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RADIO NEWS

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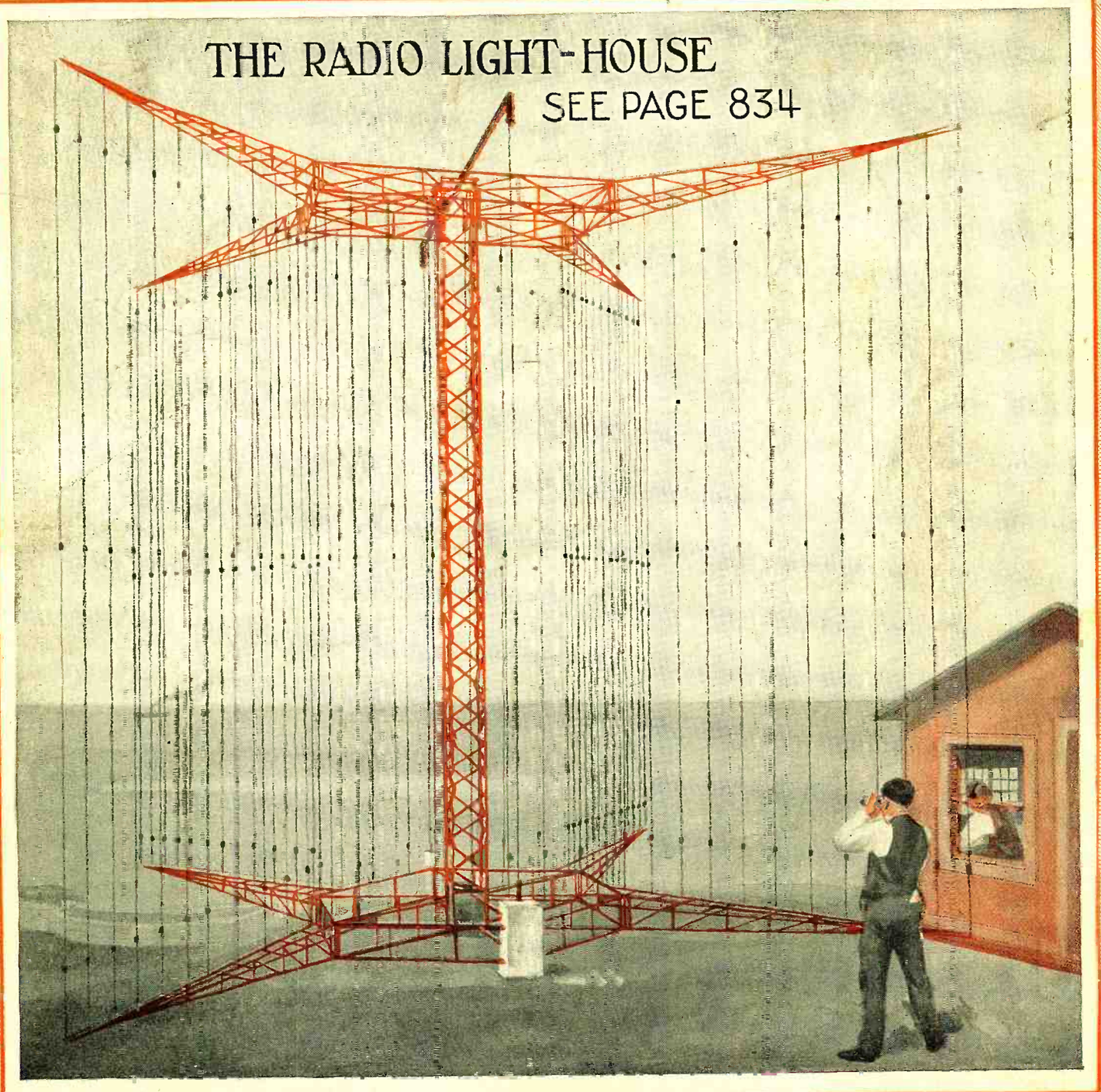
November

1922

Over 175 Illustrations

Edited by H. GERNSBACK



CIRCULATION LARGER THAN ANY OTHER RADIO MAGAZINE

VACUUM TUBES CUNNINGHAM

Built To Give Maximum Efficiency

VACUUM tubes are used for two distinct individual purposes in a receiving set—as DETECTORS and as AMPLIFIERS. The qualifications of a tube for these two uses are so different that for maximum efficiency tubes of entirely different design must be used.

This point was one of the chief considerations of the research engineers who designed Cunningham tubes in the great laboratories of the General Electric Company. After years of research and experimental work, the Cunningham C-300, a SUPER-SENSITIVE DETECTOR, and the Cunningham C-301, a DISTORTIONLESS AMPLIFIER, were developed. These two tubes, now nationally recognized as standards for all types of receiving sets, are responsible for the highly perfected results obtainable in radio phone reception.

Amplifies As It Detects

TYPE C-300
GAS CONTENT
DETECTOR
$5.00

TYPE C-301
HIGH VACUUM
AMPLIFIER
$6.50

The trade mark GE is the guarantee of these quality tubes. Each tube is built to most rigid specifications.

