

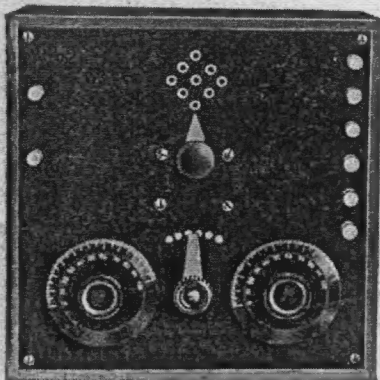
Vol. 5. No. 4.—Published by A. F. Penton & Co. at 60-62 Adelaide St. E., Toronto, Ont.

# RADIO

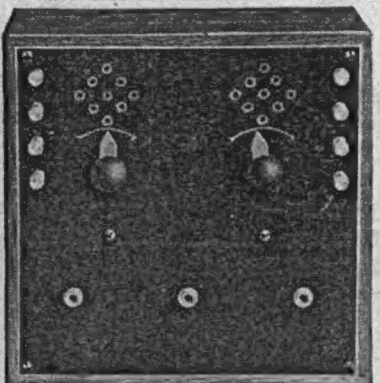
Incorporating "WIRELESS & AVIATION NEWS"

JULY - 1922 \* Price 15c

## RADIO SUPPLIES FOR LESS



Type A Detector and Tuner, assembled unwired \$24.00

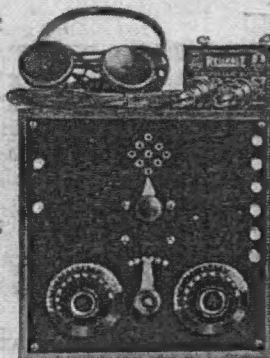


Type C 2-Stage Amplifier, complete \$24.00

Save  
40 to 50%

Compare these  
Prices on Parts

- Single Head Phones, 1,000 ohms \$2.95
- Double Head Phones, 2,000 ohms \$3.95
- Wentworth Special D Phones, 2,000 ohms ..... 4.95
- Everett Phones, 3,000 ohms..... 7.50
- Variocouplers, best made ..... 4.00
- Variometers, Wentworth Special ..... 6.00
- Bakelite Dials, 3 in. bevel..... .75
- Bevel Dials, size 4 in. .... 1.25
- V.T. Sockets, panel mounting... .85
- Rheostats, the finest made..... .85
- Galena, tested ..... Each .15
- Crystal Detector, Bakelite base 1.25
- Two Circuit Jacks ..... .90
- Single Circuit Jacks ..... .75
- Single Plugs ..... 1.00
- Double Plugs for 2 Sets Phones 1.40
- Two Slide Tuning Coils.....Each 1.40
- Thorndarson Amp. Transformers 6.35



Type B Detector Tuner, includes Phones, A Storage Battery, B Battery, Insulators and Aerial, complete, assembled unwired \$49.50



Type D Detector Tuner and 2-Stage Amplifier, includes Phones, Loud Speaker, one 45-volt B Battery, one A 6-volt Storage, Aerial and Insulators \$95.00

Any Amateur can wire these sets in 20 minutes.

We Carry a Complete Stock of Supplies for the Amateur.



Terms Cash with Order or C.O.D.

Write for Complete Price List

### WENTWORTH RADIO SUPPLY CO., Limited

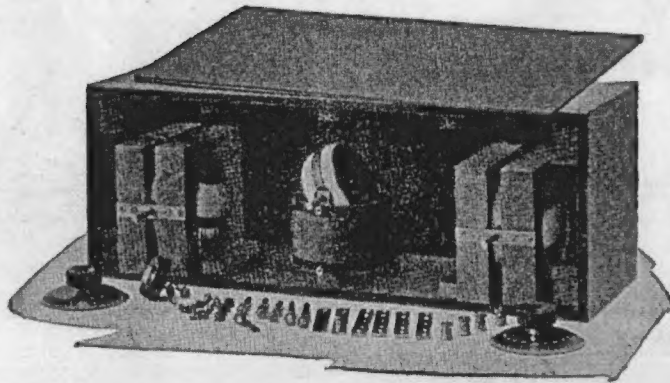
Head Office:  
31 JOHN ST. N.

Radiophone Broadcasting Station C. K. O. C.

Phone Reg. 4521

HAMILTON, ONT.





## Paquin Unassembled Receiver

Complete as shown above, with  
exception of Dials and Windings

**\$22.50**

Made-in-Canada

200—600 Meters

Complete with Panel Drilled,  
Dials, Case, etc.

**\$27.50**

The Set consists of—

- 1 Stained Oak Cabinet, 18" x 7" x 7", removable top and back.
- 1 Polished Celoron Panel, 18" x 7" x 1/8" to fit Cabinet
- 2 Variometers, 4 3/4" square, mahogany wood, beautifully turned.
- 1 Winding Form for Stator Windings.
- 1 Celoron Coupler Primary tube 3-5/8" x 2 1/2" high.
- 1 Coupler Secondary Ball, mahogany turned.
- 7 Contact Points, 6 Binding Posts, 1 Switch Lever, 2 Stops.

Set Complete with all holes drilled, (except panel), all necessary brass parts, screws, etc. for assembling, with directions. Panel drilled \$0.75 extra. Dials \$1.10 each.

This complete set of parts assembled in an hour's time, is a most exceptional value at only \$27.50 (\$22.50) if you do your own winding) and is our contribution towards the lower cost of Radio. Each set is of perfect workmanship, and sold under a money back if not satisfied, basis. This is undoubtedly one of the greatest values ever offered. Place your order to-day and be convinced.

Variometer Parts separate, wound \$5.00 Unwound \$4.00.

Complete Vario Set comprising grid and plate Variometers and Variocoupler, all wound and ready to assemble \$15.00. Cabinet only \$5.50.

Note these SPECIAL Prices on Radio Apparatus—

Panel Mounting Rheostats .....	\$1.00	Firco Loud Speakers .....	\$48.00
Bakelite Plugs for Coils .....	.60	Bakelite Knobs and Dials .....	1.00
Fibre Plugs for Coils .....	.40		

Send for Our Latest Price List.

787 Queen St. W. **J. M. PAQUIN** Toronto, Ont.  
THE ELECTRICAL SHOP



**NOW READY FOR DELIVERY**  
**THE EVERYMAN**  
**RADIOPHONE RECEIVER**



The EVERYMAN is a Crystal Detector Set with a receiving range up to approximately 30 miles.

The EVERYMAN is so much superior to any other Crystal Set that it is strictly in a class by itself when compared with others.

There is a lot of real enjoyment to be had with an EVERYMAN and if there is no local radio dealer that can tell you about it, write us and we will be glad to do so. Be sure to get the particulars regarding the EVERYMAN before purchasing a crystal receiving set.

**ATTENTION DEALERS**

We are now in production on Head Sets, Vernier Type Variable Air Condensers and Rheostats. These should be included in your stock. Particular customers who want the best will ask for them.

**CANADIAN INDEPENDENT TELEPHONE CO., LIMITED**  
 Offices : 212 KING STREET W.      Factory : WALLACE AVE., TORONTO

*When writing to Advertisers please mention RADIO*

### DEAL WITH THE MANUFACTURERS

Sole Distributors for all Radio Apparatus and Parts

GUARANTEED

Receivers—1500 ohms—\$7.50 per pair

Acme Special Radio Set—\$7.50

### IMMEDIATE DELIVERY ON MAIL ORDERS

CONDENSERS, VARIOMETERS, VARICOUPLERS, DETECTORS, DIALS,  
TUBES, Etc.

### ACME RADIO CO.

143 QUEEN ST., W., TORONTO, ONT.

DETROIT OFFICE—448 FIELD ST.

Telephone: Main 4958

### TOMLINSON & FORBES

Manufacturers of

### High Grade Radio Parts

LATERAL COILS

Cabinets, Sockets, Rheostats,  
Coil Mounts, Receiving and  
Amplifying Radio Sets, Plugs

216 VICTORIA ST., TORONTO, ONT.

### Manufacturers of Radio Apparatus for Amateurs or Dealers

LESCO RHEOSTATS - \$1.00

LESCO V.T. SOCKETS - \$1.00

THE

LESLIE RADIO SUPPLY CO.

685 SHAW ST.

TORONTO

### Radio- Batteries

"A" (All Rubber)



"B" (Rechargeable)

GRAY BATTERY & ELECTRIC SERVICE,  
Park 4097 77 Roncesvalles Ave., TORONTO

### Manufacturers of Radio Apparatus and Parts FACTORY NOW OPEN

Immediate Delivery on Condenser Plates and Separators

Radio Electric Products

OAKVILLE

ONTARIO

### Canada's Leading House for Amateur Wireless Parts

IT IS OUR BUSINESS AND OUR AIM TO GIVE SERVICE AND SATISFACTION.

IF WE HAVE NOT WHAT YOU REQUIRE WE WILL GET IT.

*BOYS— Opportunity Knocked at Your Door Once Before—  
How Many Failed to Open ???*

**\$14<sup>50</sup>**

**BROWN'S FAMOUS RECEIVERS**

**\$14<sup>50</sup>**

Type A. Adjustable. 8000 Ohms. Reconditioned.  
LIMITED SUPPLY. ALL ORDERS TREATED IN ROTATION.

**VISCO Rheostat - \$1.00** The First Canadian Moulded Rheostat.

**THE VIMY SUPPLY CO., 567 College St., TORONTO**

MAIL ORDER OUR SPECIALTY

*When writing to Advertisers please mention RADIO*

# RADIO PANELS and RADIO PARTS

Start right. The panel is the very foundation of your set. High volume and surface resistance are essential factors. Make sure that you get them in both the panel and parts that you purchase. To make doubly certain look for the dealer displaying this sign



CONDENSITE  
**CELORON**

Radio Panel Service



Condensite Celoron, Grade 10—approved by the Navy Department Bureau of Engineering—is a strong, handsome, waterproof material, high in resistivity and dielectric strength. It machines easily, engraves without feathering and is particularly desirable for panels. It is also widely used for making many other important radio parts, such as tube bases, platform mountings, variable condenser ends, tubes for coil winding, bases, dials, knobs, bushings, etc. We are prepared to make these various parts to your own specifications.

Where economy is a factor we can supply panels of Vulcanized Fibre Veneer made of hard grey fibre veneered both sides with a waterproof, phenolic condensation product. This material has a hard, smooth, jet-black surface, machines and engraves readily and will give excellent service where very high voltages at radio frequencies are not involved.

Shielded plates (patent applied for) are made with a concealed wire shield. This shield, when properly grounded, effectively neutralizes all howl and detuning effects caused by body capacities.

Are you a Radio Dealer? Let us tell you how easily and profitably Celoron Radio Panel Service enables you to supply your customers with panels machined and engraved to their specifications. Write to-day for our Dealer's Proposition covering panels, dials, knobs and tubes.

## Diamond State Fibre Company

of Canada, Limited

Head Office and Works: 235 Carlaw Ave., - Toronto, Can.

*When writing to Advertisers please mention RADIO*



# RADIO FANS!

**H**OOK UP Eveready Radio "A" and "B" Batteries to your outfit and get the best results. Eveready Batteries are made by the largest dry and storage battery manufacturers in Canada. "B" Batteries are equipped with Fahnestock clips which grip the wires firmly and prevent loose connections. "A" Batteries have mahogany-finished boxes and nickel-plated handle and trimmings. The bail handle is supplied so that the battery may be moved or carried about with one hand. A specially-designed vent prevents the spilling of the electrolyte.

## EVEREADY "A" and "B" Batteries

are made in sizes to suit  
every vacuum tube outfit

**Y**OUR dealer will supply the correct size of batteries for your outfit.

Insist on Eveready Batteries for the best results.

*For sale by all dealers.*

**CANADIAN NATIONAL CARBON CO., LIMITED**  
Montreal Toronto Winnipeg Vancouver



No. 766 - 16½ to 22½ Volts  
"B" Battery



"A" Battery

# The Electroplax Company, Ltd.

HARRY E. COREY, President

## Everything in RADIO Insulation!

CANADIAN MANUFACTURERS of

AERIAL INSULATORS	LIGHTNING ARRESTORS
BINDING POSTS	LAMINATED TUBING
CONDENSOR END PLATES	MICA CONDENSOR CONTAINERS
COIL MOUNTS	PANEL BOARD (Redmanol Bakelite)
COUPLER INSULATING PARTS	RHEOSTAT BASES
DIALS	RADIO BOXES
DETECTOR BASES	ROTOR INSULATING PARTS
FUSE PARTS	SWITCH BOARDS
GROUND SWITCH BASES	SWITCH HANDLES
INSULATORS	SOCKETS
INSULATION ON JACKS	TELEPHONE EAR CUPS
KNOBS	VACUUM TUBE HOLDERS, ETC., ETC.

Also

MOULDERS OF PHENOL RESIN PLASTICS  
REDMANOL — BAKELITE — CONDENSITE — AND COLD PRESSED PLASTICS,  
THERMOPLAX, PYROPLAX

ACID HEAT PROOF VARNISHES

SYNTHETIC AMBER PRODUCTS

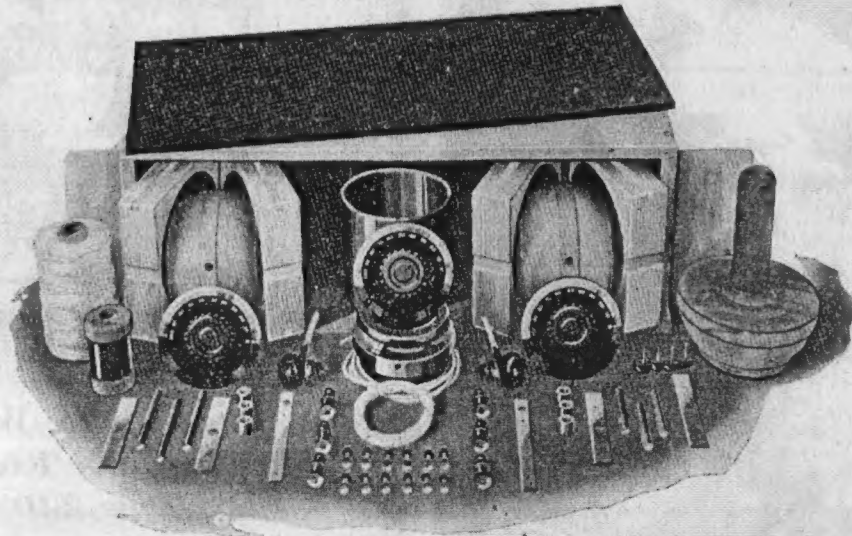
Factory—Mount Dennis, Ont.  
Jct. 5985. City Office, Adel 7971

City Sales Office—  
YORK BLDG., TORONTO  
W. M. Davidson, Sales Manager

*When writing to Advertisers please mention RADIO*

# ASSEMBLE YOUR OWN VARIOMETER TUNER

**\$25.**  
COMPLETED!



**\$25.**  
COMPLETED!

The new improved MILLER knocked down variometer tuner,  
with the original reinforced variometer stators.

The set is exactly as illustrated. Each part is of the finest material obtainable. YOU can assemble this SHORT WAVE VARIOMETER TUNER with a pair of pliers, a screwdriver and a soldering iron.

## IMMEDIATE DELIVERY GUARANTEED

The improved set consists of:—

- |   |                           |
|---|---------------------------|
| 1 Hardwood cabinet 17¼-inch x 6½-inch x 7-inch, with removable back.    |                           |
| 1 Polished Cerebon panel 17-inch x 8-inch x ½-inch, accurately cut.     |                           |
| 3 Moulded bakelite dials, 3-inch diameter.                              |                           |
| 2 Sets of variometer parts. Forms of seasoned wood and absolutely true. |                           |
| 1 Set variocoupler parts. Moulded tube, hardwood rotor.                 |                           |
| 2 Switch levers, bushing type.  |                           |
| 4 Rubber feet for cabinet.  |                           |
| 1 Set aluminum shields.   |                           |
| 6 Binding posts.  |                           |
| All necessary hardware.   |                           |
| Assembling instructions.  | (Shipping weight 14 lbs.) |

- |                                  |
|----------------------------------|
| 6 Feet spaghetti tubing.         |
| 14 Switch contacts.              |
| 1 Winding form for Variometer.   |
| Wire for variometers.            |
| Wire for variocoupler.           |
| Wire for connecting instruments. |

## SOLD WITH A MONEY-BACK GUARANTEE

Variometers and Variocouplers are not just plain wood turnings—they are machined with the utmost precision.

THE COMPLETE SET OF PARTS COMES NEATLY PACKED IN INDIVIDUAL CARTONS.

### ORDER FROM YOUR DEALER OR DIRECT FROM US

RADIO  
APPARATUS  
EXCLUSIVELY

RADIO  
APPARATUS  
EXCLUSIVELY



"Better Radio Apparatus"

136 VENDOME AVE., N.D.G. MONTREAL, P.Q.

When writing to Advertisers please mention RADIO

Among Radio users everywhere the name Magnavox stands for quality products of dependability and service.



**M**AGNAVOX Radio, the Reproducer Supreme, can be used with any of the good receiving sets.

Without a Magnavox Radio no wireless receiving set is complete. It makes it possible to hear all that is in the air as if it were being played by your phonograph.

**TYPE R-2:** with 18 inch Horn, serves the requirements of professional use for large audiences, dance halls, etc.

**TYPE R-3:** with 14 inch Horn, ideal for use in homes, amateur stations, offices, etc.

**MODEL C POWER AMPLIFIER:** insures getting the largest possible power input for your Magnavox Radio, 2 and 3-stage, and is specially designed for power tubes.

Ask your dealer to demonstrate or write us for descriptive booklet and name of nearest dealer.

The Magnavox Co.  
Oakland, California  
N. Y. Office: 370 Seventh Avenue

"Radio brings it  
MAGNAVOX  
tells it"



## KENNEDY

### Intermediate-Wave Regenerative Receiver Type 220

Maximum effectiveness with a high degree of selectivity on all wave lengths within its tuning range of 175 to 3100 meters is assured by the design of Kennedy Receiver Type 220.

This receiver is made for those who want highly efficient reception over a range of wave lengths somewhat more comprehensive than that provided by the ordinary short-wave instrument.

In its design full use has been made of the accepted principles of the best radio engineering practice. This has resulted in a highly selective receiver of maximum effectiveness.

Type 220 receiver has proven very popular for the reception of radio amusement, educational features, news and market and weather reports.

KENNEDY RADIO EQUIPMENT IS LICENSED UNDER ARMSTRONG U. S. PATENT NO. 1,113,149 AND IS SOLD BY GOOD DEALERS EVERYWHERE

Write for Latest Bulletin C-3

KENNEDY  
EQUIPMENT

THE COLIN B. KENNEDY COMPANY

RIALTO BUILDING

SAN FRANCISCO



— WHOLESALE ONLY —

## Leading Canadian Radio Jobbers

We handle the Best of all Standard Radio Apparatus and Equipment.

Our large orders to manufacturers enable us serve the trade promptly and efficiently.

**DEALERS WANTED THROUGHOUT CANADA.**

It will pay you to be able to give your customers "Dominion" Service. Write for particulars.

**Dominion Radio and Supply Co.** General Offices: 152 Bay St., Toronto, Ont.

Warehouse—65 Front Street East.

## RUSSELL RADIO PRODUCTS

*Announcement to TRADE*



Will be shortly on production of Variable Air Condensers, Vacuum Tube Sockets, Rheostats, Telephone Plugs and Jacks—all of "Russell" Standard of Quality.

Enquiries Solicited from Trade. Watch for our Exhibit at Canadian National Exhibition and First Canadian Annual Radio Convention.

**Russell Gear and Machine Co., Ltd.**

1209 KING STREET WEST

TORONTO, ONT.

## "Everett" Double Radio Phones

*"When better phones are built we will build them"*

Loud in Tone

Sensitive to weak signals.

Will withstand amplification without distortion

Price in Canada

**\$12<sup>50</sup>**



Approved by professional and amateur Radio Experts throughout the country

At All Dealers

*On account of their supreme quality you will EVENTUALLY buy—why not NOW*

**Everett Electric Corp.**

320 BROADWAY, NEW YORK, N.Y.

Place Your Order Now for  
**GILSON RECEIVING SETS**

With our large manufacturing facilities and organization, we will shortly be in a position to fill orders in any volume.

Our low prices will prove sensational.

The trade and public are urged to write at once for literature and prices.

GILSON MANUFACTURING CO., Limited, 131 York St., Guelph, Ont.

RADIO PANELS and OTHER INSULATION  
 FOR WIRELESS WORK  
**BAKELITE-DILECTO**

Grade XX Black was used by the United States Government during the War for this purpose. It is the **STANDARD** of the WORLD

THE CONTINENTAL FIBRE COMPANY, Newark, Del.

85 Plymouth Ave., South Rochester, N. Y., and 1927 First Ave., South Seattle, Wash.



**Absolutely Noiseless  
 Wireless Batteries—  
 At Last**

You know how irritating those hissing and rattling noises become when receiving broadcasts.

Now they are a thing of the past. The Manufacturers of Reliable Wireless Batteries have discovered the secret of making a Wireless Battery that is absolutely noiseless, and that will give highest capacity for the lowest price in actual hours of service.

You can easily prove this by ordering a set of Reliable Wireless Batteries from your Radio or Hardware Dealer, and attaching them to your Wireless.

Manufactured only by

**The Dominion Battery Co., Limited**

Montreal - Toronto - Winnipeg - Calgary - Vancouver

RADISCO AGENTS

**Concentrated Buying  
 For Canada**

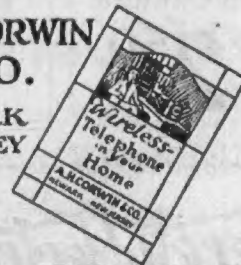
**Y**OU can waste a lot of time and have some sad experiences by shopping for your radio supplies among many firms, but we offer you an alternative.

We are RADISCO agents and, as such, our stock includes the entire lines of the Radio Corporation of America; Clapp-Eastham Company; John Firth & Co. Inc.; Westinghouse Electric & Manufacturing Co.; Radio Manufacturing Company; Acme Apparatus; Wm. J. Murdock Co., and certain specialties of other manufacture.

Your orders will be promptly attended to and the necessary triplicate certified invoices made out.

**A.H. CORWIN  
 & CO.**

**NEWARK  
 NEW JERSEY**



This book "Wireless Telephone in Your Home," will be sent to you for a less-than-cost charge of 25 cents.

When writing to Advertisers please mention **RADIO**

# BRACH vacuum LIGHTNING ARRESTER

In all parts of Canada as in all sections of the States you'll hear skilled radio engineers commend the Brach Vacuum Lightning Arrester as the highest development in lightning protection—that is why they so universally specify it—that is why, also, it is

*Listed by the Underwriters' Laboratories*

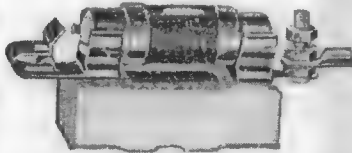
Not only since radio has become popular has the Brach Arrester been demonstrating its superiority, but for the past 16 years it has been used by the principal railroad and telegraph companies, by fire alarm systems, by the U. S. Army, and others. It is conceded that the vacuum gap system, which is a feature of the Brach Arrester, is best for radio protection.

