 ¼ watt resistors, 2 jacks of the open circuit type, one of which has two extra filament control levers, one banana plug attached to a length of flex, and fourteen banana sockets. The fourteenth is used as a grommet panel feed through for the flex of the wandering banana plug, which acts as a range selector. This latter socket will need to have its metal back end cut off before it may function as a grommet.



The two jacks which are for volt ranges and M/A ranges respectively are automatic switching and are the only means provided for them from internal to external connection, thus these eliminate the necessity of having a pair or two pairs of transmission block terminals on the panel and eliminate the need of a volts to M/A on-off type of switch.

The circuit is extremely straightforward and is set out in the same manner as the parts should be laid out or orientated when building. The two jacks should be mounted in line with and directly below the two vertical rows of volts and M/A sockets. The ohm. socket should be mounted directly between and slightly above the two lines of sockets and the socket that is to serve as a grommet or flex feed through should be placed in symmetrical relationship to the ohm socket in that it should be mounted directly between and slightly below the two lines of sockets. In this position the hanging flex will keep nicely out of the way of the sockets.

The resistance of the M/A meter must be brought up to 1000 ohms, as is indicated in the circuit and its face should be calibrated with the ohms range, as indicated in the diagram. It can also be calibrated with other ranges to suit the convenience of the constructor or user.

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