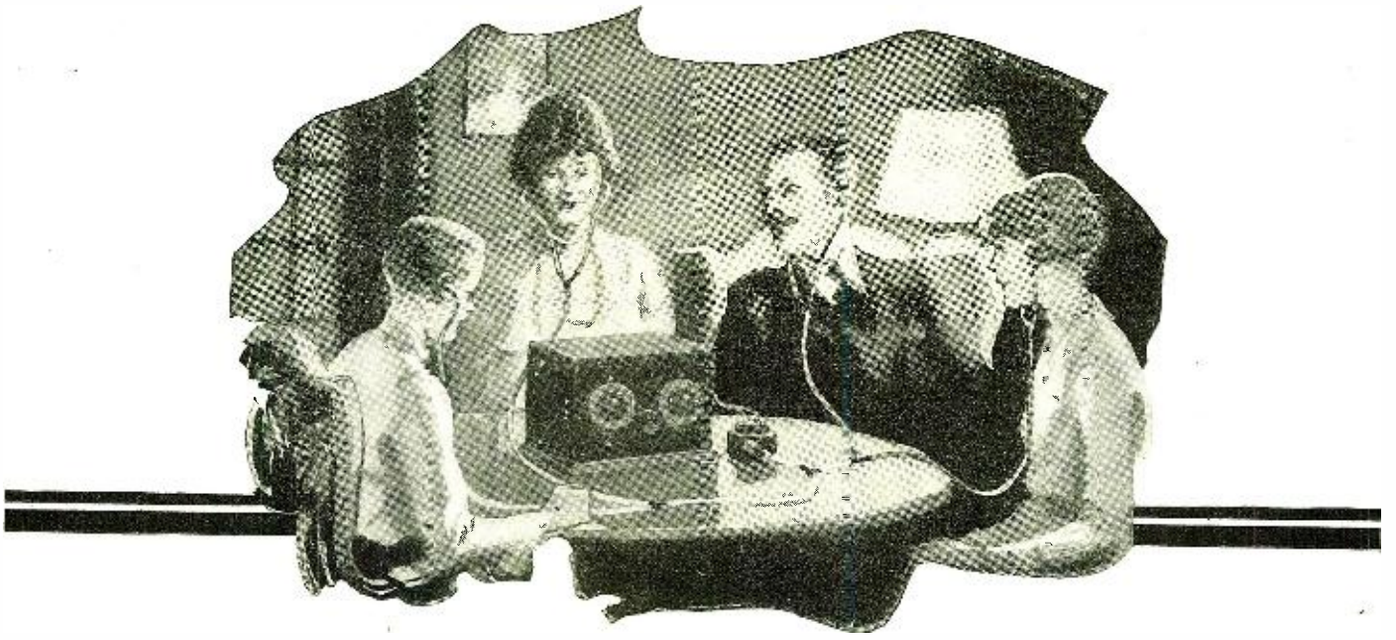
E. T. Cunningham

Trading as

AUDIOTRON MFG. COMPANY

248 First Street
San Francisco, Calif.

154 West Lake Street
Chicago, Illinois

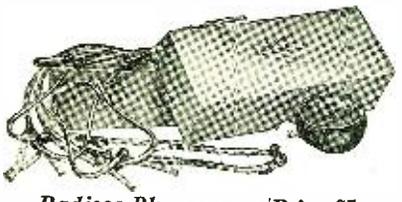


4 People for $5

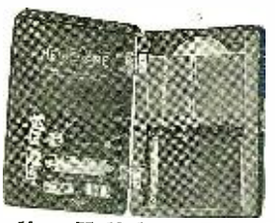
THAT'S what the Radisco Phonoscope means to your radio receiving set. Four people can listen in on a crystal or audion set where only one could before with ordinary head phones. Since head phones cost from $5 to $15 each the expense for phones to let the whole family listen in would be from $20 to $60 or more. The Radisco Phonoscope allows four people to listen in as easily and clearly at a cost of only $5.

Briefly, this is the way it works. A receptor is provided into which one receiver of your present head set can be automatically inserted. The signals received by your head set will then be transmitted through pure para rubber tubing to the four listening ends of the Phonoscope itself. These are very comfortable and easily adjustable to the tension you desire. Four people for $5 can hear each concert comfortably.

The Phonoscope is but one of the hundred products sold by the Radio Distributing Company and its agents throughout the country. If your dealer cannot supply you, send money direct with name of dealer. Money gladly refunded within 15 days if you are not perfectly delighted with the results you secure. 10c to cover mailing charges will bring you a copy of the new Radisco Radio Catalog. THE RADIO DISTRIBUTING COMPANY, Newark, N. J., U. S. A.



Radisco Phonoscope, Price $5



Radisco Heliphone, Price $5
(Pocket receiver)

Radisco Vario-coupler, Price $6.50

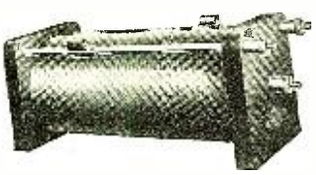
RADISCO
RADIO PRODUCTS

-and that's not all

OF course we are not seriously advocating that golf enthusiasts proceed to equip themselves with a radio set while playing, still they will find a radio set just as refreshing as the nineteenth hole, especially after supper on the veranda. If it's too cool to sit outside there is no better fun than listening in on the news and doings of the world over one of the many types of Radisco receiving sets.

These sets may be had in a range of prices suitable to the most lean and emaciated or plump and prosperous pocket-books. There is a set suitable for Tommy just turning seven and another for his dad who owns the only bank in town. Some Radisco receiving sets are of the simple crystal detector type and others range up to the long range high power set with two stages of amplification and loud speaker attachment so a whole roomful can hear.

In addition to complete sets the Radisco line comprises all kinds of radio parts and accessories. There is great fun in building your own set. Write us for full information and interesting radio catalog. THE RADIO DISTRIBUTING COMPANY, Newark, New Jersey, U. S. A.



Radisco Two Slide Tuner
Price $4.00

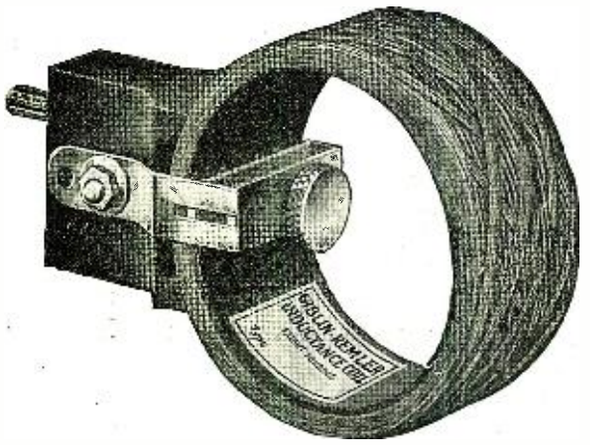
Radisco Lily Horn and Coupler
Scientifically designed fibre horn; no distortion, only 95c. Coupler connects all makes of phones to Victor, Columbia and other phonographs—also to Lily Horn. Price 60c.

Radisco Duplex Phonograph Adaptor
Price $2.50

RADISCO
RADIO PRODUCTS

REMLER Cunningham

Giblin-Remler Inductance Coils



Ideal For Reception On All Wave Lengths

It is well known among radio engineers that the most efficient receiving sets are those designed so that all of the turns of wire in their inductance coils are in constant use, regardless of the wave length being received. This factor limits the wave length range of the most efficient sets for Radiophone reception.

Maximum efficiency is obtained for any given range of wave lengths in either single circuit or coupled circuit receivers by using Giblin-Remler Coils, shunted by variable condensers. Any desired range of wave lengths is at the operator's disposal by merely changing the size of the coils used in the coil mounting.

This operation does not require the connecting of any wires and is as simple and quick as inserting a telephone plug in a jack. If variable condensers of .001 micro-farads capacity are used, four sets of Giblin-Remler Coils (of sizes determined from the table) will cover the entire range of wave lengths between 128 and 23,800 meters.

Maximum Inductance and Minimum Distributed Capacity

Type and Number of Turns, Mounted	Price, Mounted	Type and Number of Turns, Unmounted	Price, Unmounted	Inductance in Millihenrys at 1000 cycles. Accuracy ½%	Natural Wave Length in Meters. Accuracy ½%	Distributed Capacity, in micro-micro-farads, Accuracy 1%	Wave Length Range in Meters using Condenser of .001 max. and .00004 mfd. min.		High Frequency Resistance in Ohms at Wave Length shown			
							Min.	Max.	200	500	1000	2000
RG 20M	1.50	RG 20U	.70	.030	39	14.3	63	334		1.1		
RG 25M	1.50	RG 25U	.70	.041	47	15.2	75	389		1.5		
RG 35M	1.50	RG 35U	.70	.083	87	25.4	128	550		3.5		
RG 50M	1.60	RG 50U	.80	.169	114	21.6	185	785		8.8	4.4	
RG 75M	1.65	RG 75U	.85	.377	163	19.8	266	1170		28.3	12.1	6.2
RG 100M	1.70	RG 100U	.90	.666	217	19.9	358	1550		80.3	26.3	12.6
									1000	2000	5000	10000
RG 150M	1.75	RG 150U	.95	1.503	281	14.8	512	2320	69.8	23.8	7.1	
RG 200M	1.80	RG 200U	1.00	2.68	374	14.7	690	3110		50.6	12.5	
RG 250M	1.90	RG 250U	1.10	4.20	424	12.1	860	3880		87.5	19.9	
RG 300M	2.00	RG 300U	1.20	6.11	494	11.2	1030	4680		141	29.3	13.8
RG 400M	2.10	RG 400U	1.30	11.04	618	9.7	1380	6300			54.6	22.3
RG 500M	2.30	RG 500U	1.50	17.50	747	9.0	1730	7900			93.1	34.9
									2000	5000	10000	20000
RG 600M	2.40	RG 600U	1.60	29.2	1024	10.1	2260	10250		111	43.8	
RG 750M	2.65	RG 750U	1.85	39.0	1249	11.3	2660	11850			64	
RG1000M	3.40	RG1000U	2.50	71.6	1620	10.3	3570	16000			123	
RG1250M	3.80	RG1250U	2.90	108.0	1930	9.7	4380	19700				
RG1500M	4.40	RG1500U	3.50	159.8	2300	9.3	5300	23800				

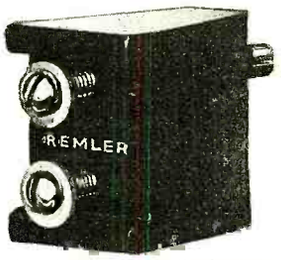
This table compiled by Robert F. Field of Cruft High Tension Electrical Laboratory, Harvard University, Cambridge, Mass.