The Brach Vacuum Lightning Arrester stands like a sentinel, day and night, guarding your radio and home against interference and destruction—does it automatically, requiring no switching or other attention. Both indoor and outdoor types.

Sold by leading Radio and Electrical Dealers.

**L. S. BRACH MFG. Co., Newark, N. J.**

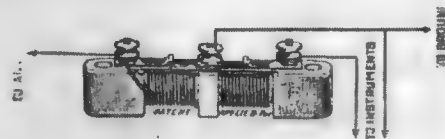
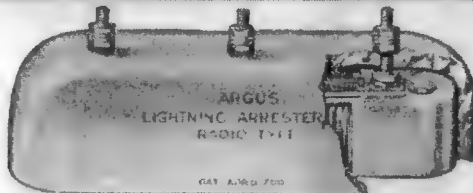
16 years Specialists in Lightning Protective Apparatus.  
Also Makers of SOLDERALL



Indoor Type,



Outdoor Type



## ARGUS LIGHTNING ARRESTER RADIO TYPE

Especially adapted for protection to Radio Receiving Sets against damage by lightning. It is as efficient after lightning has passed through it as it is before, and it does not deteriorate or change in capacity as do arresters of the vacuum type. It requires no attention—all you have to do is install the ARGUS ARRESTER in your antenna circuit and forget to worry about damage to your Home or Receiving Set, even during the most severe lightning storm.

The Argus Arrester is built for rough weather, and has seen 18 years of active service, therefore can be depended upon.

It eliminates the necessity of a costly lightning switch. You will never be sorry because "You forgot to throw the switch" as there are no switches to throw. It is fool-proof. It acts as a filter for static.

Price.....\$2.00

F.O.B. Toronto, Ontario

Canadian Agents,

**"CAM-FISH" CO., Limited**

70 King St. West., Toronto, Ontario.

Complete Line  
of  
Radio Supplies

—  
QUALITY

Liberal Discounts  
to  
Dealers

—  
SERVICE



# BRANSTON RADIO

"STANDARD QUALITY"

Head Sets - Crystal Receiving Sets - Duo Lateral Coils  
Coil Plugs - Three-Coil Mountings - Telephone  
Plugs - Lightning Arresters - Series Parallel  
Switches - Condensers - V. T. Sockets  
Audio Frequency Transformers  
Rheostats - Loud Speakers, Etc.

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## Duo Lateral Coils

(Honeycomb)

All sizes  
25 to 4,000,  
mounted and  
unmounted.  
The finished  
product resulting  
from many years'  
experience in  
coil winding



BRANSTON "STANDARD" HEAD SETS  
2500 Ohms, \$9.50 - 5000 Ohms \$12.00

## Lightning Protectors

(Vacuum Type)

Absolute safety  
combined with  
great strength  
and durability.

Very finely  
polished and  
finished.

Price \$4.00 each

The name  
"BRANSTON"  
is a  
guarantee of  
satisfaction  
for  
YOU

It is a revelation to "listen in" with a "Branston Head Set."  
The natural rich mellow tones are there — right in your ear —  
clear as a bell—without ear strain. Branston Head Sets are the  
successful result of long experimentation for something better than the  
ordinary.

Scientifically adapted to give the utmost in voice and concert reception.

You can pay more for less value, but you can't get more value at any  
price.

Light in weight and designed so that they can be worn for hours without discomfort.

Dealers  
and Agents  
write for  
prices and  
discounts

## CHAS. A. BRANSTON LTD.

355 YONGE ST., TORONTO, ONT.

When writing to Advertisers please mention RADIO



A. F. PENTON & Co.,  
Publishers.

60-62 ADELAIDE ST. EAST, TORONTO, CANADA.

C. LINCOLN-MITCHELL,  
Publication Manager.

Volume 5.

TORONTO, JULY, 1922.

No. 5

## RADIO TELEGRAPH REGULATIONS

### GOVERNMENT RADIO FEES

The Canadian Government fees for Radiotelegraph Licenses and examinations for Certificate of Proficiency in Radiotelegraphy, as announced by the Department of Marine and Fisheries at Ottawa, from now on will be as follows:—

#### Fees for Licenses

The annual fees to be paid in respect of Licenses issued by the Minister of the Department of Marine and Fisheries for the installation and operation of radiotelegraph stations in the Dominion of Canada, or on board any ship registered in Canada, shall be as follows:—

#### Fees for Examinations

1. Limited Coast Station .....	\$50.00
2. Public Commercial Station .....	50.00
3. Private Commercial Broadcasting Station .....	50.00
4. Private Commercial Station .....	10.00
5. Experimental Station .....	5.00
6. Amateur Broadcasting Station .....	5.00
7. Amateur Experimental Station .....	1.00
8. Private Receiving Station .....	1.00
9. Technical or Training School Station....	5.00
10. Ship Station .....	1.00

The fees to be paid in respect of examinations for "Certificates of Proficiency in Radiotelegraphy and Radiotelephony," shall be as follows, for each examination or re-examination:—

1. Extra First Class Certificate .....	\$5.00
2. First Class Certificate .....	2.50
3. Second Class Certificate .....	1.00
4. Third Class Certificate .....	1.00
5. Experimental Certificate .....	2.50
6. Amateur Certificate .....	0.50
7. Emergency Certificate, any class .....	2.50
8. Radiotelephone Certificate .....	2.50

Mr. C. P. Edwards is director of Radio service at Ottawa and no doubt would gladly reply to enquiries from Radio operators in Canada who may desire further information. The announcement given above is dated at Ottawa, July 14th, 1922.

The following is the concluding instalment of the regulations governing the installation of Radio telegraph or telephone apparatus, as compiled this month by the Dominion Fire Commissioner:

#### Operating Ground Wire (for Transmitting)

(1) The Radio operating ground conductor shall be of copper strip not less than three-eighths ( $\frac{3}{8}$ ) inch wide by one sixty-fourth (1-64) inch thick, or of copper, or approved copper-clad steel having a periphery, or girth (around the outside) of at least three-quarters ( $\frac{3}{4}$ ) inch (for example a No. 2 B. & S. gage wire), and shall be firmly secured in place throughout its length. The Radio operating ground conductor shall be protected and supported similar to the lead-in conductors.

#### Operating Ground

(m) The operating ground conductor shall be connected to a good, permanent ground. Preference shall be given to water-piping. Gas-piping shall not be used for ground connections. Other permissible grounds are grounded steel frames of buildings or other grounded metal work in the building and artificial grounding devices, such as driven pipes, plates, cones, etc.

#### Power from Street Mains

(n) When the current supply is obtained direct from street mains, the circuit shall be installed in approved metal conduit, armoured cable or metal raceways.

If lead-covered wire is used it shall be protected throughout its length in approved conduit or metal raceways.

#### Protection from Surges, etc.

(o) In order to protect the supply system from high-potential surges and kick-backs there must be installed in the supply line as near as possible to each Radio-transformer, rotary spark gap, motor in generator set and other auxiliary apparatus, one of the following:

(1) Two condensers (each of not less than one-half ( $\frac{1}{2}$ ) microfarad capacity and capable of withstanding six hundred (600) volt test in series across the line and midpoint grounded across (in parallel with) each of these condensers shall be connected a shunting fixed spark-gap capable of not more than one thirty-second (1-32) inch separation.

# Simple Instructions for the Beginner

## MAKING AN R. F. TRANSFORMER

Among Canadian beginners there has been a consistent popular demand for a simple radio frequency transformer which can be made without difficulty at home. The complicated calculations of this type of transformer has made it difficult to present a simple article on the design of this piece of apparatus. The transformer described is flexible enough to permit variation in range covering the normal conditions usually found in the average receiving station. The novice will feel amply repaid for any time and trouble spent in the construction of this comparatively simple transformer.

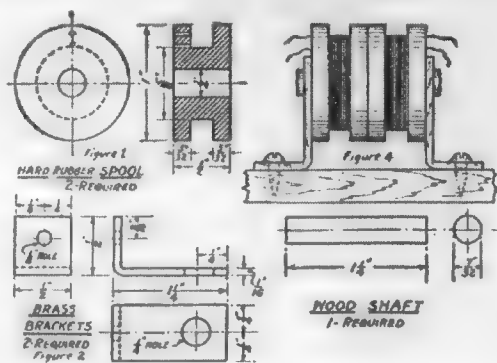
Radio frequency amplification is the one way in which the advantages of the loop aerial can best be utilized. It will strengthen signals enough for phone reception for considerable distances, and with a step or two or audio frequency, following the detector, will satisfactorily operate any loud speaking device. This would not necessarily be true of reception from a detector alone or even with two step audio frequency amplifier. The impedance of the audio frequency amplifier is often too great for the weak signals received alone.

### Parts Required

The following parts are needed in the construction:—

- Hard rubber spools as shown in Figure 1.
- 2 brass brackets as shown in Figure 2.
- 1 wooden shaft as shown in Figure 3.
- 2 rounded-headed wood screws.
- No. 40 enamel covered copper wire.

The spools are turned from half-inch stock which should be preferably hard rubber or bakelite. Fiber can be used, but is very difficult to turn as it wears the edge of the cutting tools very rapidly. A number of these spools should be turned up to permit an assortment of windings. The two small holes indicated on the



side are for the wire to pass through at the start and finish of the winding.

### The Windings

The number of turns for primary and secondary of the transformers necessary to cover the variations in wave length range will mean that about nine of these spools should be wound for the following number of turns, namely: 50, 60, 70, 80, 90, 100, 120, 150 and 200 turns. The combinations will usually work best as follows:

Primary—50, 60, 70, 80, 90, 120, 150.

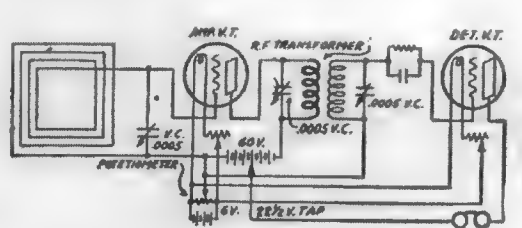
Secondary—70, 80, 90, 100, 120, 150, 200.

This will permit a range up to about three thousand

meters. These number of turns have been approximated but are not necessarily the best for variations in design. It will be difficult to give accurate figures due to the different types of circuits that are used by the different amateurs. It will, therefore, be necessary to experiment with these combinations in order to get the best results. Furthermore, it is advisable to shunt a .0005 mfd. variable condenser across each of the coils. This will permit a finer control of the adjustment to the proper wave length desired. It has been found best to connect a potentiometer across the "A" battery to permit accurate adjustment of the potential of the grid. This will give the most efficient performance and maximum amplification. After the spools have been wound, a layer of cord is wound over the wire and fastened, and the spool is then dipped in paraffine and this is left to harden, after which the units can be assembled as desired, as illustrated in Figure 4.

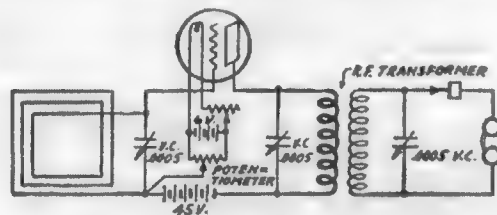
### Vacuum Tube Hook-up

In Figure 5 is illustrated a hook-up, using a loop aerial with amplifier vacuum tube, Radio frequency transformers and vacuum tube detector. Note that there are sixty volts on the plate circuit of the amplifier tube, but the plate circuit of the detector tube connects to the 22½-inch volt tap on the plate battery.



### With Crystal Detector

A crystal detector can be used with one or more steps of Radio frequency amplification. This form of diagram is shown in Figure 6. Two 23-plate variable condensers



are used for the transformer—one each on the primary and secondary, and one is shunted across the loop aerial. Although not shown, a .001 mfd. phone condenser can be connected across the receivers. A 35-volt "B" battery is used for the plate circuit of the amplifier vacuum tube. As has been stated above, a potentiometer is connected across the filament battery.

The use of these Radio frequency transformers need not necessarily be limited to loop aeriels. They can be used for any regular Radio amplifying circuit that has heretofore been given.



## Summer Radio Decline Boon in Disguise

DEALERS AND MANUFACTURERS ALIKE WILL PROFIT IN THE END, SAYS J. D. R. FREED

New York, July 20.—“The present temporary decline in the radio business during the summer months is a boon to the entire industry,” declares Joseph D. R. Freed, President of the Freed-Eiseman Radio Corporation, one of the largest radio manufacturing organizations in the United States, in an exclusive interview to-day. “Both the radio dealers and the more stable and serious radio manufacturers are learning a well-needed lesson from this.”

“For example,” continued Mr. Freed, “dealers are beginning only now to realize the truth of the fact that they cannot afford to carry a large and heterogeneous lot of odds and ends in radio apparatus in the hopes that they will be able to dispose of it. They are learning now, by a stern process, that hysterical overstocking of apparatus in a neffort to meet the spasmodic demand of radio ‘faddists’ is not going to prove profitable in the long run. They are beginning to realize that dependable apparatus, bought to meet the varying radio conditions is more to be relied upon than unknown apparatus that looks good in the catalogue, and is merely an ornament upon the shelves.

“Manufacturers, too, are learning their lesson from this slump. They are realizing that the time of ‘order taking’ is past and that the time of ‘order getting’ is here. They are learning now, if they didn’t know it before, that in order to sell radio apparatus, they must give good value, serviceable merchandise, attractive prices and real service and dealer co-operation. Competition is very keen and hitherto there has been too little of this healthy form of competition. Now that dealers find they must discriminate between the good and the bad in radio apparatus, for they cannot buy everything, they are learning to serve themselves and their customers better, in that they are buying and selling apparatus they know to be good. As a result the entire industry must improve, and that is why I believe this present slump in radio, which is bringing the entire industry to its sense, is a good thing.”

### What Have the Radio Dealers Learned?

“In my opinion,” continued Mr. Freed, “radio dealers are being impressed with a great many new ideas which, perhaps, were never brought to their attention before. These include the elementary principles of radio apparatus buying, selling and service. For example, in buying, dealers are only now beginning to assimilate the first principles, learning what to look for in crystal sets, what to avoid in telephone construction, which vacuum tube outfits may be depended upon and why, and so on. The caution which has been engendered as a result of the slack in consumer buying has made the dealer more conservative than ever in his purchasing. Whereas before, he was in the habit of ordering a couple of dozen sets of various makes, without troubling himself about how they were designed or put together, now he insists on opening and examining the apparatus before ordering.

“Why, some salesmen are even astounded to learn that dealers are refusing to order from salesmen’s samples—they insist on getting a sample order from the manufacturer right out of stock first! And then he orders just enough to take care of the logical demand. Dealers are learning that radio apparatus of dependable

quality cannot be bought from undependable manufacturers—it can only be had from known makers with known reputations for manufacturing dependable goods.

“This sounds very simple, but it isn’t so clearly understood. Good radio apparatus can be made only by people who thoroughly understand the radio business. Yet, within the last few months, hundreds of new firms have gone into the radio business, most of these without any technical preparation whatever. On my desk I have a file of letters from new manufacturers offering to make radio apparatus for the Freed-Eisemann Radio Corporation. These, of course, we refuse, as all our apparatus is made in our own factories. But the list includes cloak and suit manufacturers, jewelers, grocers, a manufacturer of distilled water, a button hole maker, and a dentist. Dealers are guarding against these ‘get-rich-quick’ people, whereas earlier in the year, when business was booming, they bought from anybody who happened along.

“Another good thing this slump has brought along is the calmer attitude dealers have fallen into as regards the quality of the stuff they sell. They are less hysterical in their haste to sacrifice quality and reputation for speed. The slogan ‘send me anything, but send it quick’ has now become ‘send me nothing if you can’t sent it right!’

“Dealers have also been forced to think up new and more stable merchandising schemes. Radio apparatus no longer sells itself, and dealers are forced to become more businesslike in the handling of this line. I say this, not in any spirit of criticism, but rather to point out the crying need for a general stabilizing of radio selling methods throughout the country. ‘Ballyhoo’ methods are not necessary in the sale of radio apparatus, which should be viewed in the lighth of a legitimate line of electrical or household appliance, or a musical instrument, requiring the same keen merchandising sense as any other allied line.

“We must remember that there was a time when the phonograph business was a fad—when even automobile selling required pretty wild methods—and of course, the radio industry must pass through the same comparative stage. But the sooner we are out of it the better off we all will be. Radio is little different from any other line—the dealer who conducts a serious business along recognized lines will be doing business next year, when the ‘ballyhoo’ men will be out.

### What Have the Manufacturers Learned?

“Radio art is advancing rapidly,” continued Mr. Freed, “and manufacturers are kept constantly on the jump to keep up with it. Manufacturers can no longer wait in their offices for orders to come in—they must get out and hustle for it. Another thing they have learned is that the day of apparatus ‘made to sell and dependability in manufacture and stability in reputation. not to use’ is past—that nothing counts for as much as ‘They have learned that permanence can be had only with service apparatus which continues to give satisfaction for a long, long time. Dealers are refusing to buy ‘temporary’ improvements or ‘temporary’ apparatus, which lasts just long enough to make a customer wish he had bought something else.

“Manufacturers are learning that dealers are looking for stability and reputation before they look for appara-

tus, and that they want some sort of guarantee that the manufacturer will be in business when the kicks, if any, come through. Radio is like the automobile business in one respect—if you buy a car and then cannot get separate parts in case of need, your car might just as well be relegated to the junk heap. If a consumer buys a radio outfit and then seeks separate parts to make a new circuit with or for additional installations, he will not be easily calmed if his dealers say, 'Sorry we can't oblige you, but that manufacturer went out of business last week.' The buyer feels that it was up to the dealer not to sell him stuff made by a manufacturer who goes in and out of business over night.

#### Lasting Through the Drought

"Most business men, interested in radio, foresaw this summer slump. It was generally understood that the tremendous pace of the radio craze during the first half of this year could not endure. Predictions were made that there would be a tremendous increase in sales for about six months, followed by a swift decline, a period of depression, and then a steady upward swing. The decline has come, the depression is on, and the upward swing is still ahead of us.

"The legitimate manufacturers and dealers will work together to profit by the steady radio demand—the 'fly-by-night' ballyhoo workers are scrambling out of the field. Those radio dealers and manufacturers who have placed their reputations behind their apparatus will survive, and the opportunists who sought to make capital

of a sudden fad without regard either to public benefit or their own to-morrows, will be relegated to the limbo of the things that were.

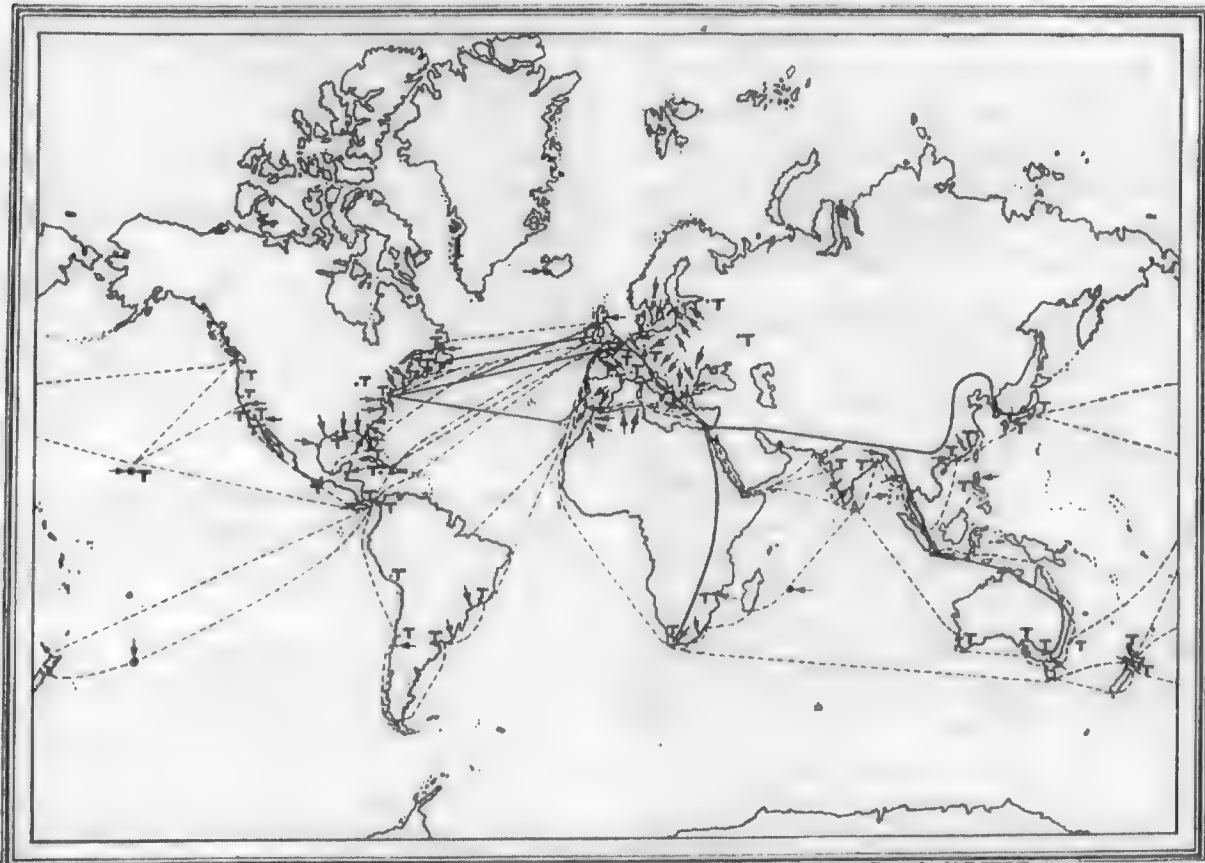
"There are plenty of reliable radio dealers and manufacturers in the radio field and to them, for simple economic reasons, will gravitate the bulk of the radio business and the bulk of the public confidence. For this reason," says Mr. Freed, "serious manufacturers and dealers alike should observe the summer slump with a certain degree of satisfaction, knowing that the future welfare of the industry lies in the sale of dependable apparatus from dependable sources by dependable merchants along dependable merchandising methods. Patent infringers, too, are finding things a little too warm for them, and are leaving, one by one.

"In the long run," concludes Mr. Freed, "the benefit from this radio slump will go to the public—for the people will be the gainers by this general clearing of the radio atmosphere."

#### HOSPITALS GIVEN RADIO SETS

Cambridge, Mass.—Three detector and two stage amplifier receiving sets, together with three audiophone loud speaker, have been donated to hospitals for disabled soldiers.