Send 10c for new 40 page Remler Catalogue just off the press containing circuit diagrams for Remler Apparatus and other useful information including a table of inductance, capacity and wave length.

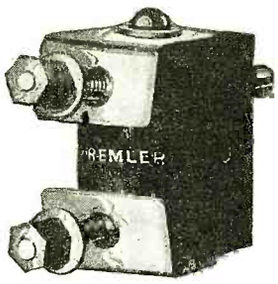
REMLER RADIO MANUFACTURING COMPANY

248 First Street, San Francisco, Cal. **154 W. Lake Street, Chicago, Ill.**

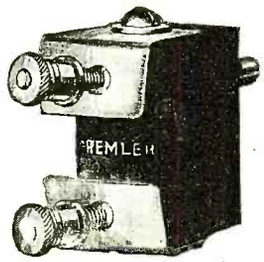
REMLER Cunningham



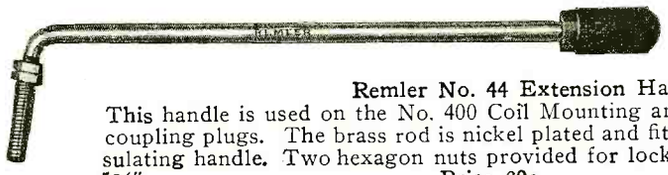
Remler No. 42 Bakelite
Panel Plug
Price 60c



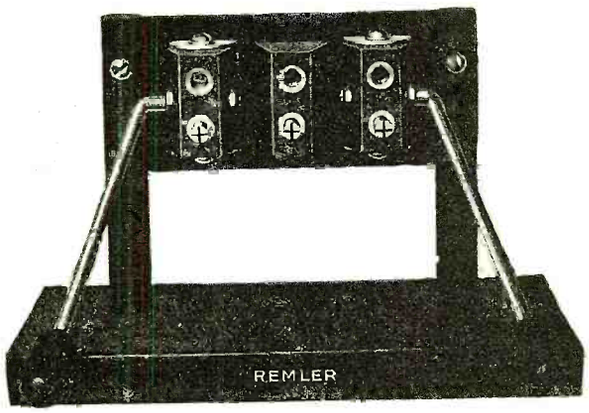
Remler No. 43 Bakelite
Coupling Plug
Price 90c



Remler No. 46 Bakelite
Coupling Plug
Price $1.00



Remler No. 44 Extension Handle
This handle is used on the No. 400 Coil Mounting and fits No. 43 and 46 coupling plugs. The brass rod is nickel plated and fitted with moulded insulating handle. Two hexagon nuts provided for locking on plug. Length 5¼".
Price 30c



Remler No. 400 3 Coil Mounting
The Remler No. 400 3 Coil Mounting is specially designed for the Giblin-Remler Inductance Coils, but is equipped with standard coil plugs and permits the use of any standard inductance coil. Bakelite Panel and Base. Price $7.50.

Specify Remler— It Radiates Quality

The Remler All BAKELITE 3 coil mounting is undoubtedly the most efficient coil mounting on the market. The special shape of the Plugs allows a coupling range from zero to 90 degrees. The use of the long, insulated handles for adjusting coupling keeps the operator's hands away from the coils and minimizes body capacity effects.

For those who desire to build their own sets Remler high quality BAKELITE panel and coupling plugs and Extension Handles are sold unmounted as listed above.

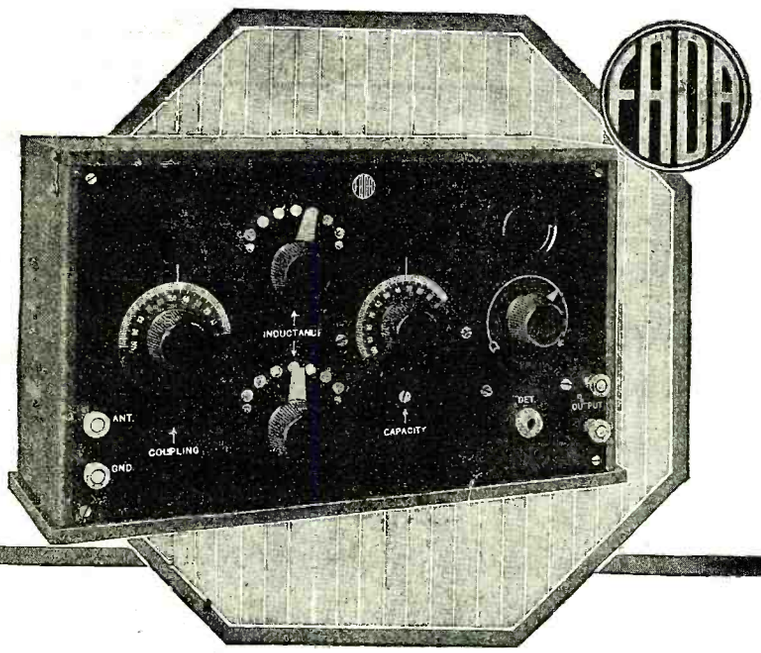
Send 10c for new 40-page Remler Catalogue just off press, containing circuit diagrams for Remler Apparatus and other useful information, including a table of inductance, capacity and wave length.

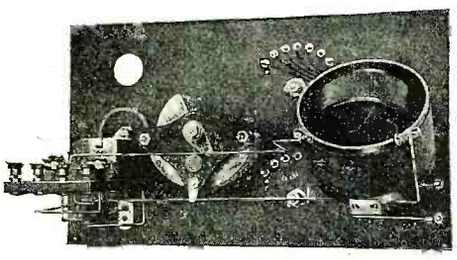
REMLER RADIO MFG. COMPANY

248 First Street, San Francisco, Cal. **154 W. Lake Street, Chicago, Ill.**

This Fada receiver meets the demand for dependable radio sets within the price range of everyone. Fada prices make it possible for "a radio receiver in every home"