It is said that Station 9CT located in the Wrigley Building, Chicago, recently established communication by Radio telephone with the University of Texas in Austin, more than 1,400 miles away.



Stations supplying Time and Weather Reports. (1) Stations issuing Meteorological Reports marked  $\rightarrow$ . (2) Stations issuing Time Signals marked T. Principal Steamship Routes marked ..... and long-distance Aeroplane Flights marked ———.

# Some Miscellaneous Notes on Radio

*By a Canadian Expert*

## Tuning

Tuning is the process of obtaining electrical resonance in two circuits.

Now that sounds quite technical but really is not as hard as it sounds and is very well illustrated by the following:

If we stretch a string, say three feet long, between two points and hang from it two other strings, say one foot long, which have small weights attached to them we will have the mechanical equivalent of a coupled Radio circuit.

Hang the two strings with the weights about six inches from each other near the center of the long string.

For convenience we will call the long string number one, the short string on the left, P, and the one on the right, S.

Now pull the string P to one side and release it, and note that it swings back and forth in a series of oscillations, each one of which is shorter than the previous one. Also note that string S starts to swing back and forth and soon is oscillating as hard as P, but P is gradually slowing down. However, after having slowed down and partially stopped, P will start oscillating again until it will be oscillating almost as hard as before, but S has stopped.

Thus it is seen that the energy is given to the first string by pulling it to one side is transferred to the other one and then transferred back until it is all used up in friction.

The length of time it takes for these oscillations to die down depends upon the horizontal movement of string number one and the horizontal movement depends upon how tightly the string is stretched.

If the horizontal movement is great there will be a frequent transfer of energy. This corresponds to "close coupling." If the horizontal movement is slight, there will be a less frequent transfer of energy, which corresponds to "loose coupling."

The strings P and S, corresponds to the primary and secondary of an oscillation transformer, generally known as a coupler.

Advantage may be, and is, taken in the better stations of "loose coupling" on account of the purity of the wave either sent out or tuned to in the case of a receiving station.

The reason for using loose coupling is this: If we use a receiving set for example, containing a primary and secondary coil, and tune the primary and secondary separately by means of a wave meter to a given wave length or frequency, say 360 meters, and then bring the primary up to the secondary until signals are heard, we find that only stations tuned to the exact wave length to which we tuned our set can be heard. In other words there is only one wave length in the circuit, 360 meters. Let us now move the primary and secondary very close together and we find that stations on 200 meters and probably 600 meters are now heard. Our circuits are now closely coupled, and we are getting interference from undesirable stations. Sometimes we blame those stations for not staying on the wave length they are supposed to, but there are times that readjusting or coupling our own sets looser would avoid the interference.

As a matter of experiment, the writer at one time, using a large receiving loose coupler, carried the primary thirty feet from the secondary and continued to receive signals from the old Sayville station, which indicates that there still was a transfer of energy from one circuit to another.

In very loosely coupled circuits the normal frequency of oscillation or wave length is unchanged. On the other hand where circuits are closely coupled the normal frequency or wave length is changed and more than one wave length is present or rather may be detected in the case of a receiving set and radiated in the case of a transmitting set. Such sets are "broadly tuned."

## Methods of Obtaining Variation of Inductance

There are several ways by means of which a change of inductance may be obtained. Change of coil method, the step method and the variometer method.

The change of coil method requires that one have a number of coils for a given band of wave lengths, for example, one coil for 160 to 215 meters; another for 200 to 350 meters and so on. These coils must be or should be so equipped that they may be taken out or inserted in the circuit with a minimum loss of time.

The step or top method is the one familiar to nearly all who have taken up Radio and is the one where we find a single coil of wire wound on a form of suitable size, and from which a short wire extends every few turns to a switch.

In this way any given number of turns of the coil may be cut into the circuit and since the inductance depends upon the number of turns of wire, the inductance may be varied in steps corresponding to the number of turns included in each top.

However, there are limitations to the practical size any coil should be made as it has been found that it is not good practice to make a coil large enough to tune to the longest wave length in use and expect it to function well on the short wave lengths.

The third method for varying inductance is by means of a variometer.

Briefly, a variometer consists of two coils of wire wound on suitable forms, and so arranged that one can be rotated inside the other or moved away from each other, one end of the winding on one being connected to one end of the winding on the other.

When these windings are both in the same direction, and current flows through them, the magnetic field set up assist each other and a maximum inductance value is obtained, but if the windings are opposite, then the magnetic fields oppose each other and a minimum value is obtained. Any degree between minimum and maximum may be obtained by changing the relative positions of the windings.

However, there is never a time when the inductance value is zero, because only the mutual inductance of the coils is changed; the self-inductance of each coil is still present.

It is estimated that \$5,000,000 is spent weekly by Radio fans. The industry is assuming such proportions that it is impossible to foretell how soon it will settle down with an organized business. At this time when the country is just recovering from a severe economic depression it is encouraging to note one industry that is far from



# Characteristics of Vacuum Tube Amplifiers

Ordinarily in the usual types for amplifier circuit both very low and very high frequencies are neglected, leaving the middle range over amplified. Unless the coupling transformers are very large and carefully designed, the coupling between primary and secondary may be very much less on frequencies below, say 100 cycles, than 1,000 cycles.

On the other hand, if the disturbed capacity of the windings is high, the higher frequencies above 3,000 cycles, will be suppressed by capacity conduction. For good results in speech amplification, the circuits must transmit current frequencies from about 100 to 3,000 cycles. For musical amplification the range must be much greater, from say 50 to at least 10,000 cycles. Resonance effects which might either over or under amplify certain small bands of frequencies, depending on the nature of the circuit, should be prevented.

## Choosing of Transformers

Another point of importance lies in choosing the transformers to fit the tubes with which they are used. In general, for highest amplification the impedance of the primary winding should match the impedance of the tube over the operating frequency range. Inasmuch, however, as the tube impedance is constant with frequency while the transformer impedance is variable, this impedance matching must be a compromise between the extreme values for the extremes of frequency so that the middle range is again of necessity favored. The secondary windings of the transformers should deliver the highest possible voltage for highest amplification.

Another point of importance in minimizing distortion is brought out by a study of the dynamic characteristics of vacuum tubes. Without entering into a lengthy discussion concerning this phase of amplification, it will suffice for practical purposes to state that there is always a certain amount of curvature in every tube's characteristic which causes some distortion, and that this can be compensated for by making the impedance of the output circuit of the tube as high as possible. But since highest power amplification demands matched impedance and minimum distortion requires highest possible impedance, a compromise must be reached based on other practical considerations.

A typical two-stage audio frequency amplifier is shown in Figure 1.

## Matching Impedances

Here an input transformer is used whose primary impedance matches the impedance of the source of current to be amplified and whose secondary gives the highest possible voltage. In this way the small currents in the input circuit are used most effectively to impress a high voltage across the first tube. The primary of the second transformer is connected in series with the plate circuit of the first tube.

So long as the plate current is constant no voltage is induced in the secondary or impressed on the input of the second tube. But when this steady plate current is being modulated by variations of input voltage across the grid and filament, the primary current variations induce voltage variations in the secondary. These voltage variations, if all distortion reducing precautions have been taken, will bear a close resemblance to the original variations on the input circuit with the exception that they

will be considerably amplified by the action of the first tube and transformer.

## Cascade Amplification Enormous

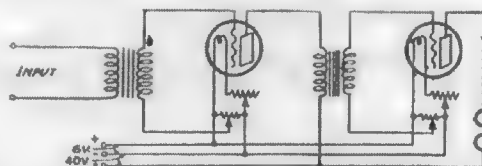
These amplified voltages are impressed across the input of the second tube, wherein they undergo a second amplification. In such a cascade system of amplification it is possible to produce enormous magnification of energy. In small Radio receiving amplifiers of two stages the energy amplification may easily reach 200 per stage, so that with two stages the total amplification would be 40,000. When very careful precautions are taken to prevent all transfer of energy from the output back into the input of such amplifiers and all tendency to oscillate is thereby eliminated, truly amazing amplification may be secured.

Thus with only five stages we will have an energy amplification of  $(200)^5$ , or 320,000,000,000. For all practical purposes, however, it is very difficult to obtain good results with more than three stages in any one frequency range. Ordinarily two stages of audio frequency are as many as may be used with satisfaction. These will transform a signal that is inaudible or barely audible in the telephones into a strong, clear signal.

## Use of Same "A" and "B" Battery

As shown in Figure 1, the filaments of both tubes may be energized by the same "A" battery, and likewise the plate circuits by the same "B" battery. The grid potential is adjusted by means of a potentiometer connected across the "A" battery.

Sometimes this grid potential is obtained by connection to a suitable point on the filament resistance, or if the tube characteristic permits, directly to one side (usually the negative) of the "A" battery. These methods, while oftentimes giving good results, do not provide the ac-



curate control really required for best operation. When so used, the only variation of grid potential obtainable must be secured by filament current variation with the rheostat and immediately we have two variables instead of one, and the grid potential variation is merely incidental to the variation of filament current.

It would be much better where simplifications of controls is desired to omit filament current control and provide only grid control, as the latter is of much more importance.

## Control of Grid Potential

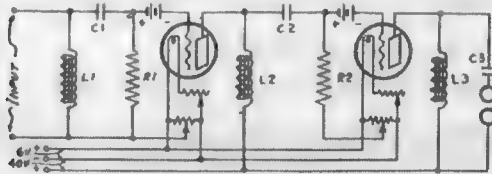
Control of grid potential and amplification by filament current control may be likened to the control of the speed of a locomotive by regulating the temperature of the fire beneath the boiler.

In Figure 1 the telephones are shown connected directly in series with the plate circuit of the second tube. While this is the general practice with small receiving tubes it is sometimes desirable or necessary to use an output transformer. In that case, the primary should match the last tube's impedance and the secondary should match the impedance of the telephone, loud speaker, or other final device to be operated by the amplified energy.

When the larger tubes are used for power amplification, greater negative grid potential may be required than that available on the filament heating "A" battery. In this case, a fixed battery of about the correct voltage may be connected directly in the lead to the grid element and the potentiometer across the "A" battery may be used to secure a continuous variation of potential somewhat above and below that fixed voltage by adding or subtracting the "A" battery voltage on the potentiometer to or from the fixed voltage of the grid or "C" battery.

### Impedance Coupling

Instead of transformers as a means of impressing the voltage amplified by one tube onto another, other methods may also be used. Chief among these are reactance and resistance. A reactance or impedance coupled two step amplifier is shown in Figure 2.



Here the alternating or varying currents to be amplified are passed through the inductive reactance  $L_1$  which has a low resistance and high reactance. If these currents consist of a continuous modulated current, alternating or varying voltages will be set up across  $L_1$ , due to the modulation, while the direct component flows through with little opposition. In order to impress these voltage variations upon the grid of the first tube without the direct voltage due to the DC drop across  $L_1$  a blocking condenser  $C_1$  is inserted in the grid lead.

This condenser should be large enough to convey by electrostatic action the impressed voltages throughout the range of audible frequencies required. In practice a capacity of .01 microfarad has been found about right. In order to secure a correct operating grid potential and to prevent the building up of a charge on  $C_1$  by grid rectification, the high resistance  $R_1$  is provided.

### Value of High Resistance

The value of the high resistance  $R_1$  is governed largely by the capacity of  $C_1$ . It must be small enough to permit the leaking off of any uni-directional charge that may tend to accumulate on  $C_1$  and small enough to prevent appreciable short-circuiting of the voltage applied to the grid. A resistance of about one-half megohm has been found satisfactory in practice.

The grid potential may be secured by grid batteries as shown in connection with an "A" battery potentiometer, or with the smallest tubes these grid batteries may be omitted. The reactances  $L_2$  and  $L_3$ , like  $L_1$ , should have a low enough resistance to take care of the direct current flowing and the highest possible inductance in order to produce the highest possible voltage amplification.

Condenser  $C_3$  is provided to keep the direct component of plate current of the last tube out of the telephone and to permit the desired alternating component to flow unhindered. It should have a large value, say about one microfarad.

### "C" Battery Gives Grid Potential

Instead of using the condensers and resistances in the input circuits of the tubes, another scheme may be resorted to for maintenance of proper grid potential. This plan provides a "C" battery in each grid connection large

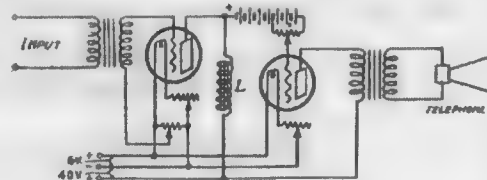
enough to counteract the large positive potential on the plate of the preceding tube and to provide just the right potential for proper operation.

This circuit is shown in Figure 3.

If desired, of course, input and output transformers may be used in impedance coupled circuits. These are shown in Figure 30 as a variation from that given in Figure 29. The same general reasoning is carried out in this circuit as in preceding types.

### Resistance Coupling

A third form of coupling may be provided for certain amplifying requirements by a non-inductive resistance connected in the plate circuit of an amplifier tube. When applied to a two step set, the coupling resistance would replace the coupling impedance of  $L_2$  of Figure 2 and  $L$  of Figure 3. Otherwise the circuit would be the same.



This coupling resistance should have a value equal to at least double the plate resistance of the tube in whose plate circuit it is used. For small receiving tubes a resistance of about 50,000 ohms is suitable. This may consist of a graphite rod, or it may be made by pencil marking between conductors on a piece of insulating material.

### Comparison of Methods

Of the three above described methods of coupling in cascade amplification, the transformer provides highest amplification and the resistance, lowest. However, the transformer has a limited frequency range which causes a general over-amplification of mid-range frequencies and neglect of the lower and upper frequency extremes. The resistance coupling provides a perfectly flat characteristic so that all frequencies are amplified alike, but the amplification provided is quite low, so that about two to three times the number of tubes are required for the same amplification given by transformer coupling.

The impedance coupling provides medium amplification with a somewhat flatter frequency characteristic than the transformer coupling, but not so good as the resistance type in this respect.

Both resistance and impedance couplings require the use of "C" batteries of about 20 volts or otherwise blocking condensers and leak resistances, as shown in Figures 29 and 30, which add some complication to a set not required by the transformer coupling. For general use the transformer type coupling is preferred as the distortions are not extremely great and because the amplification is high.

Editor's Note.—Radio frequency amplification will be discussed by Mr. Miessner in the next article of his series. Radio frequency amplification is very important in strengthening weak signals before rectification and audio frequency amplification.

### GOOD WINDING VARNISH

A good grade of low capacity winding varnish may be made by dissolving scrap celluloid in acetone. Keep acetone away from flames, as it is very explosive.

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## SOMETHING NEW in RADIO

The Universal Radio and Electric Company of Windsor, Ontario, wish to announce to their friends and clients that they have perfected a new **RADIO** set to be put on the market immediately. This set is a detector and two-step amplifier and is novel in that it **USES NO STORAGE BATTERY**. It uses **ONE 1½ VOLT DRY CELL**, for filament lighting. The valves are a new development and can only be used with this set. Replacement bulbs can be furnished at any time. The cabinet work, panel, dials and engraving make it the best looking set on the market. Bank wound and special coils are used throughout. We absolutely guarantee that this set will out-perform any regenerative or other set sold to-day.

The price of this set with valves and batteries without fones is \$130.00. Dealers write for proposition. Territory allotted definitely.

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## RADIO TRADE REVIEW

### CONDENSITE CELORON RADIO PANELS

Recognizing for sometime the need of a material possessing many of the best qualities of hard fibre with the added feature of being thoroughly waterproof this company, through exhaustive tests and experiments, have developed a remarkable waterproof material called Condensite Celoron.

Condensite Celoron is a smooth, highly finished material, particularly adapted to Radio work. Its unusual insulating properties and its very attractive appearance, combined with the great ease with which it may be machined into many intricate shapes required by the Radio industry, makes it an ideal material for this purpose. It is especially adapted to the manufacture of instrument panels. It may be readily sawed, drilled, turned, tapped or milled; in fact machined in any manner in which it is possible to machine metal. Its natural finish is a lustrous black, but a dull mat finish may be obtained by rubbing with fine sand paper.

The electrical properties of Condensite Celoron must be the very highest in order to handle successfully without losses Radio frequency, voltages and currents. Tests by the Bureau of Standards and in our own laboratory show that the restivity including volume and surface leakage resistance are very high, in fact almost infinite. Another important property of Condensite Celoron is its low power factor. This is a measure of its dielectric properties, or how much it heats up when subjected to high power Radio frequency currents.

Possessing all of these properties, Condensite Celoron is particularly suited for Radio panel work.

Condensite Celoron is produced in three grades. Grade 10 is the highest type insulation produced and is particularly recommended where high voltage at Radio frequencies are involved. Veneered vulcanized fibre, as its name implies, consists of a centre core of hard fibre having a heavy layer of Condensite Celoron on each side. This material was developed to meet the demand for a panel having a high finish and fine appearance at a lower cost than the Grade 10 panel.

Shielded Condensite Celoron panels are made by embedding in the back of the panel, about 1/32-in. under the surface, a fine copper wire mesh which acts as a shield. When in use, this shield must be grounded. The purpose of shielded Condensite Celoron is to eliminate capacity effects from the operator's body while tuning in a Radio signal. When tuning in a Radio signal the capacity effects between the body and instrument are such that when the hands are moved towards and from the instrument while tuning the wave length adjustment of the instrument is varied enough by this change of capacity to completely detune a short wave radiophone signal. To eliminate this effect a copper screen is inserted in the panel. This screen being grounded, it provides a constant capacity between the various parts of the instrument and the ground. Any capacity effects from the body would then act on the shield instead of the instrument and no de-tuning effects would then be experienced from external body capacities.

This company has installed a complete Radio panel

service by which they are prepared to furnish partially or completely machined and engraved panels in large and small quantities at very reasonable prices; also rheostat bases, condenser bases, socket bases, switch bases, detector bases, coil mountings, coil, blocks, etc.

### MONTREAL FIRM HAS NEW RADIO OUTFITS

J. B. Miller of Montreal, Que., is putting out a knocked down variometer-variocoupler tuner, which they state is excellent and which retails at \$20.00. The outfit contains everything that is required to assemble a first class tuner, including a hardwood cabinet, condensite celoron panel and three bakelite dials.

In the improved type, retailing at twenty-five dollars, the variometer stators are reinforced, a novel feature which does not appear in any other such instrument on the market to-day. Aluminum shields, drilled panel and hard rubber feet for the cabinet, are some of the features of this improved set.

A knocked down two stage amplifier with automatic filament control is shortly being put on the market by this firm. This unit which will sell for \$35.00 complete (except valves) is of the same high quality as the fore-mentioned tuner and the two together form the finest short wave receptor on the market.

In both these sets, the woodwork is finished and they can be assembled with the simplest of tools. Full instructions for assembling accompany each unit.

### M. C. RYPINSKI JOINS C. BRANDES, INC., AS VICE-PRESIDENT

Mr. M. C. Rypinski, formerly Radio Sales Manager of the Westinghouse Electric and Manufacturing Company, has associated himself with C. Brandes, Inc., 237 Lafayette St., New York city, as Vice-President and Sales Manager.

Those who are familiar with the development of broadcasting will remember that it was Mr. Rypinski and his associates at the Westinghouse Electric and Manufacturing Company who are said to have first successfully exploited the radiophone for broadcasting entertainment. The famous KDKA station erected at Pittsburgh under their direction, formed the nucleus for the extraordinary growth of radio which has been brought about during the past two years. As Radio Sales Manager of the Westinghouse Company, Mr. Rypinski not only officiated in the erection of other stations, but was also in a position to study at first hand the various commercial and merchandising problems that naturally grew out of such a unique situation. In allaying himself with C. Brandes, Inc., he is placing at the disposal of this organization, manufacturing radio phones, an experience in the radio field which has come to but few men. Occupying a position of great responsibility in the very center of the radio industry, Mr. Rypinski has occasion to familiarize himself with every phase of commercial radio as related to broadcasting.

Rarely do we find an engineer who is able to master the art of salesmanship and merchandising. Mr. Rypin-

ski is such a man. His technical education was received in the Rose Polytechnic Institute, Terre Haute, Indiana. He graduated from this institution with the class of 1897 and shortly afterward became a member of the engineering staff of the General Electric Company in the capacity of Assistant to the Chief of the Standards Laboratory. Between the years of 1902 and 1906 he was associated with independent instrument manufacturers, after which period he joined the Westinghouse Electric and Manufacturing Company of Pittsburgh. With this organization he has had fifteen years of broad business and engineering experience. In August, 1920, he was placed in charge of the commercial exploitation of the radio telephone.

During the war Mr. Rypinski was Chairman of the Instrument Manufacturers' Committee and a member of the Transformer Manufacturers' Committee. Serving in these positions he was able to do much toward the solution of the many technical problems that confronted these bodies.

Mr. Rypinski's organizing ability has manifested itself in the work that he has done in the National Electric Light Association, American Institute of Electrical Engineers, Illuminating Engineering Society and the Electric Power Club. As the new Chairman of the Radio Apparatus Section of the Associated Manufacturers of Electrical Supplies, the radio industry may look to him for much needed guidance. His influence is already manifest in the analysis that the Radio Apparatus Section has made of radio's peculiar problems and in the program that has been formulated for the solution of these problems.

#### RADIO DEVELOPMENT IN SOUTH AFRICA

Various wireless telegraph schemes are now occupying the attention of the Government of the Union of South Africa. Trade Commissioner Stevenson has informed the United States Department of Commerce that the British Imperial Government has a scheme of connecting Great Britain and South Africa by a series of short range stations via Cairo and Nairobi, which will involve the expenditure on the part of the Union Government for its station of approximately £180,000. Under this scheme the range of the South African station is to be between 2,000 and 2,500 miles.

#### AMPLIFYING TRANSFORMERS

For the Canadian operator who wishes to build apparatus during the summer months, a simply constructed and at the same time efficient amplifying transformer may be made. This is of the so-called Audio or low frequency type.

A core of soft iron wire is built up three inches long and one-half inch in diameter and thoroughly insulated with a good tape. On top of this wind the primary coil, consisting of 4000 turns of No. 32 B. & S. enameled copper wire. Insulate this winding thoroughly and then wrap a layer of varnished tape over it.

The secondary winding may now be put on and consists of 15,000 turns of the same wire. The secondary should now be protected by winding one or two layers of the tape over it. Bakelite heads or ends may be fitted and the two ends of the primary winding brought out to binding posts on one head, and the two ends of the secondary treated in the same manner, at the other end of the coil.

#### RADIO WILL FEATURE NEW MOVIE COMEDIES

Los Angeles, Cal.—A new corporation, Radio-Films, Inc., of this city, plans to produce a series of two-reel educational comedies based on the science of Radio. Each picture will teach a direct lesson as to the construction and operation of various kinds of Radio receiving and transmitting apparatus. They will also produce a reel film on what to do and what not to do in Radio work.