$35.00





Interior of Fada Receiver

A Fascinating Recreation—Build Your Own Radio Set

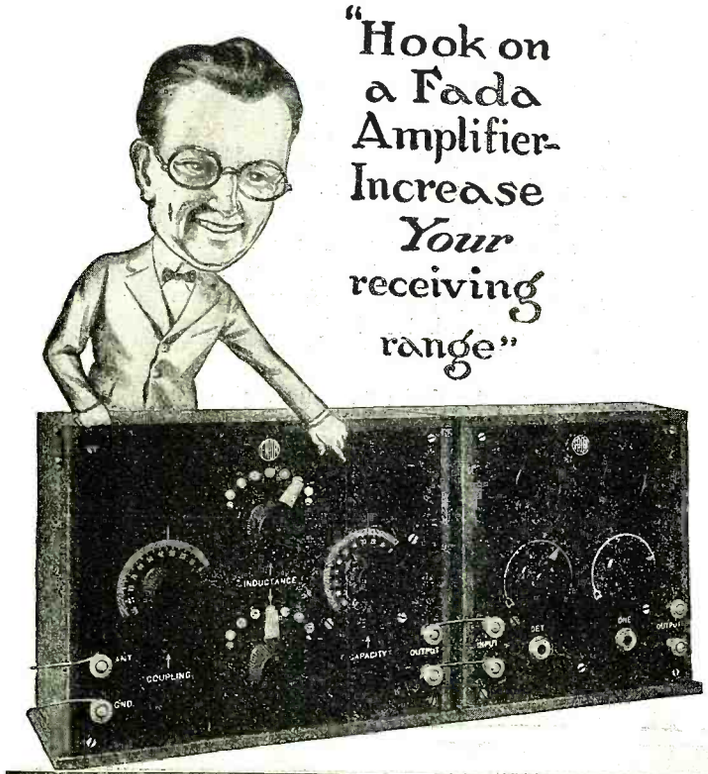
THAT inherent instinct, within us all, to experiment, create and construct, influences many to build their own radio sets.

Fada equipment is so designed to give you the greatest possible reward for your creative efforts. All instruments and parts are definitely simple in construction and unusually easy to assemble into neat, dependable radio sets. Anyone, with the aid of the Fada handbook, can assemble Fada parts with greatest ease and assurance.

Fada detectors, mounted in cabinets with both one and two stage amplifiers, hook up with any set, and increase your receiving range. The addition of Fada amplifiers in no way necessitates any change in your original construction.

Fada rheostats, variable condensers, switches, variocouplers, dials, etc., can be used with other equipment to make even a better radio set. Fada parts, if used exclusively in your assembly work, will give you a finished instrument of good appearance and highly satisfactory.

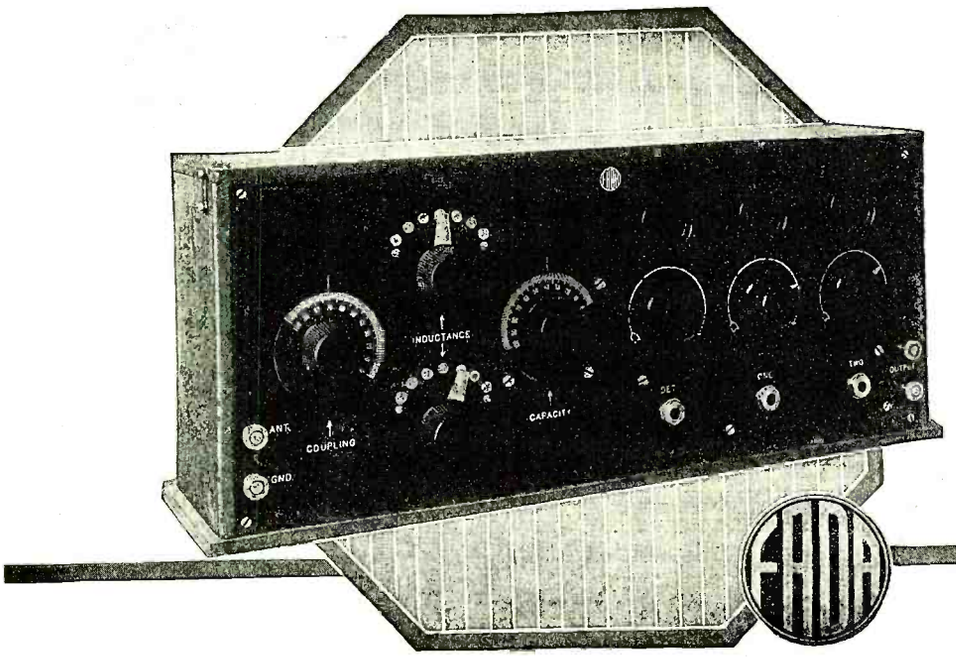
After you once use Fada equipment, you will take great pride in having Fada imprinted on every radio part you use.



Frank A. D. Andrea

1581-B JEROME AVE. NEW YORK CITY

Now $2.00 **Now $ .75** **$4.00**



The Fada receiver, detector and two-stage amplifier represents the highest type of cabinet construction. A fitting instrument for the finest home and instantly responsive to various receiving ranges

$80.00

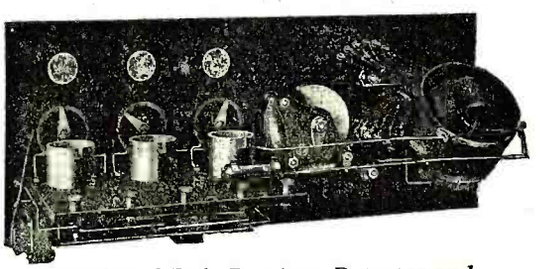
An Ideal Home Entertainer

THE Fada receiver, a result of the same perfection in design and construction that distinguishes all Fada products, is gaining popularity as an ideal home entertainer.

When it's radio time in your home, you can sit back in your favorite chair, among the family circle and command at your fingers' touch, the talent of such noted artists as May Peterson, Percy Grainger, Mme. Margaret Namara, or Lydia Lipkowska—Russian coloratura soprano of the Imperial Opera of Petrograd.

You marvel that their voices can come into your home with such depth of emotion and true personality. Music is an inspiration to everyone, it goes to the very soul of things and brings joy and happiness to all.

With a Fada radio receiver, music can be made part of your daily recreation. And after the musical program there is broadcasted a digest of important world events. You can, with a Fada receiver, literally keep a jump ahead of the headlines in tomorrow's newspapers.



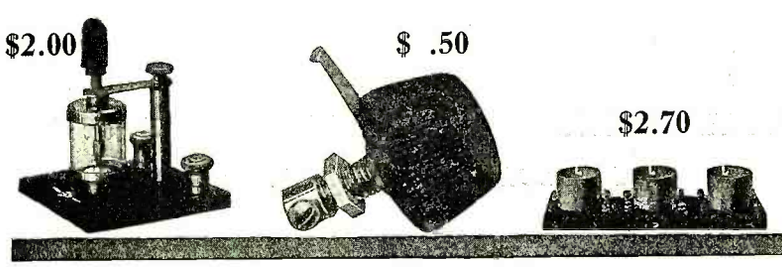
Interior of Fada Receiver, Detector and Two-stage Amplifier

"Let me send you this Fada Handbook."

The new Fada handbook will be sent to you upon receipt of 5c to cover postage. It's a How-To-Do-It book and you should have it.

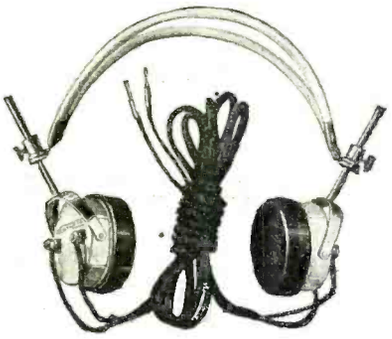
Frank A. D. Andrea

1581-B JEROME AVE. NEW YORK CITY



WORKRITE RADIO

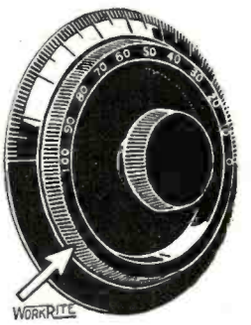
Here is the WorkRite Concert Headphone



There are phones and phones on the market—good, bad and indifferent. How reliable is the company back of them? The WorkRite Concert Phones are designed by one of the oldest telephone engineers in the country. They have been tested and improved until now they are up to "WorkRite" standards of excellence.