#### TO HANDLE CREDITS BY AIRPHONE

New York.—The exchange of credit information by Radio is to be inaugurated by the Foreign Credit Interchange bureau of New York, operated by the National Association of Credit men, according to Benjamin Tregoe, manager of the bureau.

T. J. McFadden, who travels for the Diamond State Fibre Company in the Province of Ontario, is at present on a canoeing and fishing trip in Northern Ontario. On his return he will again be on the old ground with renewed vigor.

Mr. J. A. Regan, of the same company, whose territory is in Quebec Province, is also holidaying.

#### STORAGE "B" BATTERY BEST

The "B" battery is an efficient and well built battery, and is usually made in blocks of fifteen cells for the 22½ volt units. In the larger sizes, up to ninety volts, as many as sixty separate cells are used. While the unit block "B" battery possesses many advantages of compactness, light weight, etc., still it has many faults.

If one cell goes dead, as happens occasionally, the voltage of the whole unit may be expected to drop, and the efficiency of the battery will be cut down until the troublesome cell is located and taken out of circuit. Again, loose connections, defective cells, etc., may cause noises and no end of trouble in receiving and amplifying circuits.

The storage "B" battery does away with many of the troubles. Unlike the block "B" battery, it does not "wear out" after a few months' use, but will improve to a certain extent with each charge. There is no need to throw it out after it has finished its "shelf" or guaranteed life, inasmuch as it has none.

The cells used in this "B" battery are commonly known as lead cells and are of the general type used in automobile ignition and starting batteries.

#### Mysterious Code Signals



Drawn by "Radio" Staff Artist—Sherlock.

# Do You Know What Static Is!

Every once in a while we hear an experimenter say: "There is too much static in the air," but if you ask him: "What is static?" he will say: "Electricity!" But ask him "what is electricity?" and he says "I don't know." In other words "static" is simply an "excuse" with most people for a difficulty they do not know how to surmount.

Static fills a need. It explains why paper sheets stick together in printing shops, or why carbon papers stick together when removed from a typewriter; why, when a person grasps your hand you sometimes feel an electric shock; why sometimes you can light the gas by walking across the floor and tuching the gas tip; why a woman's hair snaps when she combs it; why moving belts will draw fire from your finger tip; why the telephone hums, or refuses to work; why the lights of St. Elmo appear on the spars of ships; why the lightning exists, and a lot of other things. Taking it all together, it's a very convenient word to have around. It explains so many things. What would the experimenter do for an excuse when he fails, if he didn't have "static?"

## Static is Ether Waves

But what is it? It is ether waves, from unknown sources.

We have static light and color waves in the lightning, the lights of St. Elmo and Aurora Borealis. We have static magnetic waves in the papers that stick together. We have static heat waves demonstrated when lightning strikes resistance. We have static Hertzian or Radio waves. All are related, and get away with the general term of "static electricity."

They are simply a mixed up jumble of waves, that have all kinds of wave lengths and depth, that "jam the ether" with waves that are at discord with known waves or vibrations. A flash of lightning in South America or China, a volcano on some star, an ex-

ploded planet, a meteor, an earthquake under the sea, a wind over the ocean, the friction of two air currents in the air, or between two clouds, or a number of such things may make ether waves or vibrations. In some kinds of weather there seem to be more waves than in other weather. At intervals the wave lengths seem to be in tune with the printing presses, or with your body or other machinery. At other times there are fewer waves in that length but may be affecting some other apparatus.

## Difference in Wave Lengths Fine

Sometimes the difference in wave-lengths may be in fractions of one-millionth of an inch, and the inventive genius is being taxed to the utmost to produce instruments delicate enough to tune out waves of all lengths but those desired.

Brushes of very fine copper wire, wired to the ground, will often carry off the static of the printing press, if the brushes brush lightly the paper as it passes through the press. And even so, there may be but one or a very few of all the wires in the brushes, that are in molecular tune to catch the particular static wave that bothers the press. That is why one wire will not do what a wire brush will often do. The temper of a piece of steel, the tension of a wire, or even the temperature of the steel may make a different molecular tuning that is susceptible to static waves that are always existing.

To theorize farther means only to hunt out examples that seem to support this theory. There are likely a number of cases where this theory might not seem so applicable. But the generally accepted theory by scientists is that "static electricity" is unknown wave lengths in the ether, of unknown origin, coming into atmospheric and material conditions that are "in tune" with the waves, and thereby vibrate with them till they are detected.



## RADIO IN PRISONS

Stone walls and iron-barred gates may keep lawbreakers within prisons, but they cannot keep radio signals out. The penetrability of radio telephone waves has been taken advantage of by at least one prison warden, who says the men have found a new interest to alleviate their condition.

Charles C. Clarke, Warden of New Hampshire State Prison, recently stated:

"Received a wonderful radio concert to-night at New Hampshire State Prison from Schenectady. We are the first prison in the United States to install a radio receiving outfit for our inmates."



## Capt. Amundsen's Ship "Maud" to Broadcast While at North Pole

**CALL SIGNAL LWZ BELONGS TO EXPLORER—WILL BE IN FROZEN ARCTIC CIRCLE BY OCTOBER  
—TO TRANSMIT ON 600 AND 2,000 METERS WAVE LENGTH**

Fans, listen in for call-sign LWZ. If you should hear this call any night, tell the world. For it will mean that you have heard Capt. Roald Amundsen's ship, the Maud, which is now on the way to the north pole.

The Maud left Seattle, June 10, bound for Nome, Alaska, as the first stopping point. There the famous explorer will join his ship, and set out for the long drift in the Arctic circle.

A reply to a wire to Capt. Amundsen for a short description of the Radio outfit on the Maud, states that both spark and continuous wave transmission will be used. The wave length for spark is 600 meters, and for continuous wave, 2,000 meters.

Captain Amundsen estimates the Maud's Radio outfit will have a range of 1,000 miles for spark and 2,000 miles for continuous wave transmission. This would mean that ordinarily he would be unable to make his dispatches heard throughout Canada. But when the ship gets up in the Arctic circle, where it is expected the normal range for Radio transmission will be increased tremendously, owing to clear atmosphere, it is possible that no stray occasions signals from the lone drifters will float down around here. And some amateur may become famous by picking them up.

### Receiving Wave Lengths

The Maud has a wide variation of wave-lengths for reception, namely, from 300 to 2,300 meters. The operator will be on duty every day between ten and eleven o'clock in the morning, and from seven-thirty to eight-thirty at nights. It is Capt. Amundsen's plan to maintain communication with Washington, D.C., four times a day, starting in October.

There is nothing in fiction to excel the romantic nature of the trip that Captain Amundsen is taking. He expects to drift on pans of ice for five or six years, all the time making research that will be invaluable to science. He will endeavor to find out whether there is animal or vegetable life of any kind in the far north.

Besides, he will seek for traces of the "phantom fleet" which the Eskimos claim is frozen and gripped in the ice, swinging perpetually around the north pole.

Captain Amundsen will tread where the foot of white

man has never before been. But he cannot go to any corner of the earth where the voice of man has not already reached. For Radio has carried beautiful songs and addresses on many topics, to the most remote places wherever atmosphere exists.

### Will Keep in Touch with World

While he is in those grim regions where primeval nature holds sway, voices from civilization may from time to time reach him. Certainly, he will be in daily touch by the dot and dash system of signaling, with the world.



Beginning in October, when the vessel reaches far enough north, a daily weather report will be sent from the Maud to the United States weather bureau in Washington. These messages will have to be relayed by other land stations when the ship gets in the arctic circle. It may be that some amateur stations are destined to pick up and relay some of those messages.

Captain Amundsen is starting on his long trip just at a time when the world apparently is on the verge of developments in Radio that will revolutionize the science. Who knows that before the explorers begin their long journey homeward it may not be possible for all amateurs who have Radio receiving sets in their homes to listen in daily to reports from the Maud?

### RADIOPHONE STATION OPENED IN NEW YORK

Atop the Telephone Building at 24 Walker street, New York city, is this 80-foot aerial tower, by means of which radiophone conversations may be carried on. The telephone company is inaugurating a system of Radio telephony, somewhat along the present telephone system. Regular business may be transacted via the radiophone, the advantage being mainly for long distance work. At the present time transmitted messages are being made only from the main station at the Telephone Building, but it is expected that a regular individual system will be installed.

### AIRPHONE USEFUL IN COLLEGE BOAT RACES

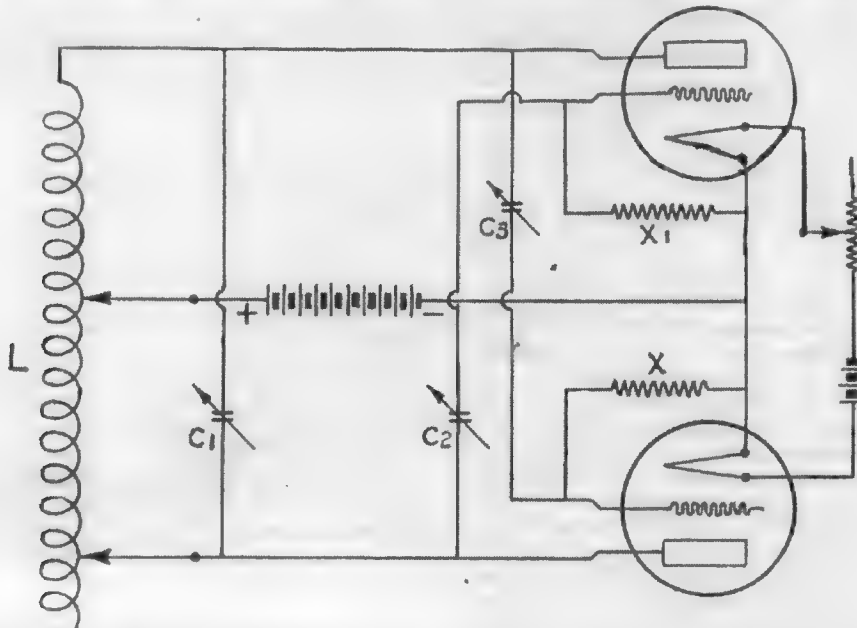
Naval Academy to Radio Poughkeepsie Race Periods  
Annapolis.—Successful experiments conducted by Lieutenant Commander Frank W. Rockwell, Naval Academy rowing representative, with the Radiophone indicate that the device may be used to increase the pleasure of those who attend college boat races by keeping them informed as to the different periods of the race. It is planned to put the system in use during the Poughkeepsie regatta. Information will be sent into a receiving apparatus near the finish, and amplifying devices will make it practicable for many persons to receive the bulletins.

## Simple Methods of Making Station Measurements

It happens quite often that the Canadian amateur station owner wishes to know the capacity of his antenna or some other constant of his system but is at a loss to know how to determine it. Two simple methods of obtaining the antenna capacity are described herein which may be used at any station.

In the first method a wave meter is required having a mil-ammeter or current squared meter as an indicator, and a calibration curve of the condenser, also a receiver of the feed back or regenerative type. Setting the receiver into oscillation at some point on the higher wave lengths, couple the wave meter closely to it and locate the resonance point carefully. Make note of this reading at the condenser scale, and then attach to one terminal of the wave meter condenser the antenna lead and to the other terminal the ground lead. It will now be found that the wave meter is detuned due to the added capacity of the antenna, turn the wave meter condenser toward

two settings the measurement will be incorrect. In case the wave meter can not be coupled strongly enough to the receiver to give a sufficiently large reading on the current squared meter, the primary coil of the receiver may be substituted for the inductance coil of the wave meter. If no wave meter is at hand any calibrated variable condenser will be suitable provided its capacity be sufficiently large. If a current squared meter is not available a two volt flashlight lamp will do as an indicator although the resonance points can not be determined as accurately with this as with the meter. Another method is the click method, so called because of the click heard in the telephones attached to an oscillating circuit when another circuit coupled to it is brought into resonance with it. In this method the telephones are worn and the wave meter is closely coupled to the oscillating circuit. When the wave meter is brought into resonance a click will be heard in the telephones, ordinarily two clicks will be observed



zero until resonance is again found and make note of this reading also, then referring to the calibration curve of the condenser find the capacities at the two points, and the difference between them is the capacity of the antenna. For the first reading the oscillating circuit should be set so that the resonance point will fall along the high part of the condenser curve so that there will be an appreciable difference between its capacity and that of the antenna. For example, let us suppose that the first reading falls at 165 degrees on the condenser scale, and the second at 92 degrees, also that we find by reference to the calibration curve that the capacity at 165 degrees is .0014 M F and at 92 degrees it is .00085 M F, then the antenna capacity would be the difference between the two or .00055 M F. It must be understood that when the first setting is made no change can be made in the driving circuit before the second setting is obtained, the idea being to substitute the capacity of the antenna for a part of the wave meter condenser capacity and find resonance at a constant frequency of driving circuit. If the exciting frequency be changed through any cause between the

a number of degrees apart on the condenser scale, by reducing the feed back coupling on the receiver, and the coupling between the receiver and the wave meter, these two points may be brought closer and closer together until they are merged into one click. When this is accomplished attach the antenna and ground leads to the wave meter condenser as before and find resonance lower down on the scale, then referring to the calibration curve as before the antenna capacity is found. In case it is found to be not possible to manipulate the couplings so as to bring the two clicks together, the middle point between the two may be taken as the point of resonance. If the receiving circuits do not supply enough power to give a good indication a driving circuit as shown in Fig. 1 employing the two tubes may be made which will give excellent results. L is a coil of one hundred and fifty turns of number sixteen cotton covered wire four inches in diameter having two variable contacts, C<sub>1</sub> is a .001 M F variable air condenser, C<sub>2</sub> and C<sub>3</sub> are variable air condensers roughly .0003 M F each, X and X<sub>1</sub> are ten to fifteen thousand ohm grid leaks. The amount of plate voltage required

will vary with the tubes used, and it is essential that two tubes having approximately the same characteristics be used in order to obtain maximum output. The natural period, the inductance, and the total resistance of the antenna may be obtained easily using this driving circuit. Wrap a few turns of the antenna lead around the driving coil L, and connect to ground through a current squared meter, then setting the circuit into oscillation vary the number of turns cut in on the coil L and vary the condenser C<sub>1</sub> until the current squared meter shows resonance, the wave length of the driving circuit as measured with the wave meter will then be the natural period of the antenna. It will be found that the variable contact leading from the positive of the plate battery to the coil L will be quite critical at the lower wave lengths. Having the natural period and the capacity of the antenna the induction will be equal to the square root of the wave length divided by 2:—Call in centimeters.

To obtain the resistance make the coupling sufficiently strong so that the current squared meter will register nearly full scale, then insert in series a non-inductive resistance and vary this until the current squared meter reading falls to one-half, the value of the non-inductive resistance cut in then will be the resistance of the antenna. An excellent method of calibrating wave meters is one making use of such a driving circuit. Setting the driver into oscillation bring the meter to be calibrated into inductive relation with it and find the resonant point, then remove this meter and substitute a meter known to be correct and determine the wave length the driver is oscillating at. A series of such readings at different points on the scale gives the data on which to construct the wave length curve. Condensers may be accurately calibrated also as follows: Set the driving circuit at a wave length which will measure along the upper range of the wave meter condenser and get an accurate reading, then connect the condenser to be measured in shunt with the wave meter condenser and set it at ten degrees, find resonance with the wave meter again and the difference in the two settings of the wave meter condenser is the capacity of the condenser being calibrated at ten degrees. Proceed similarly at twenty, thirty, forty, etc., degrees and draw the curve from the capacities obtained. The mil-ammeter used should be of the thermo type and have a full scale reading of 100 or 150 mils. Such a meter is not costly and is well worth while having at any station. Placed in the plate or grid circuits it will show the amount of current flowing, and placed in the plate circuit of a telephone transmitter it indicates the degree of modulation taking place.

#### WIRELESS TELEPHONY

The possibility of utilizing wireless telephony in remote parts of South Africa and the parts otherwise difficult access has been engaging the attention of the Post Office authorities. Two suitable Marconi sets were purchased in England and various trials and tests made in Swaziland and other remote parts of South Africa, as well as between Cape Town and Touws River in the Cape Province, a distance of 160 miles, by the local representative of the Marconi Company. While these trials proved very satisfactory so far as the range and efficiency of operation under favorable atmospheric conditions were concerned, the Post Office authorities express some doubt as to the commercial practicability of the method, particularly in a sparsely settled country like South Africa where the amount of traffic between the

outlying districts would not be sufficient to guarantee the cost of installations. A source of power is also necessary, and if, as would normally be the case in outlying districts, a gasoline engine and generator would supply the necessary power, the running costs would be considerable as compared with communication by land lines.

In view of the great development of the wireless telephone in North America, particularly by amateurs, considerable publicity has been given to the subject in South Africa, particularly by the Marconi Company which is represented in Cape Town by the Wireless Agency. This company is manufacturing receiving sets from \$25 to \$200 in value. A radio society was recently formed in Cape Town composed of amateurs interested in wireless telegraphy and telephony (The Radio Society of South Africa, Argus Building, Cape Town), but in view of the sparseness of the white population radio development in South Africa must necessarily be limited.

London, Ont.—Railway officials in this city are seriously considering the use of the Radiophone as an auxiliary dispatching utility, which might gradually be developed to supplant both telegraph and ordinary telephone dispatching. The advantages of Radio were brought to the attention of local railroad officials and divisional managers by a brakeman on a Grand Trunk local train running between London and Sarnia. The brakeman has installed a complete Radio outfit, both for sending and receiving messages, on the baggage-coach, and communicates with his family at home, and with his amateur Radio friends in London and Sarnia without any difficulty while the train is traveling at a fast rate of speed.

New York.—Fire alarms by Radio may be an outcome of the rapid growth in the use of this method of transmission in New York City, according to a reporter of firemen's activities. The men in many of the fire houses have received permission from the department to install receiving sets at their own expense, and though up to the present these have been used for amusement only, the firemen are ready to respond to any call to duty which may reach them in this way.

Seattle, Wash.—The girth of the world is now one-tenth of a second, the time required for a wireless wave to make the circuit. It may soon be possible for an operator to speak as Columbus sailed, into the West and hear his own voice from the East.

#### AMATEURS WORK ENGLAND

New Bedford, Mass.—New England Radio amateurs who operate spark keys have been successful in getting messages to various stations in England. Four individual amateurs in Massachusetts and one in Connecticut have been heard in trans-Atlantic amateur tests in England. At the present time there are over 2,600 licensed amateur transmitting stations in New England, most of them operated by young high school or college men. In the recent trans-Atlantic Radio tests, for amateurs, W. F. Burns, of Cheshire, England received messages from Station IUV; Joseph B. Lodge, Manchester, N.H., 1ZE; Irving Vermilya, Marion, Mass., 1XM; Massachusetts Institute of Technology, Cambridge, and 1BCG, Minton Cronkhite, Greenwich, Conn.

#### RADCLIFFE GIRLS TO STUDY RADIO

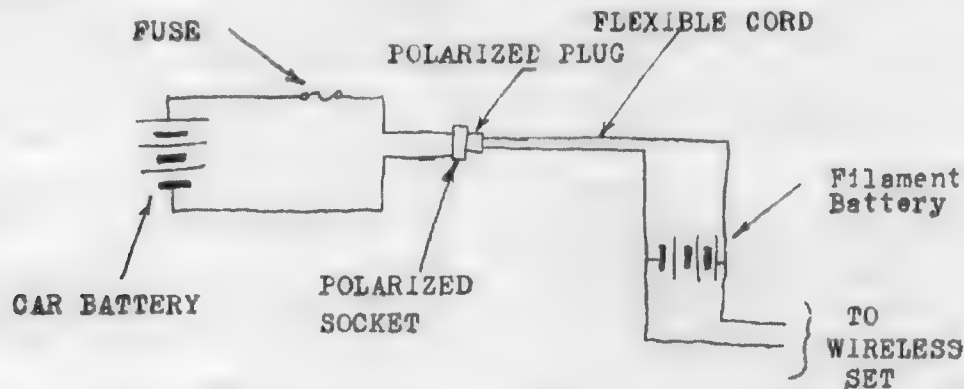
Cambridge, Mass.—New courses in Radio vacuum tubes and electric oscillations are to form a part of the curriculum at Radcliffe college for women next fall, to meet the rapidly increasing interest in Radio among Radcliffe girls.



## Keeping The Filament Storage Battery Charged Without Trouble

Experimenters have frequently made use of the automobile storage battery to supply current for heating audion filaments, etc., but have repeatedly abandoned the idea because the car was generally gone when the "juice" was most wanted.

plug is placed in the socket. This connects the two batteries in multiple, and, if the voltage of the filament battery has fallen below that of the car battery, the former will be raised, the charge continuing until the two batteries are equal in voltage.



A practical method of allowing the automobile to furnish current for wireless purposes is to connect the automobile storage battery in multiple with the filament battery whenever the car is not in use.

This is readily done by mounting a polarized socket in the car, connecting it to the car battery, and connecting the wireless storage battery to a polarized plug by means of a flexible cord.

When the car is driven into the garage the polarized

The expense and interruption of having the filament battery removed and charged is thus eliminated as the car battery will keep the charge of the filament battery practically constant.

Likewise, the experimental battery can be depended upon to occasionally replenish the voltage of the car battery, should the latter accidentally become discharged.

The rated voltage of the two batteries should be equal.

### WHAT'S IN YOUR PHONES?

Telephone receivers are delicate mechanical organisms. Although they are clothed in mystery, they should not be opened up for inspection, dropped, or otherwise mishandled. They might be likened to the carburetor on a motor car—simple to take apart, but oh, putting them together again!

The casing of a receiver is usually made of some insulating composition or of some non-magnetic and light metal such as aluminum.

On the inside there are two electro-magnets wound with a great many turns of very fine wire. These magnets, or pole pieces, are fastened on the ends of two legs that project from a ring of soft iron. A thin iron disk rests on the edge of the receiver casing and is held in place by the receiver cap. This iron disk or diaphragm as it is called, is usually tinned to prevent corrosion, and when in place, it rests close to the magnets.

Unlike the ordinary electro-magnet, the pole pieces of a receiver are made of hard steel and are permanently magnetized. This causes the diaphragm to be always under a tension. The windings of the magnets are connected in series, and the two remaining ends are connected to two binding posts on the back of the case.

There is a physical law which states that the greatest effect will be produced in a magnet when there are the greatest number of ampere turns within a given space. As the amperes, or current, flowing in a receiving set is infinitesimally small, there must be a great

many turns in a small space on the magnets to secure the best effect. And to get this great number of turns within the small space allowed within a receiver very fine wire must be used.

It is this magnetic effect, and not the resistance caused by the great length of fine wire, that makes for sensitivity in receivers. Bear this in mind, when making a purchase, that because a pair of phones are marked 3,000 ohms it does not necessarily mean that they are more sensitive than a pair of phones that are more carefully and accurately constructed, and which are rated lower.