Our new sanitary head band is made from strong celluloid which is light and easily cleaned. No rough edges to catch the hair. Aluminum phone cases. All parts light but sturdy. All manufacturers make big claims for their phones. All we ask is: TRY WORKRITE PHONES SIDE BY SIDE WITH ANY ON THE MARKET, even those selling at twice our price. You will find WorkRite Concert Phones extremely sensitive and free from distortion. Just try them and see.
WorkRite Concert Phones (2500 Ohms) Price..... **$8.50**

WorkRite E-Z-Tune Dial



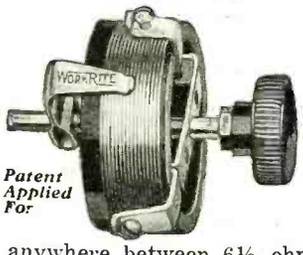
When you are tuning in an out-of-town concert and you want to turn the dial of your variometer or variocoupler the smallest fraction of an inch, where do you grasp the dial? On the rim. That is where the new WorkRite E-Z-Tune Dial has a grip that fits the hand. You can make a turn of a hair's breadth with the WorkRite E-Z-TUNE DIAL.

Made of the finest material, highly polished, and with figures that stand out from the surface, the WorkRite E-Z-Tune Dial at the price listed is extremely cheap. 3½" Diameter. Specify whether 3/16" or ¼" shaft.
Price..... **75c**

BEFORE BUILDING A SET WRITE FOR OUR *FREE* CATALOG

WorkRite Super Vernier Rheostat

The Rheostat with 50,000 Adjustments



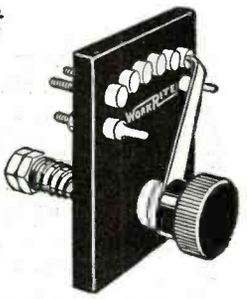
Patent Applied For

Here is a REAL Rheostat—something entirely new and very much needed. Indispensable on the detector tube when working long distance concerts or code. Indistinct and mushy music can be brought out clear and loud by tuning with this Rheostat. Pushing the knob way in turns off bulb. Quick adjustment anywhere between 6½ ohms and zero, or by turning the knob you can get 50,000 different adjustments. All metal fittings made from brass and nickeled. Our special resistance wire is non-corrosive, and does not change in resistance through change in temperature. **Positively Never Gets Hot.** Screws for mounting on panel furnished.

The WorkRite Super Vernier Rheostat is really remarkable in its performance and will double the audibility of distant concerts. Price..... **$1.50**

WorkRite Switch Set

Just what you want! Remove parts and use the block for a template in drilling panel. The Switch Arm and Points made to work together. Be sure to use a WorkRite Switch Set with your WorkRite Variocoupler.
Price, complete... **80c**



Type "A" WorkRite Hydrometer

Every auto owner has his storage battery looked after once or twice a month at least to see that it is in good condition and has not run down. It is just as important to take good care of your "A" Battery. Test it at least twice a month. Never let it get below 1150. The WorkRite Hydrometer is just the instrument that you need to test your battery. Get one right away.
Price **$1.00**

WORKRITE

THE WORKRITE MFG. CO.

5530 EUCLID AVENUE CLEVELAND, OHIO, U. S. A.

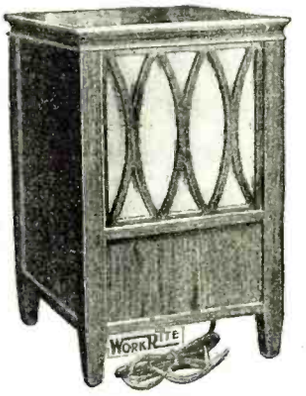
(Branch Office, 2204 South Michigan Avenue, Chicago)

PARTS WORKRITE

WorkRite Concertolas SR. and JR. *"They Speak for Themselves"*

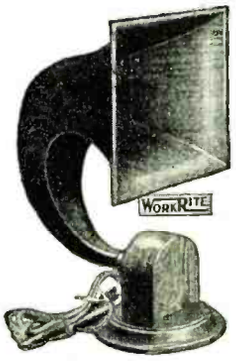
Here are two Loud Speakers perfected until they are worthy of the name "WorkRite." Hundreds of thousands of radio fans who have used WorkRite Radio Products know that "WorkRite" means perfection.

Except for the phone units, THERE IS NOT THE SLIGHTEST METAL in either the WorkRite Concertolas Junior or Senior. The sound chambers of the Concertolas are made from our specially developed material, which reproduces voice or music in a clear, loud tone without the slightest distortion. Just right for the home. Why listen to music through a "tin-panny" metal horn that loses all the beautiful tones of the artists, when you can get a WorkRite Concertola that will give you perfect reproduction of concerts?



WorkRite Concertola SR.

Made from the finest grade mahogany with handsome rubbed finish.



WorkRite Concertola JR.

A graceful, beautifully constructed instrument harmonizing with your house furnishings

IMPORTANT! The best sound amplifier will not get results with the ordinary head phone. Our engineering department has developed the WorkRite phone unit for just one purpose—to be built in our Concertolas, making a combination that is unequaled. This special 5000 ohm phone unit is not sold separate from the Concertolas.

The WorkRite Concertola Senior is built from numerous plies of the finest mahogany, oil rubbed and finished exactly like your piano. It is 10″ square by 15″ high. Place it on your library table and run wires to your set in any other part of the house.

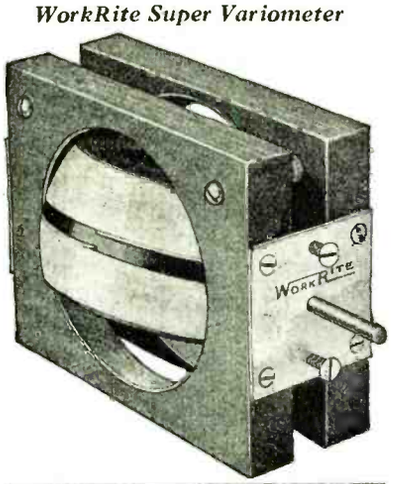
Test the WorkRite Concertolas side by side with ANY other loud speaker on the market—then you will see the superiority of "WorkRite."

Each instrument furnished complete with Cord and Phone Unit.

WorkRite Concertola JR. **$12.00** *WorkRite Concertola SR.* **$24.00**

BUILD YOUR RADIO RECEIVING SET WITH WORKRITE PARTS

WorkRite Super Variometer



JOBBERS AND DEALERS: Wire or write for discounts.

The WorkRite Variometer

The WorkRite Variometer is made from the finest mahogany and positively guaranteed not to warp or shrink. Finished like a piano. Both connections made by DOUBLE springs. Has 3/16″ shaft. Easy to mount on panel. Substantially built throughout. Just the right number of wire turns and air space to make it very sensitive and to tune extremely sharp. Two WorkRite Variometers and one WorkRite Variocoupler are unequaled for a tuning set. There are no better.