### SENDS RADIO FOG SIGNAL

Washington.—An automatic Radio fog signal is one of the features of the newest and largest light vessels in the United States lighthouse service, vessel No. 105, which will shortly go into commission off Cape Hatteras, on the dangerous outer Diamond shoal, one of the most treacherous and exposed points on the Atlantic coast.

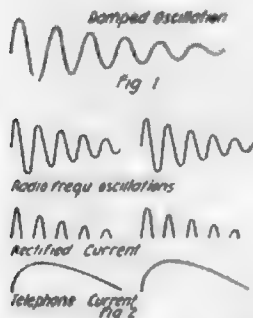
In foggy weather three distinct fog signals will warn the mariner near this vessel. On a 1,000 meter wave length the Radio signal will go out through the ether to ships equipped with the Radio direction finder, a steam chime whistle will create sound waves in the air that will be recorded on human ears, and a submarine bell will send sound through the conducting water.

# RADIO TELEPHONY

Until the recent wave of broadcasting swept over Canada very few amateurs had devoted any attention to the telephone end of Radio, but now that Radio telephony is making a bid for supremacy in the Radio field many operators are investigating it with a view to adding the necessary equipment so that their stations will be complete. Those operators who have stuck to the spark or damped wave method will find the field a new one entirely, but those operators who have handled C. W. or undamped wave sets will find Radio telephony very similar to their old stand-by.

Previous to the very general use of the vacuum tube the methods of obtaining a continuous wave were very expensive and not at all suited for the pocketbook of the average amateur, but the advent of the vacuum tube as a generator has opened up a new field for experimentation. It is the only method at present adaptable to small powers and has other advantages such as comparatively low cost, simplicity, and stability of operation; in short, it is ideal for amateur short wave transmission.

There is a great similarity between Radio telegraphy and Radio telephony. One who understands the fundamentals of one field can easily pick up those of the other. There is nothing really hard to master. As a matter of fact, the receiving circuits are identically the same. In transmission, however, it is necessary to employ undamped waves instead of the damped such as are used in spark transmission.



A damped Radio frequency wave transmission system cannot be used in the transmission of speech because such a system produces trains of oscillations as shown in Figure 1. These trains arrive at the receiving system and are rectified by the detector, and give impulses of current in the telephone receiver as shown in Figure 2.

Now when an undamped Radio frequency wave arrives at the receiving station it is rectified by the detector. This rectified current, however, is practically constant and therefore produces a constant uninterrupted pull on the diaphragm of the telephone receiver. Therefore no sound is heard.

Voice currents or waves are complex and when we consider how comparatively crude Radio telephony is, we see the big problem of Radio telephony. In the case of telegraph signals all that is necessary is to start and stop the flow of energy by means of a key. In telephony, however, we have to radiate the energy in close

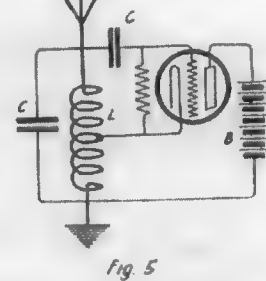
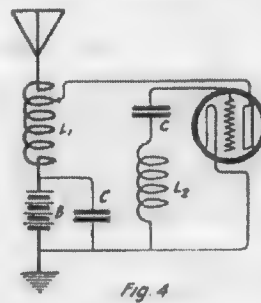
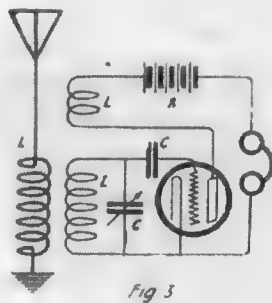
approximation to the complex wave forms of speech. When we consider how complicated these wave forms of speech vibrations are, we can readily realize that it is quite a problem.

The solution is to generate an undamped Radio frequency wave and modulate it by means of voice or audio frequency waves. That is to say, waves of Radio frequency are sent out by antenna, the intensity of which varies with the frequency of the speech waves. Therefore, we need an undamped wave generator and a device to modulate the waves generated.

The following methods may be used to produce the undamped Radio frequency wave: First, the high frequency alternator; second, electric arc; third, vacuum tube oscillators.

As the first two methods are complicated and the cost of the equipment is above the average amateur's pocketbook, we will only devote our attention to the vacuum tube oscillators.

The V. T. is in common use as far as amateur receiving systems are concerned, but when it comes to employing it in a transmission system the amateur seems to hesitate. There is nothing really complicated in the basic theory of operation. Let us consider a simple inductive feed-back receiving circuit as shown in Fig. 3. While this is really a receiving circuit, it is also a miniature transmitter. In the plate circuit there is oscillating energy, and if the circuit is coupled to the antenna there will



be a small amount of energy radiated. The problem is to get more energy into the antenna. The power is in the B battery. Raise the voltage of this battery by adding cells or employing a DC generator. Be sure the particular tube will not break down with the increased voltage. Also, there is nothing to be gained in using inductive coupling between the plate and antenna. We can get greater power and efficiency by using the circuit shown in Fig. 4.

For use with the circuits of figures 4 and 5 the following data is given:

Wave length—150-300 meters.

$L_1$ —24 turns heavy stranded wire wound on tube 4 inches diameter. Plate connection is tapped on twelfth turn.

$L_2$ —30 turns No. 18 DCC wound on same tube  $\frac{1}{2}$  inch from  $L_1$  windings in same direction.

Fig. 5 shows another feed-back circuit.

Wave length—130-300 meters.  
 $L_1$ —24 turns heavy stranded wire wound on tube 4 inches diameter. Tapped on thirteenth turn.  
 So much for the inductive feed-back circuits.  
 The common capacity feed-back is shown in Fig. 6.  
 Substitute the antenna for C and we have the circuit

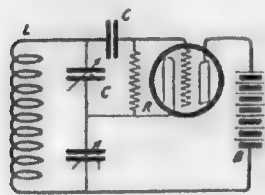


Fig. 6.

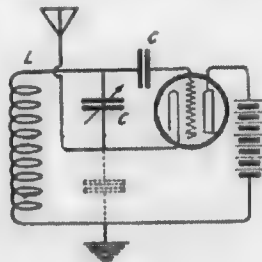


Fig. 7

shown in Fig. 7. A modification of this circuit is shown in Fig. 8.

Now that we have a simple means of generating undamped Radio frequency waves, we come to the problem of modulation. For this purpose we will connect a telephone transmitter in series with the ground lead in order to modulate the Radio frequency wave.

Fig. 9 shows a set employing capacity feed-back which has given very good results. It may be constructed from parts found about the average laboratory or workshop.

Wave lengths—150-500 meters.  
 $L_1$ —100 turns heavy stranded wire wound on tube 4 inches diameter and tapped every 20 turns.

$C_1$ —Variable condenser .0016 mfd. maximum capacity.

$C_2$ —Variable condenser .001 mfd. maximum capacity.

In order to place the set in operation it is necessary to connect a hot wire ammeter in series with the antenna in order to observe maximum radiation. Adjust the inductance and capacities until the set oscillates on the desired wave lengths. A wave meter will come in handy when making these adjustments. Then speak into the transmitter. Adjust grid leak for modulation; that is, increase modulation. In adjusting the set remember that you have or decrease its resistance. It is a good plan to have someone listen in on a nearby receiving set to observe the ALL of the following things to adjust: tuning inductance, tuning condenser, grid condenser, grid leak resistance, filament current and plate voltage. Failure to get

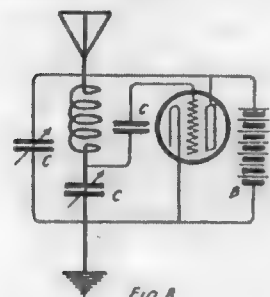


Fig. 8

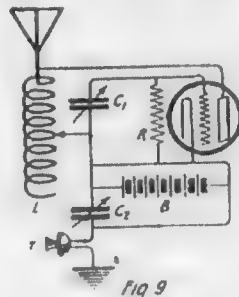


Fig. 9

the proper values for one of these may cause the set to be a failure.

Fig. 8 is a modification of Fig. 7. In Fig. 9 is shown a circuit employing capacity feed-back which has given very good results. Fig. 10 shows the method of connecting iron core inductances on each side of the D. C.

supply, as well as a large capacity condenser across the circuit in order to eliminate undesirable ripples.

Know well the vacuum tubes you are using and their operating characteristics. The curves from most tubes in use to-day may be had from the respective manufacturers. If several tubes are connected in parallel, more power will

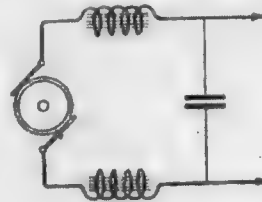


Fig. 10

be radiated. When a DC generator is used, a large capacity should be shunted across it and iron core inductances connected in series, as shown in Fig. 10. The proper values of  $L$  and  $C$  are determined by the operating characteristics of the machine. The more slots on the commutator the lower the ripples or unevenness of the voltage. Don't raise the voltage above the safety point of the particular tube you are using.

For greatest efficiency, all inductances should have a very low high-frequency resistance. This may be done by using heavy stranded wire or Litzendraht. Connections must be as short as possible and soldered properly.

In conclusion, there is nothing really mysterious in the use of V T transmitters, but good engineering practice has to be adhered to and if the reader follows the suggestions and uses the data given in this article, success is within his reach. Patience and perseverance are big factors in experimental work. Amateur Radio telephony is the coming thing. It is surprising, when we consider the advantages, why more work isn't being done with it in the amateur field to-day, and the sooner we take it up the better it will be for everyone in general. We are capable of accomplishing big things. Why not do it? The one big problem in Radio telephone is interference. But it is no larger than those that have been solved already. With all the amateurs working with radiophone, someone is bound to hit upon the proper solution.

**CALL IN THE RADIO INSPECTOR**

If the old-fashioned lady who wore a coil of wire around her waist and called it bustle, or around her head and called it a rat, should attend a Radio concert—would she be a broadcasting or a receiving stations?—Chicago Daily News.

We imagine she'd have to get a license as her diameter might cause a lot of interference.

Baseball fans will become Radio fans as the scores and progress of the games will be broadcasted during the season. Henceforth you may sit comfortably in your office or home and "listen in" to the progress of our great national game no matter in what city it is being held.

The very successful tests between the S. S. America and New York had evoked the promise of the installation of radiophones on every ocean going steamer, according to Chairman Lasker of the U. S. Shipping Board, which controls the America.



### A HIGH METERAGE RECEIVING SET

It is very hard for certain boys to get a good wireless receiving set on account of the cost. One writer, after long experimenting, has found the hoop-up to a very good set that will not over tax the average Canadian boy's pocketbook like most sets do.

The set that I am about to tell you of uses a loose coupler. The one which I have at present will tune up to 3000 meters, and I have been able to hear concerts regularly, many radiophone speeches and conversations, and spark sets at all times. But a loose coupler of this meterage is not necessary to be able to hear satisfactorily. A home-made loose coupler will usually do very well.

The tone of this set is clear and sharp, and even the most distant stations come in clearly, but of course a little faint. This set just "Goes right out and gets 'em."

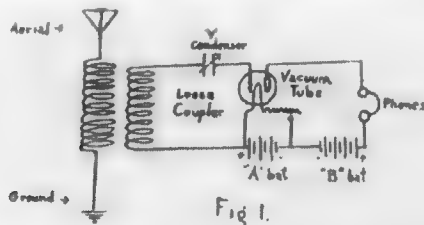
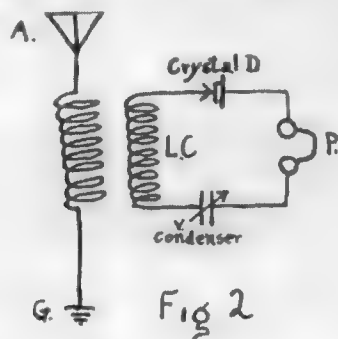


Figure 1 shows the hoop-up for the set mentioned. It contains:

- 1 Loose coupler.
- 1 Variable condenser.
- 1 Vacuum tube detector.
- 1 Vacuum tube socket.
- 1 Six ohm rheostat.
- 1 Pair phones 2000 ohms or over.
- 1 22½ volt "B" battery.
- 1 6v. storage battery or d. cells.
- 50 to 150 ft. No. 14 A wire.

If you can not get a vacuum tube detector figure 2 is a set that will work very nicely. Figure 2 is the hoop-up for a loose coupler and crystal detector set. The ap-



paratus required for this set is listed below. Most of these can be made.

- 1 Loose coupler.
- 1 Crystal detector.
- 1 Variable condenser.
- 1 Pair of phones.

And wire for aerial and ground connections.

A set like this should not at the most exceed \$25.00, which is very reasonable considering its high meterage and receiving power.

### ENGLAND TAKING UP WIRELESS

Considerable interest has been shown by the British public in the spread of wireless telephony and telegraphy in the United States, says the Electric Supplies Division of the U. S. Department of Commerce, and a campaign has been started for the development of similar facilities in Great Britain. In this connection there may possibly be a market for inexpensive American wireless outfits.

The policy of the British Government with regard to amateur wireless stations, as recently expressed by the Postmaster General, was sympathetic and aimed to facilitate the establishment of wireless stations, subject to proper regulations to avoid "jamming" and interference with the Government services. Under these conditions, it has been decided to allow the establishment of a limited number of radio-telephone broadcasting stations.

The country will be divided roughly into areas, centreing upon London, Cardiff, Plymouth, Birmingham, Manchester, Newcastle, Glasgow or Edinburgh (but not both), and Aberdeen; and one or more broadcasting stations will be allowed in each of these areas. Permission for these stations will be granted only to British firms who are bona fide manufacturers of wireless apparatus. In order that each service shall not interfere with the efficient working of other services, licenses to these British broadcasting firms will not be granted freely. The stations will be limited to a power of 1½ kilowatts and furnished with wave lengths which should not interfere with other services.

One of the large London department stores has recently begun to demonstrate an inexpensive receiving telephone apparatus, of British manufacture, to sell for six guineas (equivalent to \$27.75 at exchange rate of \$4.40).

### RADIO MARKET REPORTS

The Radio already has obtained a foothold in the produce market of Canada and the United States and there is more than a probability that Montreal will see it used in this field before long. The Family Herald learns that an agitation is under way among the produce dealers of Montreal to have a receiving set installed in a central office where the market reports that are broadcasted three times daily in the United States would be received regularly. It is anticipated that all the big Canadian cities would quickly follow suit, and then the farmers would be able to pick up the news as well.

Marshall Joffre, of France, the hero of the Marne, recently on a visit to Canada and the United States, delivered a message to Radio enthusiasts. He spoke in French but an interpreter translated the message.

Jean LaCarne of the Vallot observatory on the summit of Mont Blanc, has perfected a Radio apparatus capable of resisting severe atmosphere changes of the high altitudes which break ordinary wireless instruments.

The S. S. Leviathan which many of our war veterans will remember, is being rebuilt and every cabin will be equipped with Radio receiving apparatus.

Artists who have performed to radiophone audiences say that, when they appear following a "hearing" there are many more admirers present who are curious to see the artists whom they have heard.

### WIRELESS CHAIN FOR EMPIRE USE

London, July 20.—In answer to questions in the House of Commons to-day, Rt. Hon. F. C. Kellaway, Postmaster-General, stated that the Government, in further considering the question of an Imperial wireless chain, had decided to erect in England a station of the ultimate power contemplated by the expert commission, instead of a station with smaller power which was first proposed. The Government, he said, was advised that this station with its greater power, would provide especially for direct commercial communication with India, South Africa and Australia.

#### Direct Communication

The Imperial Government, Postmaster-General Kellaway said, would erect a station with similar power in India with Indian Government work. This station would be capable of directly communicating with England, South Africa and Australia. As a corollary of this decision, the proposed second station in Egypt and a station in East Africa would be deferred, and the question of the erection of a station at Singapore and another at Hong Kong would be reconsidered.

#### Station in South Africa

Mr. Kellaway said the Home Government was communicating with the Government of the Union of South Africa regarding a station in South Africa.

Canadian Government experts were expected to reach England very shortly, Mr. Kellaway said, in order to discuss the question of Canada's participation in the Imperial wireless chain scheme.

#### Canada's Participation

Ottawa, June 20.—The Dominion Government intends sending two representatives to England to discuss the question of Canada's participation in the Imperial wireless chain scheme with representatives of the British Government. It is pointed out here that the question is not one of a pressing nature, as the intention is to start the establishment of stations in the Far East first. The original plan was to proceed in two directions from England, the first via East Africa, West Africa and the Cape, and the second via India, Ceylon, Singapore, Hong Kong and Australia. The jump from Australia to Canada would be an exceedingly lengthy one. The names of the two men who will proceed to England on behalf of Canada have not been made public.

### MARCONI'S AIM

Senator Guglielmo Marconi, inventor of the first method of wireless communication, arrived in New York harbor recently on his yacht, in which he is groping for the crowning achievements of his life as an inventor and electrical engineer.

One of his goals is to find a perfect method for the elimination of static disturbances which hinder the Radio apparatus, no matter what its size, near the time of the summer equinox, and it became known to-day that Marconi has set up on one of his three Radio sets on the yacht a secret and as yet unpatented contrivance which virtually cuts out all static. Much is to be done yet in the perfection of the process, but tests have shown that the Marconi device increases the efficiency of the wireless to a marvellous extent during the most troublesome period of the year.

#### Radio Waves Obey?

But static is not the only problem claiming the mind of the master Radio engineer on these long cruises across the

seas. He has been working also on a method for sending a message toward a given point, so that there will be no "back-wash" of power toward points where the message is not intended to be received.

Coupled with these experiments is another set of experiments on "selectional receiving," which, if successful, will show the wireless world how to sort out and receive one particular message from the thousands that may be flying along. Great progress has been made along these lines in the Electra's laboratory.

#### Not Trying "Romantic Futilities"

Marconi said he was not trying to communicate with Mars, and had never attempted such "romantic futilities." He said that any suggestions of inter-planetary communications were "absurd," but added that the 150,000-metre wave which he picked up on the Electra's Radio apparatus on the Mediterranean several months ago certainly did not originate on the earth.

Marconi said that his experiments on his present voyage across the Atlantic had convinced him that it was possible to send a Radio message around the globe, and he pointed out that messages already had been setn from England to Australia, a distance of more than 12,500 miles, or approximately half-way around the globe.

### WAVES ARE DIRECTIONAL

In constructing and erecting an aerial, it is well to keep in mind the fact that Radio waves are, to a certain extent, directional. If the lead-in end is toward the sending station you most frequently desire to hear you will find it much easier to tune out other stations broadcasting on similar wave lengths. This will not prevent a set from tuning in stations at other points of the compass from its direction. But where the range of a set is not too great, attention to this little detail is repaid by the better tuning of at least one station.

### RADIO TO BRING ONE LANGUAGE

Esperanto and Radio are to be the greatest links in the chain which will bind the nations of the world together. Such is the opinion of delegates to the fifteenth annual congress of the Esperanto Association of North America, which is being held at the King Edward Hotel, Toronto.

Mr. James E. Morton, Chairman of the Executive Committee, expresses the belief that Radio would bring home the need of a universal language to the nations of the world.

"What is the use of having a method by which a speech can be made audible all over the world if the language is intelligible only to those who send out the message?" asked Mr. Morton.

### INSTALL AIRPHONE IN ALASKA LIGHTHOUSES

The American light-house commission has decided to install Radio equipment on the lighthouses off the coast of Alaska. This will mean a great boon to the men who, in some instances, are at their posts for three years at a time, and receive no communications from the outside world for ten months at a stretch.

Edwin H. Armstrong developed his modification of the accepted three electrode vacuum valve receiving circuit in 1912. Recently his claims have been definitely established by the success of his suit against Lee deForest, inventor of the Audion.

# Radio's Guide to North American Broadcasting Stations

## CANADIAN BROADCASTING STATIONS

Montreal			Calgary		
Name	Wavelength	Call Signal	Name	Wavelength	Call Signal
Marconi Company	440 metres	CFCF	Geo. Melrose Bell	430 metres	CFAC
Dupius Freres	420 "	CJBC	Albertan Publishing Co.	410 "	CHBC
Northern Electric Co.	410 "	CHYC	Western Radio Co.	400 "	CHCQ
La Presse	430 "	CKAC	<b>Edmonton</b>		
<b>Toronto</b>			The Journal	450 metres	CJCA
Independent Tel. Co.	450 metres	CKCE	<b>Nelson, B.C.</b>		
Marconi Company	440 "	CHCB	J. G. Bennett	400 metres	CJCB
Evening Telegram	430 "	CJSC	<b>St. John, N.B.</b>		
Globe	420 "	CHCZ	McLean, Holt & Co.	400 metres	CJCI
T. Eaton Co.	410 "	CJCD	<b>Winnipeg</b>		
Star	400 "	CFCA	Geo. Melrose Bell	430 "	CHCA
Metropolitan Motors	410 "	CHVC	Lynn V. Salton	420 "	CKZC
Simons Agnew Company	410 "	CJCN	Manitoba Free Press	410 "	CJCG
<b>London</b>			Tribune	400 "	CJNC
Radio Shoppe	410 metres	CHCS	<b>Regina</b>		
Radio Supply Co.	410 "	CKQC	Geo. Melrose Bell	420 metres	CKCK
Free Press	430 "	CJGC	<b>Vancouver</b>		
<b>Hamilton</b>			Marconi Company	440 metres	CFCB
Wentworth Radio Supply Co.	410 metres	CKOC	Geo. Melrose Bell	430 metres	CHCF
<b>Ottawa</b>			Vancouver Daily Sun	420 "	CJCE
J. R. Booth, Jr.	400 metres	CHXC	Vancouver Daily Province	410 "	CKCD
<b>Fort Frances, Ont.</b>			Vancouver World	400 "	CFYC
International Radio Dev. Co.	400 metres	CFPC	<b>Halifax</b>		
			Marconi Company	440 metres	CFCE
			Eastern Telephone & Tel. Co.	410 "	CJCS

## UNITED STATES BROADCASTING STATIONS

Owner of Station and Location	W. Lengths	C. Signal	Owner of Station and Location	W. Lengths	C. Signal
Alabama Power Co., Birmingham, Ala.	360	WSY	Dallas, City of, Dallas, Tex.	360, 485	WRR
Aldrich Marble & Granite Co. C.F., Colorado Springs, Colo.	485	KHD	Dayton Co., Minneapolis, Minn.	360	WBAH
Allen, Preston, D., Oakland, Calif.	360	KZM	DeForest Radio Telephone & Telegraph Co., New York, N.Y.	360	WJX
Altadena Radio Laboratory, Altadena, Calif.	360	KGO	Deseret News, Salt Lake City, Utah	360	KZN
American Radio & Research Corporation, Medford Hillside, Mass.	360	WGI	Detroit News, Detroit, Mich.	360, 485	WWJ
Anthony, Earl C., Los Angeles, Calif.	360	KFI	Detroit Police Dept., Detroit, Mich.	360	KOP
Arrow Radio Laboratories, Anderson, Ind.	360	WMA	Diamond State Fibre Co., Bridgeport, Pa.	360	WBAG
Atlanta Constitution, Atlanta, Ga.	360, 485	WGM	Doerr-Mitchell Elec. Co., Spokane, Wash.	360	KFZ
Atlanta Journal, Atlanta, Ga.	360, 485	WSB	Doran Brothers Elec. Co., Hamilton, O.	360	WRK
Atlantic-Pacific Radio Supplies Co., Oakland, Calif.	360	KZY	Doubleday-Hill Elec. Co., Pittsburgh, Pa.	360	KQV
Auburn Electrical Co., Auburn, Me.	360	WMB	Double-day-Hill Elec. Co., Washington, D.C.	360	WMU
Baumberv & Co., L., Newamrk, N.J.	360	WOR	Duck Co., William B., Toledo, Ohio	360	WHU
Beacon Light Co., Los Angeles, Calif.	360	KNR	Dunn & Co., J. J., Pasadena, Calif.	360	KLB
Benwood Co., St. Louis, Mo.	360	WFB	Eastern Radio Institute, Boston, Mass.	360	WAAJ
Bible Institute of Los Angeles, Los Angeles, Calif.	360	KJS	Electric Equipment Co., Erie, Pa.	360	WJT
Blue Diamond Elec. Co., Hood River, Ore.	360	KQP	Electric Lighting Supply Co., Hollywood, Calif.	360	KGC
Bradley Polytechnic Institute, Peoria, Ill.	360	WBAE	Electric Power & Appliance Co., Yakima, Wash.	360	KQT
Braun Corporation, Los Angeles, Calif.	360	KXS	Electric Supply Co., Clearfield, Pa.	360	WPI
Buckeye Radio Service Co., Akron, Ohio	360	WOE	Elliott Electric Co., Shreveport, La.	360	WAAG
Bullock's, Los Angeles, Calif.	360	KNN	Emporium, The, San Francisco, Calif.	360	KSI
Bush, James L., Tuscola, Ill.	360	WDZ	Eric Radio Co., Erie, Pa.	360	WSX
Central Radio Co., Kansas City, Mo.	360	WPE	Examiner Print. Co., San Francisco, Calif.	360	KUO
Church of the Covenant, Washington, D.C.	360	WDM	Fair, The, Chicago, Ill.	360	WGU
Chicago, City of, Chicago, Ill.	360	WBU	Federal Institute of Radio Telegraphy, Camden, N.J.	360	WRP
Cino Radio Mfg. Co., Cincinnati, O.	360	WIZ	Federal Telephone & Telegraph Co., Buffalo, N.Y.	360, 485	WGR
City Dye Works & Laundry Co., Los Angeles, Calif.	360	KUS	Fergus Electric Co., Zanesville, O.	360	WPL
Clark University, Worcester, Mass.	360, 485	WCN	Findley Electric Co., Minneapolis, Minn.	360	WCE
Coast Radio Company, El Monte, Calif.	360	KUY	First Presbyterian Church, Seattle, Wash.	360	KTW
Columbia Radio Co., Youngstown, O.	360	WMC	Ford Motor Co., Dearborn, Mich.	360	WWI
Commonwealth Elec. Co., St. Paul, Minn.	360	WAAH	Fort Worth Record, Fort Worth, Tex.	360	WPA
Continental Electric Supply Co., Washington, D.C.	360	WIL	Foster-Bradbury Radio Store, Yakima, Wash.	360	KFV
Cooper, Irving S., Los Angeles, Calif.	360	KZI	General Electric Co., Schenectady, N.Y.	360	WGY
Cosradio Co., Wichita, Kansas	360, 485	WFY	Gilbert Co., A. C., New Haven, Conn.	360	WCJ
Cox, Warren R., Cleveland, O.	360	WHK	Gimbel Brothers, Milwaukee, Wis.	360	WAAK
Crosley Manufacturing Co., Cincinnati, O.	360	WLW	Gimbel Brothers, Philadelphia, Pa.	360	WIP
Daily News Printing Co., Canton, O.	360	WWB	Gould, C. O., Stockton, Calif.	360	KJQ



UNITED STATES STATIONS—Continued

Owner of Station and Location.	W. Lengths.	C. Signal.	Owner of Station and Location	W. Lengths	C. Signal
Groves-Thornton Hardware Co., Hunting- ton, W. Va.	360	WAAR	Public Market & Department Stores Co., Seattle, Wash.	360	KZC
Hale & Co., San Jose, Calif.	360	KSC	Purdue University, West Lafayette, Ind.	360	WBAA
Hallock & Watson Radio Service, Portland, Ore.	360	KGG	Radio Construction & Electric Co., Wash- ington, D.C.	360	WDW
Hamilton Mfg. Co., Indianapolis, Ind.	360	WLK	Radio Service Co., Charleston, W.Va.	360	WAO
Hatfield Electric Co., Indianapolis, Ind.	360	WOH	Radio Shop, The, Sunnyvale, Calif.	360	KJJ
Hawley, Willard P., Jr., Portland, Ore.	360	KYG	Radio Telephone Shop, The, San Francisco, Calif.	360	KYY
Herald Publishing Co., Modesto, Calif.	360	KXD	Radio Supply Co., Los Angeles, Calif.	360	KNV
Herrold, Charles D., San Jose, Calif.	360	KQW	Register & Tribune, The, Des Moines, Iowa	360	WGF
Hobrecht, J. C., Sacramento, Calif.	360	KVQ	Rennysen, I. B., New Orleans, La.	360	WBAM
Hollister-Miller Motor Co., Emporia, Kan.	360	WAAZ	Reynolds Radio Co., Denver, Colo.	360, 485	KLZ
Holzwasser Inc., San Diego, Calif.	360	KON	Ridgewood Times Printing & Publishing Co., Ridgewood, N.Y.	360	WHN
Howe, Richard H., Granville, Ohio	360	WJD	Riechman-Crosby Co., Memphis, Tenn.	360, 485	WKN
Howlett, Thomas F. J., Philadelphia, Pa.	360	WGL	Rike-Kumler Co., Dayton, O.	360, 485	WFO
Hunter, L. M. & G. L. Carrington, Little Rock, Ark.	360	WSV	Rochester Times Union, Rochester, N.Y.	360, 485	WHQ
Hurlburt-Still Electrical Co., Houston, Tex.	360, 485	WEV	Roswell Public Service Co., Roswell, New Mexico	360	KNJ
Interstate Electric Co., New Orleans, La.	360	WGV	St. Joseph's College, Philadelphia, Pa.	360	WPJ
Iowa Radio Corporation, Des Moines, Iowa	360	WHX	St. Louis Chamber of Com., St. Louis, Mo.	360	WAAE
J. & M. Electric Co., Utica, N.Y.	360	WSL	St. Louis University, St. Louis, Mo.	485	WEW
K. & L. Electric Co., McKeesport, Pa.	360	WIK	St. Martin's College (Rev. S. Ruth), Lacey, Wash.	360	KGY
Kansas State Agricultural College, Manhat- tan, Kansas	485	WTG	San Joaquin Light & Power Corporation, Fresno, Calif.	360	KMJ
Karlowa Radio Co., Rock Island, Ill.	360, 485	WOC	Seeley, Stuart W., East Lansing, Mich.	485	WHW
Kennedy Co., Colin B., Los Altos, Calif.	360	KLP	Service Radio Equipment Co., Toledo, Ohio	360	WJK
Kierulff & Co., C. R., Los Angeles, Calif.	360	KHJ	Ship Owners Radio Service, New York, N.Y.	360	WDT
Kluge, Arno A., Los Angeles, Calif.	360	KOL	Ship Owners Radio Service, Norfolk, Va.	360	WSN
Kraft, Vincent I., Seattle, Wash.	360, 485	KJR	Shotton Radio Mfg. Co., Albany, N.Y.	360	WNJ
Lindsay, Weatherill & Co., Reedley, Calif.	360	KMC	Southern Electrical Co., San Diego, Calif.	360	KDPT
Los Angeles Examiner, Los Angeles, Calif.	360	KWH	Southern Radio Corp., Charlotte, N.C.	360	WBT
Love Electric Co., Tacoma, Wash.	360	KMO	Spokane Chronicle, Spokane, Wash.	360	KOE
Loyola University, New Orleans, La.	360	WWL	Standard Radio Co., Los Angeles, Calif.	360	KJC
Marshall-Gerkin Co., Toledo, Ohio	360	WBA	Sterling Electric Co. & Journal Printing Co., Minneapolis, Minn.	360	WBAD
Maxwell Electric Co., Berkeley, Calif.	360	KRE	Stix-Baer-Fuller, St. Louis, Mo.	360	WCK
May (Inc.), D. W., Newark, N.J.	360	WBS	Strawbridge & Clothier, Philadelphia, Pa.	360	WFI
McBridge, George M., Bay City, Mich.	360	WTP	Stubbs Electric Co., Portland, Ore.	360	KOY
McCarthy Bros. & Ford, Buffalo, N.Y.	360	WWT	T. & H. Radio Co., Anthony, Kansas.	360	WBL
Metropolitan Utilities District, Omaha, Neb.	360, 485	WOU	Tarrytown Radio Research Laboratory, Tarrytown, N.Y.	360	WRW
Meyberg Co., Leo J., Los Angeles, Calif.	360, 485	KYI	Taylor, Otto W., Wichita, Kansas	360	WAAP
Meyberg Co., Leo J., San Francisco, Calif.	360, 485	KDN	Thearle Music Co., San Diego, Calif.	360	KYF
Middleton, Fred M., Morestown, N.J.	360	WBAFG	Tulane University of Louisiana, New Or- leans, La.	360	WAAC
Midland Refining Co., El Dorado, Kansas.	485	WAH	Union College, Schenectady, N.Y.	360	WRL
Midland Refining Co., Tulsa, Okla.	485	WEH	Union Stock Yards & Transit Co., Chicago, Ill.	360, 485	WAAF
Millikin University James, Decatur, Ill.	360	WBAO	United Equipment Co., Memphis, Tenn.	360	WFO
Minnesota Tribune Co. & Anderson Beam- ish Co., Minneapolis, Minn.	360	WAAL	University of Illinois, Urbana, Ill.	360	WRM
Missouri State Marketing Bureau, Jefferson City, Mo.	485	WOS	University of Minnesota, Minneapolis, Min.	360, 485	WLR
Modesto Evening News, Modesto, Calif.	360	KDQ	University of Missouri, Columbia, Mo.	360	WAAN
Montgomery Light & Power Co., Montgom- ery, Ala.	360, 485	WGH	University of Texas, Austin, Texas	360, 485	WCM
Mullins Elec. Co., Wm. A., Tacoma, Wash.	360	KGB	University of Wisconsin, Madison, Wis.	360, 485	WHA
Mulrony, Marion A., Honolulu, Hawaii	360	KGU	Wanamaker, John, Philadelphia, Pa.	360	WOO
Nelson Co., I. R., Newark, N.J.	360	WAAM	Wanamaker, John, New York, N.Y.	360	WWZ
New England Motor Sales Co., Greenwich, Conn.	360	WAAQ	Warner Brothers, Oakland, Calif.	360	KIS
New Mexico College of Agriculture and Mechanical Arts, State College, N. Mex.	360, 485	KOB	Wasmer, Louis, Seattle, Wash.	360	KHO
Newspaper Printing Co., Pittsburgh, Pa.	360	WPR	West Virginia University, Morgantown, W.Va.	360	WHD
Noggle Electric Works, Monterey, Calif.	360	KLN	Western Radio Co., Kansas City, Mo.	360, 485	WOO
North Coast Products Co., Aberdeen, Wash.	360	KNT	Western Radio Electric Co., Los Angeles, Calif.	360	KOG
Northern Radio & Electric Co., Seattle, Wash.	360	KFC	Westinghouse Elec. & Manufacturing Co., East Pittsburgh, Pa.	360	KDKA
Northwestern Radio Manufacturing Co., Portland, Ore.	360	KGN	Westinghouse Elec. & Manufacturing Co., Chicago, Ill.	360, 485	KYW
Nushawg Poultry Farm, New Lebanon, O.	360	WPG	Westinghouse Elec. & Manufacturing Co., Newark, N.J.	360	WJZ
Oklahoma Radio Shop, Oklahoma City, Okla.	360, 485	WKY	Westinghouse Elec. & Manufacturing Co., Springfield, Mass.	360	WRZ
Oregonian Publishing Co., Portland, Ore.	360	KGW	White & Rover Co., Washington, D.C.	360	WIH
Palladium Printing Co., Richmond, Ind.	360, 485	WOZ	Williams, Thomas I., Washington, D.C.	360	WPM
Paris Radio Electric Co., Paris, Tex.	360	WTK	Wireless Phone Corporation, Paterson, N.J.	360	WBAN
Pennsylvania State Police, Harrisburg, Pa.	360	WBAX	Wireless Telephone Co. of Hudson County, N.J.	360	WNO
Pine Bluff Co., Pine Bluff, Ark.	360	WOK	Yeiser, John O., Jr., Omaha, Neb.	360	WDV
Pomona Fixture & Wiring Co., Pomona, Calif.	360	KGF	Y. M. C. A., Denver, Colo.	485	KOA
Portable Wireless Tel. Co., Stockton, Calif.	360	KWG	Zamoiski Co., Joseph M., Baltimore, Md.	360	WKQ
Post Dispatch, St. Louis, Mo.	360	KSD			
Precision Equipment Co., Cincinnati, O.	360, 485	WMH			
Precision Shop, The, Gridley, Calif.	360	KFU			
Prest & Dean Radio Research Laboratory, Long Beach, Calif.	360	KSS			

**AEROMARINE AIRWAYS INC., OPENS GREAT LAKES DIVISION WITH DAILY FLIGHTS FROM DETROIT TO CLEVELAND ON JULY 14, 1922.**

The Aeromarine Airways Inc., officially opened a daily flying boat service between Detroit and Cleveland with the arrival of two eleven passenger closed cabin flying boats, the Santa Maria, and the Wolverine, in Cleveland, after a 90 minute flight from Detroit, July 14th, 1922.

On board the Wolverine, which was piloted by F. D. Musick, were C. F. Redden, President of the Aeromarine Airways, Inc.; W. E. Metzger, President of the Detroit Athletic Club; Commodore A. A. Schontz, President of the D. & C. Steamship Company; P. J. Reid, Managing Editor of the Detroit Free Press; H. V. Wilcox, of the Detroit News, and Roland Rohlf, Detroit Manager of the Aeromarine Airways, Inc.

On board of the Santa Maria, which was piloted by D. G. Richardson, were I. M. Upperou, President of the New York Cadillac Motor Car Company, and owner and President of the Aeromarine Plane and Motor Company, the parent corporation; C. F. Ketterling, Vice-President of the General Motors Company; Dr. J. W. Inches, Commissioner of Police of Detroit; Frank Lewis of New York, T. Norris, Motion Picture Photographer; C. S. Mott, General Manager of the General Motors Company, and a representative of the Detroit Journal.

The boats arrived at Cleveland at 12.30 p.m. The distinguished passengers were greeted by a committee from the Cleveland Chamber of Commerce, Glenn L. Martin of the Glenn L. Martin Aircraft Corporation, headed the welcoming delegation; H. A. Bruno, Sales and Advertising Manager of the Aeromarine Airways, Inc., and Walter Hempel, Field Representative of the company, were also at the dock when the boats arrived.

The visitors and welcoming committee were driven in Cadillac automobiles from the dock to the Cleveland Chamber of Commerce. The procession was escorted by a troop of mounted police. At the Chamber of Commerce they were met by Mayor Fred Kohler, and Newton D. Baker, President of the Chamber of Commerce, gave an address of welcome and complimented Mr. Upperou and Mr. Redden on the initiative shown by the Aeromarine Company in developing commercial aviation in America.

The party returned to the flying boats at 3 o'clock p.m. and at 3.22 p.m. the boats left the water on their return flight to Detroit.

The Cleveland Station of the Aeromarine Airways, Inc. is at the D. & C. dock at the foot of East 9th Street. Tickets and reservations may be made at this station and also at the up-town office of the D. & C. Company, 2010 East 9th Street.

In Detroit the operating base is in the Memorial Park and the river. The down-town passenger station is at the foot of First Street. Tickets may also be had at the D. & C. offices. The operating equipment for this service is up-to-date in every way. Fast motor boats and base floats were shipped from the Aeromarine factories at Keyport, New Jersey, and are stationed at the different bases. Through the co-operation of Commodore Schontz, Aeromarine passengers have the use of the D. & C. waiting rooms at both cities. The boat schedules are as follows:

9:00 a.m. From Cleveland and Detroit. Returns at 5:00 p.m. from each city. The fleet consists of Santa Maria, The Wolverine, and a six seat open boat, the Niagara. Another eleven passenger flying cruiser has

been ordered from the factory and will join the fleet within a few days. This boat was named the "Buck-eye."

**NEW BROADCASTING STATION FOR MONTREAL**

The Montreal La Presse is about ready to begin broadcasting and as they have erected a very fine type of broadcasting station and have installed high class equipment it is expected that this station will not only give the most desirable service to the Radio set owners in that district, but it will mark the beginning of a boom in Radio business in Montreal.

With the La Presse entering the broadcasting field Montreal will have two fine broadcasting stations, as the Marconi Wireless Telephone Company have been broadcasting for some time.

Radio owners in the maritime provinces, as well as throughout the Province of Ontario, will be greatly interested in this additional broadcasting service and will certainly be tuning their instruments accordingly.

**RADIO FLASH OUTSPEEDS EDITORIAL PEN**

In a small town in the Middle West, there are two weekly newspapers, both of which publish on Friday. There is considerable rivalry between them, and the editors are continually at pen-points with each other. Recently one of the papers ran a "lead" stating that its news was "newsier" than the opponent paper. Immediately, the second editor began working on a plan to outdo his rival, and hit upon the following scheme:

This editor wrote a friend in a nearby "large city," had a Radio receiving set installed in his office, and astounded his native town, as well as his rival editor, by printing the last-minute news, even before the big city papers come to town. Finally, his method was discovered. He had his friend buy the late papers in the big city, read the important last-minute news into his Radio sending apparatus, which broadcasted the items so that the editor, with his Radio receiving set could "hear" the radiophone messages, and write copy simultaneously.

**A NEW RADIO FEAT**

At a prize fight, held in Madison Square Garden, New York, recently, there were several men at work in the cellar underneath the main floor, during the fight. These men were very anxious to learn the outcome of the fight upstairs, but had no means of learning the details of the battle. One of the men bethought himself of a friend, who, he knew, had a Radio receiving set, and he remembered the fact that the fight returns were being broadcasted from Newark.

So he telephoned his friend, who rigged up his set with a loud speaker set near the mouthpiece of a telephone connected to the cellar of the Garden, and thus the workman at the receiver of the telephone in the cellar was able to learn the details by wireless of the fight going on right above him, within a few feet of his telephone. The complete circuit was as follows: The fight returns were sent from the Garden to Newark by land telephone, broadcasted by Radio from Newark, and returned to the cellar of the Garden by land phone again.

Figures just announced indicate that in New York State alone, during the month of March, 1922, 1,717 new Radio corporations were organized.

The volume of business in the wireless telephony field is unprecedented and a vast amount is being forfeited because of the shortage of supplies and equipment.

**RADIO CABINETS**

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6 Volts 85 Amp. hrs.	16.00	to match the set, with portable handle and Rubber
6 Volts 110 Amp. hrs.	23.00	mat. Positively guaranteed.

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AGENTS for  
**Grebe, DeForest, J. Firth, Westinghouse and Hipo Batteries.**

**RADIO EXPANSION**

A "fan" is a "fan" whether in Patagonia or Iceland. Evidence of increasing interest the world over.

No product of electrical manufacturers has ever taken the world so by storm as has the Radio telephone receiving set, according to a statement made by the Electrical Division of the United States Department of Commerce. All over the globe broadcasting stations are daily disseminating news, music, and commercial information to thousands of Radio enthusiasts.

Outside of a few countries where existing political conditions have imposed restrictions, the use of Radio is being taken up universally. The development has been most rapid in this country; in Europe, in South America, in Australia, and to some extent in Africa and Asia. broadcasting stations are being installed with a resultant increasing demand for receiving sets.

In spite of an enormously increased manufacturing capacity, makers of Radio equipment are still behind on their domestic orders, and this has naturally limited their interest in export trade. Nevertheless, the total value of wireless equipment shipped abroad during the first five months of this year is more than 60 per cent. of the total for the calendar year 1921, and the inquiries from abroad have increased considerably. As productive capacity

here catches up with the domestic demand, a strong export trade may be expected.

Due to the volume and the variety of the home demand, manufacturers have developed simple, compact, efficient, reliable, and economically priced receiving sets, which showud take well abroad. As an indication of the interest shown by foreign buyers, one manufacturer reported a few days ago that as a result of circulars recently sent a list of London electrical importers, he had already received two inquiries by cable.

As an interesting feature of the sales abroad, there has for several months been a considerable call for receiving sets from our neighbors on the north and south—Canada, Cuba, Mexico, and Central America, where Radio "fans" found that tube sets would permit them to readily listen in on some of the important American broadcasting service.

**SUGGESTIONS TO RADIO PONZIS**

In many districts the farmers are depending upon Radio for their price quotations. The first thing we know, some sharp buyer will broadcast prices about two points below the market and buy up everything in sight before the fan-farmers get wise.

# Educated by Radio

By J. W. Hammond.

Many years from now—perhaps not so very many—one of the really splendid accomplishments of radio will be consummated. There will be a door flung wide open, and flung open wide to stay. It is a door which for generations has opened only to shut again, or has never opened at all beyond a tantalizing, grudging crack. It is the door of the country school house.

For radio broadcasting will eventually take the tremendous gift of a broad education to the boys and girls in the distant villages and the scattered farmsteads.

"Educated by radio" is a phrase which folks of the future may expect to hear spoken concerning some public man or accomplished specialist of the day.

Colleges will make a regular business of conducting radio courses, especially designed for students in the country districts. The enrollment of such students and their final graduation will be developed, beyond a doubt, on a logical, workable basis. Nearly all the functions of a high school or college can be accomplished, and will be accomplished, by radio.

Indeed, more than one progressive university is already planning radio lectures. But as an everyday, permanent, well-conducted activity, it is still hardly more than a shining possibility.

The far-seeing and the deep-thinking, among educators, sociologists and statesmen, are beginning to understand what this will signify. Thousands of America's best youth will be trained as their fathers and forefathers never were. The country young folk, who live far away from centres of learning, who could never get to high school, much less to college, will now have high school and college almost literally brought to them. The limitations of the proverbial "little red school house" will truly be swept away. The earnest, but often inexperienced and ill-paid, country school teacher, will be reinforced, perhaps entirely supplanted, by the best type of college professor through the wonder of the wireless. The shortcomings of the district school, which could only be kept open two or three months in the year, in some places, will conceivably vanish.