WorkRite Super Variometer..... **$5.25**

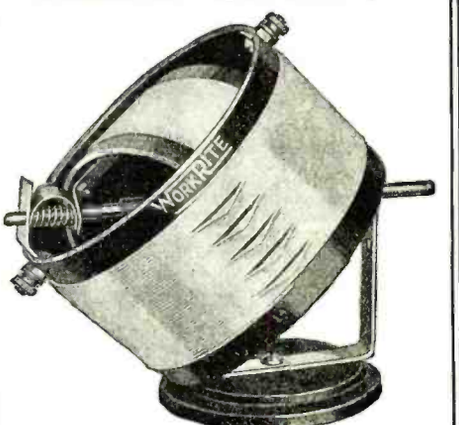
With WorkRite Dial.....$6.00

The WorkRite Variocoupler

The WorkRite Variocoupler represents perfection in getting dimensions and number of turns JUST RIGHT. Tunes twice as sharp as the ordinary 90 degree coupler.

Both primary and secondary are made from Formica. Contacts formed by DOUBLE springs, eliminating noise. Shaft 3/16″. Easy to mount on panel.

WorkRite 180° Super Variocoupler



WorkRite Super Variocoupler.... **$5.00**

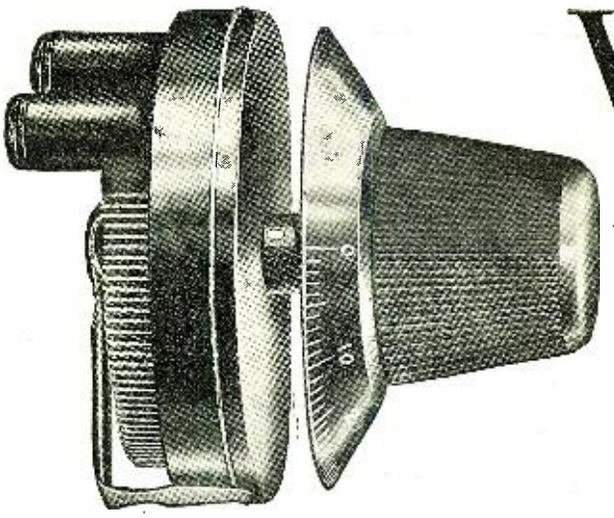
With WorkRite Dial.....$5.75

THE WORKRITE MFG. CO.

5530 EUCLID AVENUE CLEVELAND, OHIO, U. S. A.

(Branch Office, 2204 South Michigan Avenue, Chicago)

WORKRITE



Model 200

WHY Every Detector Tube Should Have a Rheostat with a VERNIER

MANY radio fans do not realize that one of the chief causes of weak reception of signals or music is their LACK of CONTROL of their detector tubes.

You can re-design and re-build your set as much as you please, but until you get BETTER CONTROL of your filament current you will never get the full joy of hearing code or concerts coming loud and clear.

When you are reaching for that small, faint voice way off somewhere, and the slightest touch of your rheostat is too much—it is then you feel the need of a rheostat with a micrometer adjustment.

The Klosner is the rheostat with a micrometer adjustment. It is the original VERNIER rheostat. Due to its patented design, both coarse and fine adjustments are operated by one knob. This design has called forth great praise from eminent radio engineers. Largest selling rheostat on the market.

Wire-wound like all other true electrical instruments. Equipped with DIAL to tell you where you are at. Made of moulded condensite, white letters on black, phosphor bronze contacts. Absolutely high-class in every respect

The Klosner shown above is Model 200.

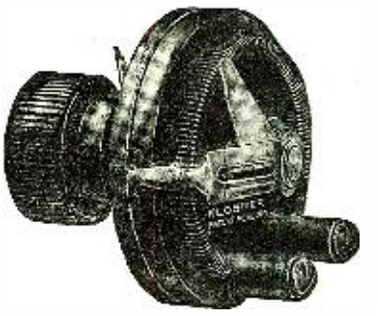
Retail price, **$1.80.**

Dealers

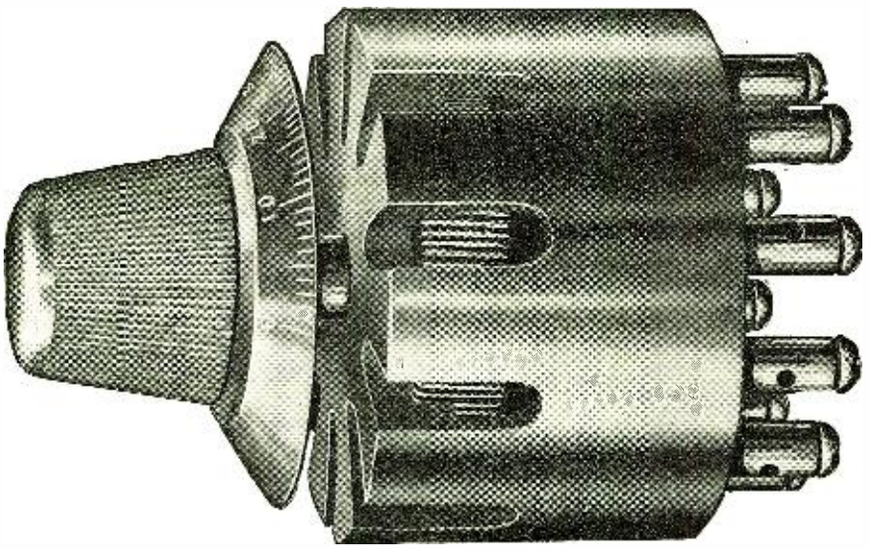
No other instruments on the market can compare with the Klosner in neatness of design or quality of material and workmanship. Show your customer a Klosner and any other kind—he selects the Klosner regardless of any difference in price. Order through your jobber.

Original Klosner Model 100

This is the original model, thousands of which are in use. Has a pointer instead of a dial. Miles ahead of all others (except Model 200). Greatly improved but still selling at retail for $1.50.



KLOSNER



How to Lengthen the Life of Your Tubes 1/3

—and eliminate plugs, jacks and rotary cam switches

THE AMPLITROL

The Amplitrol is the latest, most convenient method of controlling your amplifying tubes. Not only does it do away with all plugs and jacks and rotary-cam switches, but it also prevents burning out your tubes. With the Amplitrol, it is impossible suddenly to throw a heavy current on the delicate filament. You turn current into your tubes GRADUALLY. This makes them give at least a third longer service.

There should be an Amplitrol for each amplifying tube. Merely turning the single knob not only brings the filament current to the exact strength for maximum clearness but it also switches on the plate circuit in the proper manner. You turn on any stage of amplification at will—just one knob to turn. No plugs, no switches, no bother. Your phones or loud speaker remain permanently attached to the binding-posts.

The Amplitrol is more convenient, gives better control and means at least ⅓ longer tube life. The one method of amplifying tube control without a drawback.

All dealers have Amplitrols or can get them for you. Retail price $4.00 which is less than the cost of the plugs and jacks and switches they eliminate.

KLOSNER IMPROVED APPARATUS CO.
Originators and Sole Manufacturers
2024 BOSTON ROAD, NEW YORK CITY

READ WHAT THESE USERS SAY

"Received your new rheostat a couple of days ago and put it into use. After two days' receiving I am convinced that you have the best rheostat on the market. It makes tube adjustment easier and very much better."

Just received the two vernier rheostats, and I think they are a valuable asset to any control panel. Please send me two more, C. O. D.

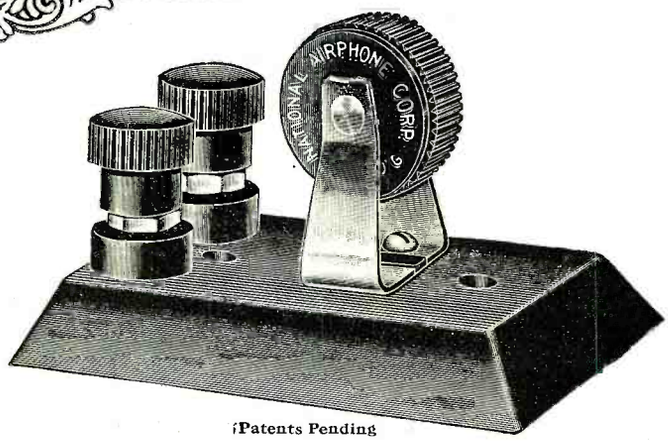
Have received the rheostat and find it a fine piece of apparatus. Please send by parcel post, insured, seven additional rheostats.

From a Jobber:
When we showed your rheostats to the trade here, they simply loaded us up with orders, absorbing the first shipments as rapidly as they arrived.

From a Dealer:
Send us at least 300 or 400 rheostats as we haven't got one in stock.

KLOSNER

NATIONAL



†Patents Pending

After you have fussed with catwhiskers, springs, balls and adjusting handles, and after you have almost become a nervous wreck, hunting for "the elusive sensitive spot"--you will welcome with open arms our 100%

GOLD GRAIN DETECTOR $2.50

GOOD NEWS FOR EVERY CRYSTAL SET USER!

Something New—A Revolutionary New Development!

The National Airphone Gold Grain Detector!

By its use you accomplish more than with any of the common detectors.

It is a radical departure from all other practise!

The difference and improvement are surprising.

No catwhisker, no springs, no balls, no adjusting handle, no fussing, no nerve-wracking experiences in trying to find the ever elusive sensitive spot—nothing but satisfaction!

When you try this wonderful detector you will understand one of the reasons why the National Airphone has been awarded the Certificate of Merit by the Testing Laboratories of the Radio News, New York Tribune and New York Evening Mail.

Users of crystal sets have become so disgusted with the constant fussing and tinkering and nursing of the old-style detectors they have urged us to sell our detector separately.

So to meet the demand we offer the National Airphone Gold Grain Detector, suitable for use with any crystal set.

Now you can throw away your old detector and attach ours, and bid good-bye to detector troubles!

The National Airphone Gold Grain Detector Beats All Others!

Ours is the most sensitive and the most practical detector in existence.

We cannot make this too emphatic.

Make us prove our words!

We know the general hesitancy to accept such a broad claim. So to back up our word we guarantee our detector to be satisfactory. If within 5 days you do not find it so, we will refund your money. We give you a year to test it. If through any fault of ours it becomes defective, return it whole, just as delivered. We will send you another with the same guarantee.

We know what we are talking about and we are giving you a chance—right now—to get a more satisfactory detector than any other on the market. Get one now and never again have any of the 57 varieties of detector troubles! Begin at once to really enjoy the use of your set!

This is Why Ours Must be Better!

Contact with the crystal of the National Airphone Gold Grain Detector is made with hundreds of loose grains of pure gold!

These grains are so placed that no matter in what position the detector may be, many grains must touch the crystal! There is always a multiplicity of contacts. The contact is constant. Not now and then, maybe and maybe not, but always.

The gold and the crystal are sealed hermetically. There can enter no air, no dust, no moisture. The gold cannot rust. It cannot oxidize. It is always clean. The contact with the crystal is always sharp. Get a National Airphone Gold Grain Detector and banish forever the detector annoyances that so often have tried your patience.

You are protected by this Guarantee:

Should any National Airphone Gold Grain Detector not be in first class condition when purchased and within five days you return it to us unbroken, or unopened, we will refund your money or give you another as you may prefer. Or if at any time within a year one should become defective or unsatisfactory to you we will take it back if unbroken or unopened and give you another in its place.

The contact cannot be weakened or broken by jarring or rough handling. The more jarring the better. Our rugged, novel detector is not delicate like the ordinary catwhisker kind. A single catwhisker is easily disturbed electrically and mechanically by static and too strong signals.

Such disturbances unless very powerful do not affect the National Airphone Gold Grain Detector. When they do they help by allowing more current to pass through. This produces better reception. You would not be bothered with the old kind of detector after one minute's use of ours.

As apparent, ours is not of the fixed or permanent variety. No detector can be permanent. Strong static charges will injure and destroy the sensitiveness of any fixed contact point. Then it is worthless. We accomplish what is claimed for the fixed type.

If static disturbs some of the sensitive points in our detector, tap lightly with your finger the revolving cartridge containing the grains and crystal and instantly you have a new, sensitive, perfect contact. You can repeat this procedure for years with the same detector.

Our detector "stays put." No fussy adjustments. You can let it remain unused for days at a time and then put your receivers to your ears and receive at once—nothing to do but perhaps tap the cartridge once, taking a second of time. This of course is impossible with any other crystal detector.

There is no better crystal than the kind we use. Specially selected for its high sensitivity and carefully tested.

You can snap the cartridge in or out in a second. Its temporary removal to prevent tampering with the instrument is sometimes a convenience.

No test buzzer is needed. Our detector is "always on the job," ready when you want it.

The construction is durable. Nothing but hard rubber composition is used for the base, cartridge and binding posts. The brackets are of heavily nickeled and polished hard spring brass. Two holes in the base for screwing to panel or table.

The Illustration is Full Size

The construction is permanent. The detector is delivered to you ready for use. Nothing to adjust, nothing to do when you get it but to snap it in and receive. The cartridge is sealed and cannot be opened without destroying it.

Price in the United States $2.50

TO DISTRIBUTORS: **Write for exclusive territory.**
TO DEALERS: **Write for discounts.**
TO YOU: **Order now from this ad. and see for yourself if our claims are not true.**

An Easy Way to Purchase--Use Coupon if You Wish

NATIONAL AIRPHONE CORPORATION,
18 HUDSON ST., NEW YORK.

Dear Sirs:

Please send prepaid to me one National Airphone Gold Grain Detector as advertised, for which I enclose $2.50 by ....Money Order....Registered Mail....Check. If within five days I do not find the detector all you claim for it or if for any reason I am not satisfied, I may return it to you unbroken or unopened and you agree to refund the full purchase price. Or if at any time within one year it should become unsatisfactory I may return it to you and you agree to send me another under the same guarantee.

NAME .....

STREET AND NUMBER.....

POST OFFICE AND STATE.....