At present radio broadcasting is a nation-wide institution. But it is an institution for entertainment. It is the lyceum platform, the concert course, of the air. Nightly, for young and old, it is being used largely to amuse. It is the promoter of relaxation, the brightener of leisure. The audiences are scattered from coast to coast.

But to utilize radio for giving a complete "schooling" to those who otherwise would be but poorly equipped mentally will move the whole world forward. A mightier, bigger North America—mightier because more generally intelligent than ever before—will come to pass.

Adequate, well-directed education is a stable rock upon which to build the destinies of a State. That sort of education will be more nearly universal for all North Americans when radio takes a hand.

The way for doing these things is now open. The voice of the instructor and the professor now carries through the air to the most distant spot. It can reach the ear of the boy and girl in the little red schoolhouse of the future. That means that the professor's thought can be conveyed to the mind of that boy or girl. The spoken thought, or idea, will reach him as quickly as though professor and pupil were in the same classroom together.

All this implies, of course, a radio receiving set in every little red schoolhouse. Perhaps it will mean a set in every town hall, in every country church, as well.

More than that. The possibilities of radio for the farmer will unquestionably make a receiving set virtually a necessity in the farmhouse. And think of the "radio college" that will be possible when, as a general practice, farmhouses are so equipped!

"Going to school" will then become an obsolete phrase to the farmer's boy and girl. Instead, school will go to them, and they will get the essentials of a high school training, or the fundamentals of a college education, without leaving the home roof!

This is not any more fanciful than the ultimate reality will become. Radio schooling will be an especially prepared sort of schooling. Quite naturally the actual teaching of school subjects by wireless will have to be done in a manner adapted to the wireless.

Notwithstanding the impossibility of visual instruction, or blackboard work, much will be possible of accomplishment. With the text-book in the pupil's hands and the instructor's voice telling him how to use the text-book, the mere machinery will be provided as successfully as in any classroom, and worth while results can follow.

The pupil's work, his examination papers, will perhaps be sent in to the school or college by mail at stated intervals. The instructor's comments thereon will possibly come by radio—in due time. A method will doubtless be devised for helping the backward pupils with special radio instruction. The slow learners will be asked, it may be, to "stay after school" in a new manner. The instructor will announce the names of such pupils at the beginning of an evening's lecture, requesting them to continue listening in after the usual instruction period is over.

The farther the pupil proceeds, the better adapted radio may be found in education. Lectures on college subjects, higher mathematics, science, literature, agriculture, music, history, art, philosophy and many others, could certainly be very effectively broadcasted by authorities. Your farmer of twenty years from now may very likely stand on a complete intellectual equality with the city business man. And the credit will belong entirely and utterly to radio.

It will be a novel school, and that fact may produce a new fascination in getting an education. Withal, it is intensely practicable. Unquestionably no more magnificent opportunity for acquiring book knowledge by the pupils of the little red schoolhouse has ever before been dreamed of.

And the great glory of radio is that this picture is not a dream at all. Very likely it will be a reality before another generation appears.

## SCRUB THEIR TEETH, TOO!

Some expert suggests soaking poor crystals in oil to revive their sensitivity. Soon we shall see ads enquiring whether our crystals have had their vitamins to-day.

The College of the City of New York Radio Club is located in a historic room at the top of the bell tower in the main building of the college. During the war this room was used by the U. S. Navy as a Radio compass station and a depot for the detection of enemy wireless stations.



## Who Saw Radiophone Broadcasting Vision

"Frank, I'm going to close your station."

Paradoxical as the statement may seem, this was the actual start of radio broadcasting as we now know it. The concerts on regular schedules, advance programmes, entertainment in the air, all came from closing "Frank's station" and opening KDKA, the first radiophone station in the world.

For "Frank" was Frank Conrad, assistant chief engineer of the Westinghouse Company, and the man who made the statement was Harry Phillips Davis, vice-president of the Westinghouse Company.

Mr. Davis had come into his office that morning in September, 1920, with an idea. The idea had come to him while reading the advertisement in his evening paper. In a corner of a full page ad he came across the words "Mr. Conrad will send out phonograph records this evening." This advertisement was in the interest of the store's amateur radio department and was explaining to local radio amateurs that Mr. Frank Conrad, who had operated his station intermittently since the war, would send out by radio, phonograph records on a certain evening. The Conrad station was very well known to amateurs all over the country, for it was one of the few amateur stations licensed to operate during the war. This special operating was in the interests of government research work which the Westinghouse Company was doing and also to test some apparatus.

Mr. Davis could not forget his idea. He was struck with the fact that the radiophone fundamentally did not lend itself only to private communication, but that it had a universal field of usefulness and that through it one could communicate with hundreds, thousands or millions; all could listen who had the suitable "ear," for if a certain class of people were interested enough to listen to music from a few records there was a possibility of increasing this small audience of radio listeners to an enormous number by sending out entertainments, current events, etc., in a regular and interesting manner. Why confine one's audience to a small portion of the country? Why not build a big station and let everyone who want to hear? Why not make radio broadcasting a public service?

Mr. Davis was so struck with his idea of a public broadcasting service that the first thing he said to his secretary on entering his office the next morning was, "Ask Frank to come in."

"Frank," as has been previously explained, was Mr. Conrad, who, having been taken so abruptly with his chief's statement, could only listen to what followed.

"Frank, my idea is that you stop sending from your station and we will start a regular service from our experimental station here at East Pittsburgh. We can arrange for a suitable wave length, and I believe that if we do this it will be the beginning of a radio broadcasting public service which seems to me to have wonderful possibilities."

The conference with Mr. Conrad lasted a short time and Mr. Davis called other conferences before actual work on the broadcasting started. It was not until November 11, 1920, that KDKA was formally opened with the broadcasting of election returns.

The remainder of the history of KDKA, is now common property. Everyone, almost, now knows that there are over 200 broadcasting stations in the United States

and that the radio audience numbers into the millions each night.

Not everyone knows, however, that it was a single line in a newspaper which suggested to the vice-president of one of the largest electrical manufacturing companies in the world, the big thing of turning a scientific novelty into a new kind of public service by unfolding a new field of communication.

Mr. Davis was one of the best equipped men in the electrical industry to take up the difficult problems of broadcasting. He has been a leader in the electrical industry since his college days, and has been issued nearly 100 patents covering electrical apparatus. He is an engineering genius and is known, not only as a designing engineer of high rank, but also as a man who gets things done. His ability to accomplish results has already been proved in the history of his company's broadcasting achievements. His ability was also admirably illustrated during the war. He was at that time in charge of fulfilling the government contracts for munitions was his. Probably no more colossal manufacturing task was ever given anyone. The quantities involved were enormous; the time limits short; the specifications most rigid, new and undreamed of problems arose at every step; the government's plans changed with bewildering frequency; material, competent help, and transportation facilities became almost unobtainable; and innumerable other difficulties were encountered. Yet, in spite of everything, the work was done and it was done properly and on time. Not a single promise made to the government was broken.

This is all by way of illustrating the character of the man who first saw that radio broadcasting was something that held greater possibilities than just being the plaything of the amateur.

Mr. Davis was born at Somersworth, New Hampshire. He graduated from the Worcester Polytechnic Institute with the degree of B.S. in Electrical Engineering in 1890 and after a trip to Europe and a few months spent with the Thompson-Houston Company, entered the Detail Engineering Department of the Westinghouse Company in 1891. In 1896 was placed in charge of this department; in 1908 he was made manager of the Engineering Department. This position he held until 1911, when he was elected vice-president.

### THE RADIO WIDOW

By George Mitchell

I've been a widow all my life;  
That is, since I have been a wife,  
Communing with myself, the time,  
In solitary pantomime.

Gold claimed him almost every day,  
And, as he niblicked on his way,  
I followed in his gallery  
Or, on the club house porch, drank tea.

At night, Bridge took him from my side;  
I couldn't play it—though I tried;  
But sat at home with ill-content,  
The while he gambled with the rent.

He gave up both. Said he: "I'm through,  
I'll stay at home alone with you."  
But Radio's got him. Fickle men!  
And I'm a widow once again.—Judge.

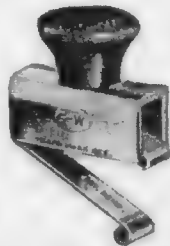
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## RADIO NEWS

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The following can also be supplied for immediate delivery:—

Manhattan Phones, 2000 ohms .....	\$8.00
Manhattan Phones, 3000 ohms .....	9.25
Everett Phones, 3000 ohms .....	12.00
Radio Frequency Transformers .....	6.00
Audio Frequency Transformers .....	5.00
"Bradleystat" Filament Control .....	2.25
Vacuum Tubes (Radiotron U.V. 200) .....	7.00
Vacuum Tubes (Radiotron UV 201) .....	9.25
Vacuum Tubes (Radiotron U.V. 202) .....	12.00
Vacuum Tubes (Mullard with base) .....	7.50
Prest-o-lite Radio Batteries, 6 volt, 80 amp. ....	18.00
Magnavox, Loud Speakers .....	65.00
Magnavox Power Amplifier .....	95.00

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### WASHINGTON DAILY RADIOS BULLETINS

Washington.—While all of the four Washington daily newspapers are carrying a so-called Radio page, only one paper, the Washington Daily News, is broadcasting.

At 12.30 p.m. (Eastern Standard time) each day the Washington Daily News broadcasts from twelve to twenty news stories through Station WPM, owned by Thomas J. Williams & Company, an electrical firm whose store is located next door to the News. It generally takes about five minutes to send out these news bulletins, as Lowell Mellett, the managing editor of the News feels that no one cares to listen to news bulletins for more than five minutes. Incidentally, Mr. Mellett feels assured that the broadcasting of news will be greatly increased as the pool rooms, cigar stands, and similar places install receiving sets.

On each Monday night at 8.30 the Williams Company stages a concert which is apparently widely appreciated from the letters received by the firm. These concerts include musical selections and occasionally a story telling expert is employed. Up to the present time, nothing but local talent has been engaged in broadcasting from the Williams Company.

### RADIO PILOTING CABLE

New York.—A recent test of the Radio piloting cable in Ambrose Channel showed that the mass of a large steel ship does not materially affect the audibility of the signals picked up from the cable, and that greater power in the cable is not necessary.

By means of underwater sound-detecting devices, a ship is enabled to keep practically over the submerged cable from which signals are constantly sent out through the water. There is a receiver on each side of the ship's bottom, and when one signal is weaker than the other the course is changed slightly until they are equal in intensity. In this manner a ship can proceed up the Sound even in dense fog.

### WIRE WAVES MAKE AUTOMAT STATIONS

Lynn, Mass.—A new application of high frequency currents is being worked out by the General Electric Plant here, in experiments conducted by Professor Elihu Thompson, head of the experimental and Radio work at the plant. The application is of a carrier current, acting like Radio waves, but going over wires.

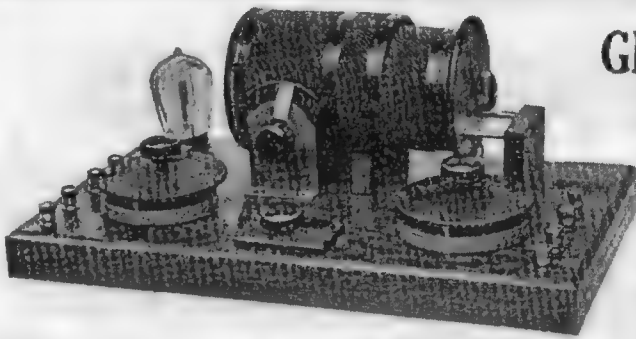
The theory has been understood for years, but this application of it is new, according to Prof. Thompson. The purpose, when fully developed, is simply to send high frequency waves over wires that are used for power or light. Countless waves may be sent over a single wire, each wave attuned for a different station. By this means, light or heat at a certain station, can be turned on or off from power headquarters by the use of the wave-tuned to that particular station. This method is called remote control. If it comes into general use, it will mean the elimination of numbers of workmen who are now employed at branch power stations, and whose chief occupation is doing what the high frequency current can be made to do automatically.

### YOU'D NEED A LOAD COIL TO GET 'EM

Prospective Purchaser: "How far is the lot from the centre of the town?"

Modern Real Estate Agent: "Oh, just a couple of wave-lengths."

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## GILBERT RECEIVING SET

NON-REGENERATIVE

Guaranteed range 100 to 150 miles.

Retail Price without  
Bulbs, Batteries  
or Phones **\$37<sup>50</sup>**

**Cleartone Loud Speaker** A wonderful instrument that does not require extra power **\$37.50**  
For use in any ordinary sized room.

**Gilbert New Head Phones** (2000 ohms.) - - **\$9.75**

**Gilbert Mineral Sets** (With Head Phones) - - **\$22.50**

Variable Condensers, Variometers, Amplifying Transformers, Binding Posts, Crystals, Horns, One Step and 2 Step Amplifiers, Lightning Arrestors, Strain Insulators, Dials, etc., etc.

*Send for Catalogue*

**The A. C. GILBERT-MENZIES CO. Ltd.**

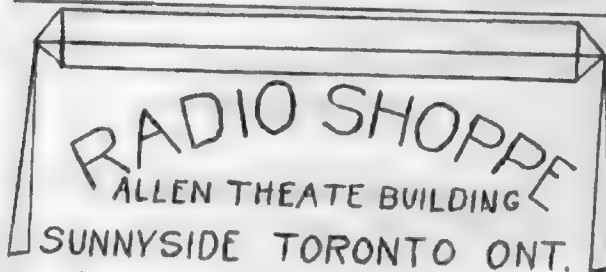
439 KING STREET WEST, TORONTO

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YOUR DEALER CAN SUPPLY YOU  
AT A PRICE THATS RIGHT

Or Write to us Direct

**HART BATTERY CO. Limited**  
Montreal Toronto Winnipeg



Vacuum Tubes, Sockets, Condensers,  
Rheostats and Wire Insulators.

Specializing in Radio Shoppe Receivers and Two-  
Stage Amplifiers for Local and American Concerts.

## Hamilton Radio Supply Co.

*Specialists in the  
Manufacture of*

## RADIO SETS

We are now manufacturing Radio parts and sets in the very best quality of material, by expert workmen.

Our sets are all guaranteed to give perfect satisfaction, and are easily operated by anyone.

If you want the best—write to us for our liberal proposition to dealers and jobbers.

Our prices will interest you.

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Write to-day

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223 King St. E. HAMILTON, Ont.

Phone—Regent 6502W

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# RADIO MERCHANDISE

## F. D. PITTS CO.

INCORPORATED

219 COLUMBUS AVENUE, BOSTON, MASS., U. S. A.

*Announces a Change of Policy :*  
**WHOLESALE ONLY**



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A. H. Grebe & Co. (New England)	Remler Radio Mfg. Company.
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Dealers are urged to send for our latest Stock Sheets, Listing Desirable Radio Merchandise for Immediate Delivery at Attractive Discounts.

The Retail and Mail Order Business Formerly Conducted by the F. D. Pitts Co., at 12 Park Square, Providence, R.I., and Springfield, Mass., is now operated by the "Pitts Radio Stores, Inc.," at the same Address.

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	Yearly Subscription
Radio .....	\$ 1.50
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Canadian Exporter .....	1.00
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**A. F. Penton & Co.**  
*Publishers*  
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## Why Should I Use a **Weston** Filament Voltmeter On My Receiving Set ?



Model 301

### Here's the Answer:

1. It simplifies tuning by eliminating guesswork as to tube adjustments.
2. Filament voltage control increases the life of the tube from two to three times.
3. The Weston Filament Voltmeter is accurate and can be relied upon for duplication of results.

### All This Means

## Better Reception!

Buy it from your dealer, or from us direct if he cannot supply you.  
Write for RADIO CIRCULAR J.

**Weston Electrical Instrument Co.**  
177 Weston Avenue, Waverly Park, Newark, N. J.  
CANADIAN REPRESENTATIVES—  
A. H. Winter-Joyner, Ltd., Toronto, Ontario Agents; Northern Electric Co., Ltd., Montreal, Ottawa, Winnipeg, Halifax, Regina, Vancouver, Calgary, Edmonton.

Prompt Shipment

## Radio Apparatus and Parts

Mail us your order from your Catalogs.

**CANADIAN WIRELESS &  
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36 PALACE HILL                      QUEBEC, QUE.

## VALLEY BATTERY CHARGER

Simple

Safe



Will charge your "A" battery overnight from the lighting socket without any attention.

Approved by the National Board of Underwriters and the Hydro Electric Power Commission of Ontario.

It also has a 12-volt tap by means of which your storage "B" battery can also be charged by arranging the battery in parallel sections.

Type MC. 25 cycle.....\$36.00  
60 cycle.....\$32.00

F.O.B. Toronto or Winnipeg

**Canadian Electrical Equipment Co.**  
199 HOWARD PARK AVE.                      TORONTO

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## "DICTOGRAPH" RADIO HEADSETS

DICTOGRAPH sound transmitting devices are recognized throughout the world as standard of efficiency.

Twenty-five years experience in the manufacture of DICTOGRAPH transmitters, receivers, Acousticons and loud speakers has combined to produce the DICTOGRAPH Radio Head Set for commercial, amateur and broadcasting service.

DICTOGRAPH Radio Head Sets will be found unequalled in distinctness, extreme sensitiveness and pure clear tonal qualities.

Send for pamphlet giving full description of same.

DISTRIBUTERS

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**IMMEDIATE DELIVERY** On Super-sensitive Radio

**Receiving Instruments & Head Phones  
NOT A TOY**

**This Unit is the First of Four Units**

(The balance to be announced at a later date) which constitute a modern Long Range Radio Outfit capable of bringing in Concerts hundreds of miles distant—Loud and Clear.

**But Each Unit is Complete in Itself**

**\$27 Complete, Ready to "Listen In" \$27**

**HUGHES SALES CO., 304 Yonge** Wholesale and Retail.

## MALCOLM and HILL

Limited

KITCHENER, ONT.

*Manufacturers of  
Radio-Cabinets*

Special designs and prices on application

**RADIO AMATEURS**—We can supply Chelsea Transformers, \$5.75; Chelsea and Signal Condensers, 23 plate, \$5.20; 43 plate, \$5.95; First Phones, 2000 ohms, \$6.75; 3000 ohms, \$7.95; Bakelite Honeycomb Mountings, \$5.00; Plugs, 60c; Rheostats, \$1.10; Bradleystats, \$2.40; Series Parallel Switch, 50c. with contacts; knob and switch, 50c; and all parts and apparatus to make your own sets.

**The J. D. FORD Radio Equipment Co.**  
974 BLOOR ST. WEST, TORONTO, ONT. Kenwood 6894

### IMMEDIATE DELIVERY FROM STOCK

2000 Ohms Ellwood Double Head Sets .....	\$9.50
Antenna Wire, 7/22 Copper in 100 ft. lengths.....	.65
Vacuum Tube Sockets, with Metal Holders .....	.90
23 Plate Condenser with new approved Dial .....	3.40
43 Plate Condenser with new approved Dial .....	4.95
3/16 inch Dials (Bakelite) .....	.85
1/4 inch Dials, (Bakelite) .....	.85
Mounted Crystal Detectors (Tested) .....	.25
1/8 Nickel Plated Binding Posts .....	each .06
No. B1 Hard Rubber Binding Posts .....	each .12c.
Deep Nickel Contact Posts .....	each .04c.
Ground Clamps .....	each .08c.
Deep Nickel Switch Stops .....	each .04c.
0101 Telephone Condensers .....	each .18c.
Rheostats, complete with Dial .....	1.35

**ELECTRIC SUPPLY CO., 283 BLEURY STREET,  
MONTREAL, CANADA**  
Mail Orders Promptly Shipped.

## Canadian Amateurs Take Notice

**We buy direct from the largest  
firms in the United States**

**Bakelite Dial \$1.00 Chelsea Rheostat \$1.35**

**Radio Corp. Sockets \$1.50**

**Radio Corp. Tube 200 \$7.00 — 201 \$9.00**

Price List Free.

Immediate Delivery. Mail Orders sent Prepaid.

**WINDSOR RADIO CO.**

26 FERRY ST.

WINDSOR, ONT.

## BUFFALO RADIOPHONE CO.,

SUCCESSORS TO: JATH WIRELESS COMPANY.

343 PARKDALE AVE., BUFFALO, N.Y.

We carry a complete stock of RADIO CORPORATION TUBES  
UV-200-201

Immediate delivery. Mail orders sent prepaid

All Standard Makes of High-Grade Wireless Equipment.

Main 5067

## E. C. SYKES & Co., Inc.

We carry a complete line of

**RADIO PRODUCTS AND PARTS**

Catalogue upon request

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## NOVO "B" BATTERIES FOR WIRELESS SETS

All Standard Sizes—22½ to 105 Volta. Send for Catalogue

**HALE BROS. 318 St. Paul St. W., Montreal**

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# When You Amplify use Acme Apparatus

Acme  
Amplifying  
Transformers



*The Heart of the  
Amplifier is the  
Transformer.*

Acme Transformers are for sale separately, and are also incorporated in complete Acme Detector and Amplifier instruments designed to connect to your present receiving equipment.

Radio has been moved to the living room, and Acme units are constructed to harmonize with the furniture.

## Acme Transformers

have been brought to a high degree of efficiency through years of specialization on this one product.

**ACME APPARATUS COMPANY, 200 Massachusetts Ave., Cambridge 39, Mass.**

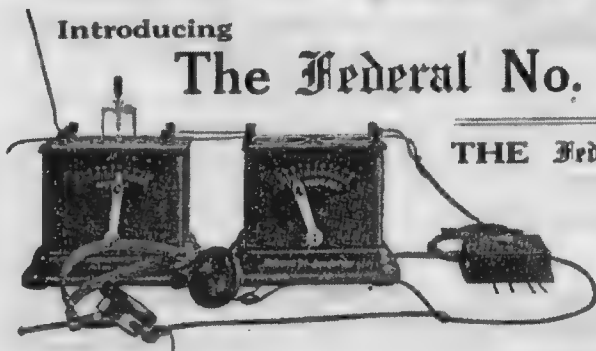
New York Sales Office—1270 BROADWAY

TRANSFORMER AND RADIO ENGINEERS AND MANUFACTURERS

# FEDERAL

Introducing

## The Federal No. 20 Amplifier



### THE Federal CRYSTAL RADIO RECEIVER

shown at left of illustration, is well known as a highly efficient instrument for receiving radio programs within a radius of 25 to 30 miles from a broadcasting station. With the addition of

## THE Federal No. 20 AMPLIFIER

Shown at right of illustration

*The Receiving Range is Increased to 100 Miles*

PRICE OF Federal CRYSTAL RADIO-RECEIVER, F.O.B. Bridgeburg, \$33.75  
PRICE OF Federal No. 20 AMPLIFIER (Less Bulbs) " " 39.00

DEMAND from your dealer GENUINE Federal RADIO APPARATUS

**Century Telephone Construction Co., Inc.**  
BRIDGEBURG, ONT.

Canadian Distributors for Federal Telephone & Telegraph Co., BUFFALO, N.Y.

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**Dealers, Attention!**

## EVERETT PHONES

We carry a large stock of the new Everett 3000 ohm Phones, ready for immediate delivery.

### "ESCO" Motor Generators

We are distributors for the Electric Specialty Company's products.

### Chelsea Variable Condensers

## BAKELITE

Panels, Sheets, Tubes, Rods.


WE CARRY ALSO A

### Full Line of Radio Sets and Miscellaneous Accessories


## BROCK RADIO COMPANY

357 St. Catherine St. West, - MONTREAL, Que.

THE NAME IS



A Guarantee



**Murdock Head Receivers**  
**Murdock Variable Condensers**

Are sold by Progressive Canadian Dealers.

No. 56.


**WM. J. MURDOCK CO.**  
100 CARTER STREET - CHELSEA, MASS, U. S. A.

**IN STOCK**

Murdock, No. 56, 2000 ohms, double phones .....	\$6.50
Murdock, No. 56, 3000 ohms, double phones .....	8.00
Stromberg-Carlson, 2200 ohms, double phones .....	10.25
Federal, 2200 ohms, double phones .....	10.80
UV 200 Detector Valves .....	7.00
UV 201 Amplifying Valves .....	9.00
UV 202 Power Valves, 5 watt .....	11.50
Arkey Amplifying Horn .....	6.50
King Amplifying Horn .....	14.00
Magnavox E3 Amplifiers, comp., 14 in. Horn .....	62.50
Grebe, CR5, Intermediate-wave Regenerative Receiver and Vacuum Tube Unit (150 to 3000 metres), \$115.00	
Grebe, CR9, Intermediate-wave Regenerative Receiver, Detector and Two-stage Amplifier (150 to 3000 metres), including two special Plugs .....	\$180.00

14-Page Catalogue Free. Dealers Wanted  
Orders Shipped in 24 Hours for Grebe Sets

**WINDSOR RADIO CO.,** 26 FERRY STREET, WINDSOR, ONTARIO



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A. W. 210

## "B" SATISFIED

FACTS ABOUT KICO STORAGE "B" BATTERIES -

1. Not an ACID "B" Battery.
2. They eliminate noises caused from "B's" that are rapidly deteriorating.
3. The switch control allows single cell variations from 12 volts up. (A critical adjustment is essential on your detector bulb for Radiophone and C.W. reception.)
4. Rechargeable from your 110 volt A.C. line in connection with the rectifier supplied with each battery.
5. Will last from three to six months on a single charge, while in the detector plate circuit.
6. NOT an experiment. All batteries are sold with the privilege of receiving your money back within a ninety day trial, if unsatisfied.
7. Neat, efficient and compact.
8. Unlimited life.

Drop a line for information  
Distributors in Toronto: THE VIMY SUPPLY CO.

**KIMLEY ELECTRIC CO.**  
290 Winslow Ave. Buffalo, N. Y.

## RADIO WORKERS

-USE-

### "Imperial" Rosin Core Solder

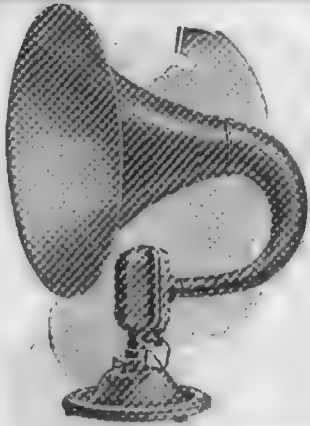
CLEAN AND QUICK for all Fine Work

Ask Your Jobber And Specify "Imperial"

## The Canada Metal Co. Limited

TORONTO





# 5 REASONS why Discriminating Operators Use the *Audiophone*

- |  |  |
|--|--|
| <p>1. No storage battery required. This is important because the new valves appearing on the market operate satisfactorily from dry cells.</p> <p>2. Will operate on either a normal strength of signal or is rugged enough to give good results from a power amplifier.</p> | <p>3. Special construction of receiver results in no distortion from resonance in diaphragm.</p> <p>4. Reproduces all sounds equally well.</p> <p>5. Static and induction noises do not predominate.</p> |
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ASK YOUR DEALER FOR DEMONSTRATION  
"HEAR IT"

**A. H. WINTER JOYNER, Limited**

DISTRIBUTORS

62 Front St. W., Toronto

New Birks Bldg., Montreal

## Full Line of Radio Supplies

Immediate Delivery.

Write for Prices.

We are exclusive distributors for many well known lines. Dealers wanted. Some territory still open. Write for proposition.

### SPECIAL

#### LOOSE COUPLER SET

- |  |                                 |
|--|---------------------------------|
| 100 ft. Aerial Wire                            | 1 lb. 22 Gauge Enam. Wire       |
| 1 Ground Clamp                                 | ½ lb. C. covered 28 Gauge Wire. |
| 4 Pr. Cleats                                   | 10 Contact Points               |
| 1 Slide and Rod                                | 1 Switch Arm                    |
| 1 4½ x 8 Paper Tube                            | 1 3½ x 8 Paper Tube             |
| 2 Long Slide Rods for secondary coil           |                                 |
| 4 Binding Posts                                |                                 |
| Galena   | Detector                        |
| Federal 2,200 Ohms Phones—Double Condenser     |                                 |
| 1 6000V double throw single pole knife switch. |                                 |

**PRICE \$22.50**

#### CRYSTAL SET

- |   |                     |
|---|---------------------|
| 100 ft. Aerial Wire                           | 4 pr. Cleats        |
| 1 600V double throw single pole knife switch. |                     |
| 1 Ground Clamp                                | 1 3½ x 8 Paper Tube |
| ½ lb. 22 Gauge Enam. Wire.                    |                     |
| 2 Slides and Rods                             | 2 Wood Blocks       |
| 4 Binding Posts                               |                     |
| Detector                                      |                     |
| Galena  |                     |
| Federal 2,200 Ohms Phones—Double Condenser    |                     |

**PRICE \$19.75**

The above prices include Blue Prints and full instructions.

### DOMINION ELECTRIC SUPPLY CO. LTD.

Wholesale & Retail

110 Queen St., West., Toronto, Ont.

When writing to Advertisers please mention *EADIO*



Our Super-Sensitive Detectograph Transmitter No. 2  
Price, \$8.00 Complete



Adjusted Model No. 80 Horn, High Grade Loud Talking Receiver, Cord Plugs and Desk Stand Base.  
Price, \$15.00 Complete



Detectograph, \$18.00  
This detecting instrument of marvelous sensitivity can be used for detecting secret conversations through conductors of sensitive transmitter. 2-ft. Black Cord. Headband, Case and Battery.



Our Special Loud Talking Telephone Transmitter No. 5, Price \$12.00

This model is especially made for Loud Talking Telephone reproduction. This transmitter can be used to advantage in connection with our Loud Talking Receivers or Horn Apparatus by wireless operators, window demonstrators, and in fact by every one desiring to build up their own loud talking telephone apparatus.



The Detectograph Junior Deaf-Phone, \$18.00



Our New Special Loud Talking Receiver No. 23  
Price \$7.50



Detectograph Rheostat, especially made for amplifying circuits. Price, \$2.00 Complete

Low Resistance

SUPER-SENSITIVE  
**Detectograph**  
MICROPHONE DEVICES

Practical Instruments for Commercial and Scientific Purposes

AMPLIFY YOUR RADIO SIGNALS

With the new DETECTOGRAPH-TRANSMITTER, the amateur can amplify radio signals to such an intensity that he can hear the signals about his station without the need of the telephone head set.

The manner in which the amplifying process is attained is by attaching with tape the DETECTOGRAPH-TRANSMITTER to the regular wireless receiver.

By the addition of a loud talking telephone he is able to hear the messages many feet away from the instrument.

The super-sensitive DETECTOGRAPH-TRANSMITTER herewith shown is two and

three-eighths inches in diameter. One-eighth of an inch thick and weighs less than three ounces. It is the most sensitive sound-detecting device ever brought before the public.

Not only is this instrument applicable for amplifying radio signals, but it can be used with equal satisfaction for amplifying other sounds. Photograph music can be transmitted from one place to another by means of this instrument, and those who are afflicted with deafness will find enormous benefit by using this transmitter.

Can be used for any purpose where a sensitive detecting instrument is required.

High Resistance

WIRELESS RECEIVERS

SUPER-SENSITIVE  
**Superphone**  
TELEPHONE DEVICES

MAGNIFYING APPARATUS

A Set of Receivers offering a Combination of a silent and loud reproduction of Wireless Signals  
**Efficiency of the Superphone Receivers**

Sound is transmitted from one medium to another in vibrating waves. These waves travel in every direction unless they are forced into one particular direction. Attached to the second cap close to the diaphragm is a small round tube, this tube is made so that it fits snugly into the operator's ears. The sound waves are now forced into one direction—the operator's ears. This attachment makes the loss of sound impossible, giving the maximum reproduction. The feature that aids the clear reproduction is the resonant chamber directly below the diaphragm and above the magnet and coils.

THIS CUT ILLUSTRATES THE RECEIVERS WITH HORN ATTACHED

The high tension metal used as a spring forces the receivers close to the ears. The receivers are so attached to the head band that they rest against the ears in a vertical position. This makes it comfortable for the operator.



Patent Pending



Superiority of the Superphone Receivers

The features that are enjoyed by only the SUPERPHONE receivers, that of the LOUD TALKING HORN attachment and the attachment that fits into the operator's ears, make them superior to any set of receivers on the market at present. The construction and arrangement, not to say anything of the matched tones of the two receivers, place them far above the ordinary receivers.

Superphone Receiving Set with Cord and Headband

2000 Ohms .....	\$12.00
3000 Ohms .....	15.00
4000 Ohms .....	20.00
With Horn Attachments as above.....	\$ 5.00 Extra

High Resistance Loud Talking Horn Apparatus for Use on Wireless Instruments

Direct



Model No. 80, 12 in. Long  
Price \$12.00

Order direct from ad. Or write for free descriptive new catalogue

G. BOISSONNAULT COMPANY, Inc. 26 CORTLANDT STREET  
NEW YORK CITY

## "SIGNAL" MEANS RADIO SERVICE



**SIGNAL VARIABLE  
CONDENSER**

Nos. 76 or 77 are very rigidly built. You can drop this condenser onto the floor from a considerable height without damaging or spoiling adjustment.

**SIGNAL  
ELECTRIC  
MANUFACTURING  
COMPANY,  
MENOMINEE,  
MICHIGAN.**

## SIGNAL RADIO EQUIPMENT

is built to **SERVE**—that is why it **SELLS!** With every "Tom, Dick and Harry" making Radio supplies these days only **STANDARD**, reputable apparatus should interest Radio dealers who are building for permanency and profit!

### GET THE SIGNAL WIRELESS BULLETIN AND SALES PROPOSITION

Simply fill in and mail this coupon to-day:—

-----  
**COUPON**

I am interested in "SIGNAL" and will be pleased to receive **SIGNAL WIRELESS BULLETIN W** and your sales proposition.

Name .....

Company .....

City ..... State .....

City ..... Province .....

## RADIO TRADE CATALOGUE

Now in the mails to Radio Dealers, the most comprehensive Canadian Trade Catalogue yet issued.

A complete guide for the radio store. Shows the code, key to symbols, diagrams and condensed description of radio communication.

Send your trade card or business letterhead when asking for catalogue.

----- **STRICTLY WHOLESALE** -----

# JOHN MILLEN & SON, LIMITED

**MONTREAL**  
321-323 St. James Street

**QUEBEC**  
96 Crown Street

**TORONTO**  
53-57 Adelaide St. West

*When writing to Advertisers please mention RADIO*



No. 3. Price \$4.75

**Amplifying Transformer No. 50**

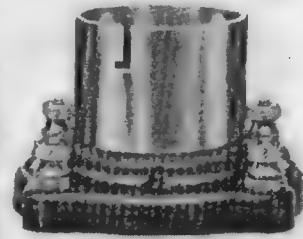
The Chelsea Amplifying Transformer gives the highest amplification possible and at the same time will not squeal, howl, or in any way cause noisy circuits. It is beautiful in design and embodies electrical characteristics unequalled by any. Guaranteed for all circuits up to 500 volts with a high safety factor.

It will not fail in service.

**CHELSEA VARIABLE CONDENSERS  
(Die-Cast Type)**

No. 1—.0011 m.f. mounted .....	\$5.00
No. 2—.0008 m.f. unmounted .....	4.50
No. 3—.0011 m.f. unmounted .....	4.75
No. 3—.0011 m.f. unmounted without dial .....	4.35
No. 4—.0006 m.f. unmounted .....	4.25
No. 4—.0006 m.f. unmounted without dial .....	3.85

Top, bottom and knob are genuine bakelite, shaft of steel running in bronze bearings, adjustable tension on movable plates, large bakelite dial reading in hundredths, high capacity, amply separated and accurately spaced plates. Unmounted types will fit any panel and are equipped with counterweight. Guaranteed for circuits up to 1,000 volts.



Price \$1.00

**Bakelite Socket No. 60**

This socket includes a bakelite base supporting four external readily accessible binding posts. The tube receptacle is highly polished nickel and will take any standard detector or amplifying tube as well as the smaller size power tubes. Although primarily intended for receiving circuits, it will operate satisfactory on any circuit up to 1,000 volts. It may be mounted either on table or panel.

Positive contact springs.

An added beauty to any radio station.



Price \$4.50

Purchase Chelsea Radio Equipment from your dealer. If he does not carry it, send to us. Write for our new No. 6 Catalog.

**CHELSEA RADIO CO., 150 Fifth Street, Chelsea, Mass.**  
Manufacturers of Radio Apparatus and Moulders of Bakelite and Condensite.

**Now that "Radio" is the Magic Word**

The Radio Station, Sixth Floor of the House Furnishings Building is the centre of the Store's attraction.

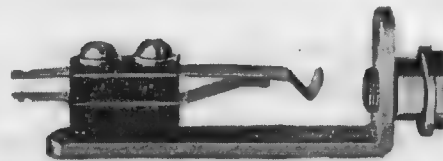
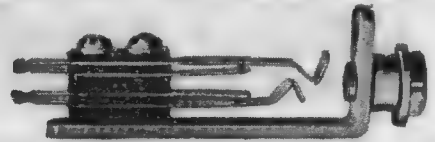
Call Signal "CJCD"—wave length 410 metres, continuous wave. This is something to know and note if you want to come in on Eaton Concerts by Wireless or to order Radio supplies. The Concerts are given daily 4 to 4.30 p.m., and Saturday at 12 o'clock to 12.30.

The Radio Station is in charge of a licensed operator who is at your service to supply you with any desired information, or to help you with any problems concerning wireless telephony or telegraphy.

Orders booked for Receiving sets. A full line of Crystal sets at various prices. Pay a visit to this department for your supplies.

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"If a man write a better book, preach a better sermon, or make a better mouse-trap than his neighbor, though he build his home in the woods, the world will make a beaten path to his door."



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Single Circuit, open .....	\$ .70
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99% sterling silver contacts-nickel-silver springs. Try them out against others and note particularly their resiliency and perfect contact. Designed by Fircos engineers realizing the need for the perfect jack. IMMEDIATE DELIVERIES.

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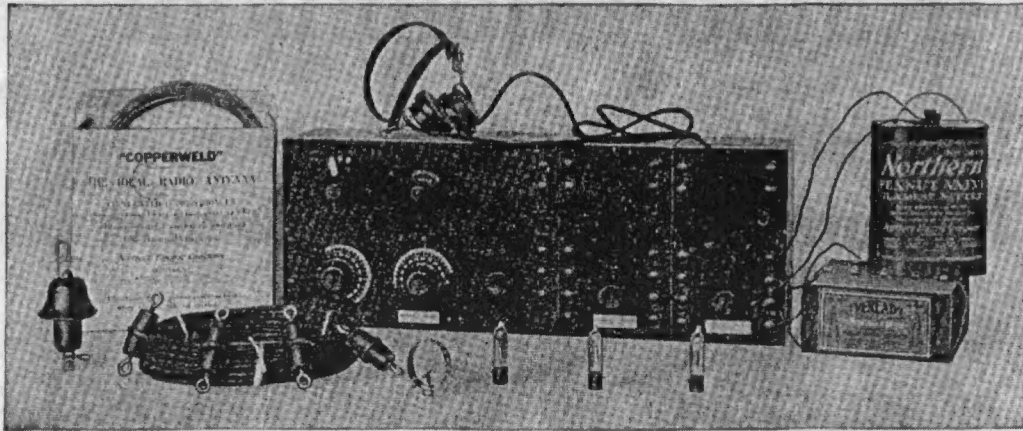
**JOHN FIRTH & CO., Inc.**  
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This set, which can be purchased complete or Unit by Unit, has the famous R 215-A "Peanut" Vacuum Tube, Copperweld Antenna Wire and many other new and desirable features.

Its wave length, from 200 to 600 metres, covers the full range of local or distant Canadian and American Broadcasting, Shipping, Stock and Weather Reports, Official Time, etc.

Full description and prices are in our Bulletin No. 1000. Ask your dealer for a copy. If he hasn't one, phone or write our nearest House.



### The R 1000 Radio Telephone Receiving Set consists of—

- 1 No. R1 Short Wave Tuner and Detector Unit.
- 2 No. R5 Amplifier Units.
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- 3 No. R215-A "Peanut" Valves.
- 1 No. R180 Northern Peanut Valve Filament Battery.
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# First National Exhibition OF Radio Equipment

AND  
Convention of Radio Enthusiasts,  
Manufacturers, Jobbers, Dealers,

To be held in Canada

SEPTEMBER 8-9, 1922

AT

PRINCE GEORGE HOTEL, TORONTO, ONT.

**TIME**—Held during the last two days of Canada's great National Trade Exhibition, gives you an opportunity to see the Radio Show at the same time you are visiting Toronto, and should be a convenience in arranging to be on hand.

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**ENTERTAINMENT**—The City of Toronto offers many places of entertainment, such as, Toronto Island, Scarborough Beach, and the fine new Water Front Amusement Park and Board Walk at Sunnyside, where every pleasure—boating, swimming, dancing and other new innovations can be enjoyed, also nearby the large natural picnic grounds, "High Park," not forgetting the Exhibition with its famous Midway.

**BANQUET**—Admission price, \$3.50, admits purchaser to all sessions of the Convention and Radio Exhibition, including Banquet on Saturday evening, Sept. 9th.

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**ACCOMMODATION**—Will be arranged by writing Mr. E. J. Bowers (3 C Z), 37 Lowther Ave., Toronto.

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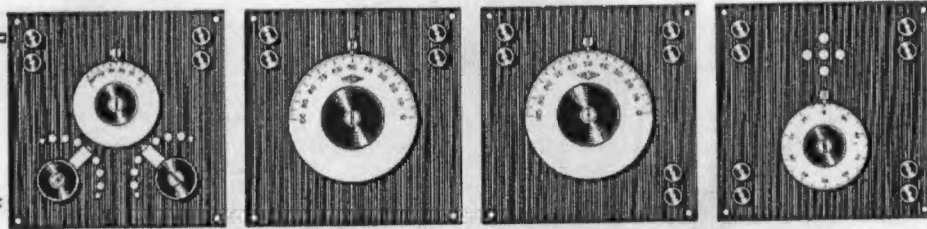
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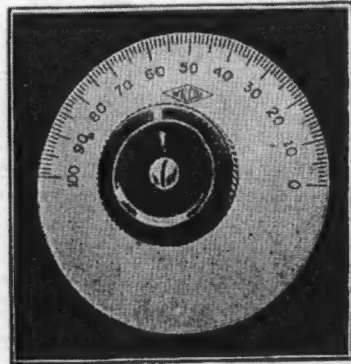
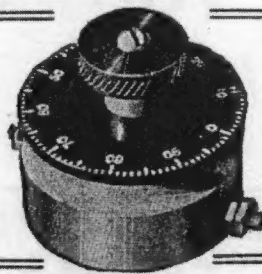
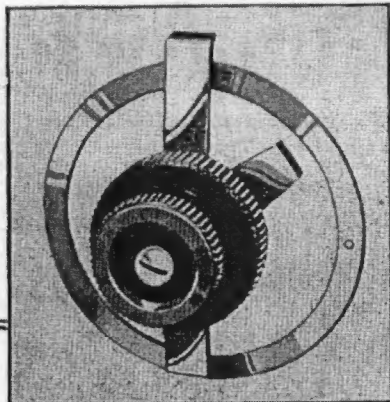
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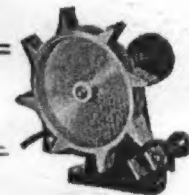
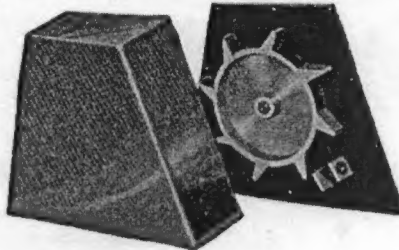
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form the cheapest, best and most versatile receiver. When coupled together the four instruments shown form a high grade, efficient short wave receiver complete with audion control for only thirty-one dollars. On the left is shown the variocoupler, with fine and coarse primary tuning switches and variable secondary coupling. Next is the grid variometer which controls the wave length from 175 to 450 meters, a range which may be increased if desired by a small fixed condenser. The third instrument is the plate variometer and last is the audion panel with grid condenser, leak, socket, rheostat, etc. The variocoupler and variometers are priced at \$8.00 each and the audion control at \$7.00, all postpaid.



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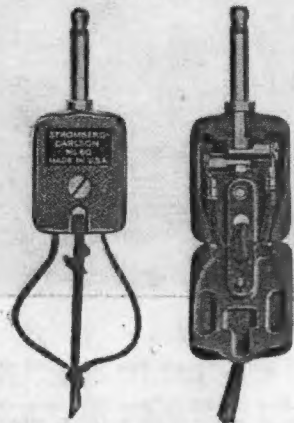
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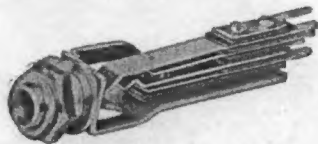




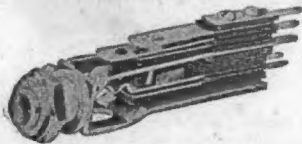
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## Stromberg-Carlson Radio Parts

There is the Stromberg-Carlson "Radio Head Set" with—its pleasing fit, its quick adjustment, its fine tonal qualities and its ability to faithfully reproduce even the faintest long distance signals.

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And there are the Stromberg-Carlson "Radio Jacks" which are adapted to all standard radio plugs and which are designed to mount neatly, without washers, on panels that are of varying thicknesses between  $\frac{1}{8}$  and  $\frac{1}{4}$  inches.

Stromberg-Carlson Radio Products are backed by a firm that has had twenty-eight years experience in the design and manufacture of radio and telephone apparatus.

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