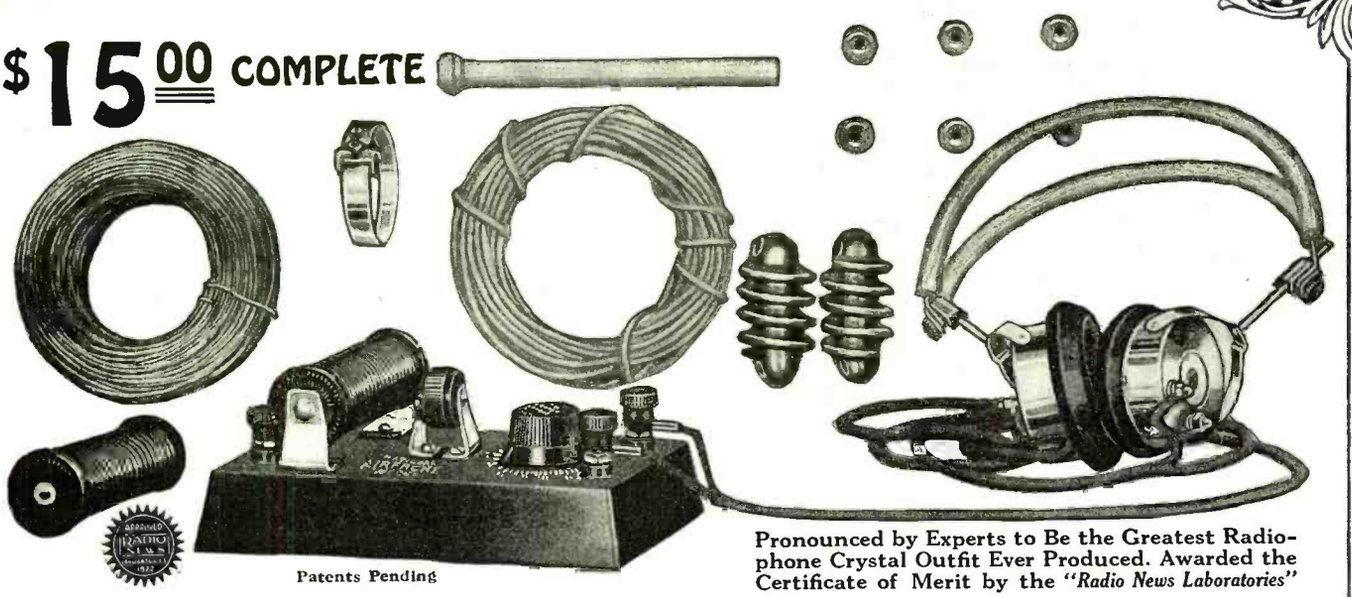
NATIONAL AIRPHONE CORPORATION

TRADE MARK REG. U.S. PAT. OFF.

18 HUDSON ST. NEW YORK

AIRPHONE

$15.00 COMPLETE



Patents Pending

Pronounced by Experts to Be the Greatest Radiophone Crystal Outfit Ever Produced. Awarded the Certificate of Merit by the *"Radio News Laboratories"*

Highest Grade Crystal Receiving Set

No Distortion. Perfect Reproduction of All Sounds With Extraordinary Clarity

SPECIAL

Many of our friends have asked us to furnish them with a complete Airphone outfit. The above special outfit has been made up by us for the holiday trade, and forms a wonderful Christmas gift, a gift that will be remembered and appreciated by every one.

The Airphone Radio Receiver comprises the following: 1 National Airphone, Model G, $12.50; 1 complete Aerial Outfit, consisting of: 150 feet first grade Aerial Wire, 1 Ground Clamp, 2 Special Antenna Insulators, 1 Porcelain Tube for Lead-in, valued at $2.50; 1 RICO Tripole Double Head Set, 2,000 ohms, $6.50; making a total of $21.50.

1 National Airphone, Model G	$12.50
1 Complete Aerial Outfit	2.50
1 RICO Tripole Double Head Set	6.50
Total Amount	$21.50

OUR PRICE $15.00

This is a wonderful offer; we advise immediate action, as all orders must be filled in rotation.

Outfit comes packed complete in a strong corrugated cardboard box, with individual boxing for the Airphone, for the Aerial Outfit and for the RICO Receivers. This outfit is complete in every respect, and you get it ready to set up and operate. Nothing else is needed.

If you have not read our former advertisements explaining the National Airphone, Model G, the following will give you detailed description:

It is a perfect crystal radiophone of compact and rugged construction, guaranteed to receive broadcast entertainment within a radius of 25 miles, and code signals 1,000 miles and over, depending on location and cartridge tuning coils used. The NATIONAL AIRPHONE is the highest attainment in crystal radio receiving sets and is the culmination of years of work by some of our greatest radio experts and engineers.

It is built along radically different principles and embodies in its superior construction all those features which inventors and manufacturers have been striving to achieve for years. By reason of its superior scientific construction there are no electrical losses whatsoever; not a piece of wood is used—only hard rubber composition. In the NATIONAL AIRPHONE every detail has been worked out carefully and logically. If you have ever experienced trouble with other crystal receivers and you know what an annoyance it is to fuss around with catwhiskers, crystals, sliders, springs and other fussy adjustments, the NATIONAL AIRPHONE will prove a revelation. You will know what pleasure it is to own "The little wonder AIRPHONE."

Super-Sensitive Detector

Our super-sensitive Gold-Grain detector is a revelation. It is positively more sensitive than any other crystal detector, and brings in the sounds incomparably stronger, clearer and louder than the ordinary catwhisker type. It is self-cleansing, remains sensitive practically all the time, EVEN DURING THE USUAL STATIC. See opposite page.

Tuning Condenser and Tuning Coils

By means of the tuning condenser interference can be eliminated successfully by merely turning the knob. If you wish to receive a station of longer wave-length, snap into place the interchangeable cartridge tuning coil, for which purpose two coils are furnished with each outfit. It will be noted that the variable condenser is of a special design, with mica dielectric, making it one of the best radio condensers known.

Construction

By reason of the highly-developed scientific construction of the outfit there are no electrical losses whatsoever, not a piece of wood being used, only hard rubber composition. All screws are secured with lock washers, impossible to become loose, and all necessary connections are soldered. The cartridge tuning coils are wound with enameled wire and calibrated for the right wave-lengths. Every part utilized in the manufacture of the NATIONAL AIRPHONE is rigidly tested and examined, and each AIRPHONE is separately tested under actual broadcasting conditions before shipment.

So Simple to Operate

To operate the NATIONAL AIRPHONE, just connect the aerial and ground wires to the proper binding posts and attach the head phones. Then, if you wish to listen to a broadcasting concert, snap into place the cartridge tuning coil marked "150 to 450 meters." turn the large knob of the tuning condenser while tapping the detector wheel slightly. If broadcasting is going on, stop the pointer of the condenser knob at the point where the sounds come in loudest and clearest. Leave the adjustment at that point and then ENJOY YOURSELF.

TESTIMONIALS

Gentlemen:

I have been using one of your Model "G" Airphones for about three (3) months and can truthfully say it is the best crystal set I have ever heard over. The fact that it is small and compact, easily tuned and has such a good detector, makes the National Airphone the best crystal set on the market at a reasonable price.

969 North 7th Street, Memphis, Tenn., Sept. 4th, 1922.

Yours truly,
JNO. E. CAMMER.

Rocky Mountain Radio Corporation, Denver, Colorado: "Our organization tickled to death with AIRPHONE. What proposition are you willing to offer on distribution of AIRPHONE, Rocky Mountain Region?"

If Your Dealer Cannot Supply the National Airphone Outfit, Mail This Coupon Today!

NATIONAL AIRPHONE CORP.,
18 Hudson Street, New York City.

Gentlemen:

Please send me, prepaid, one (1) guaranteed NATIONAL AIRPHONE OUTFIT, as advertised, for which I inclose { money order / check } for $15.00. If at the end of five (5) days I should not find the outfit to be all that you claim for it, I will return it promptly and you will refund me the full purchase price.

NAME.....

Street Address.....

City and State.....

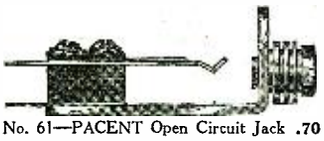
Good Radio Results Depend Entirely on the Plugs and Jacks in Your Equipment. They Are the "TRANSMISSION GEAR" of Radio

The PACENT Universal Plug

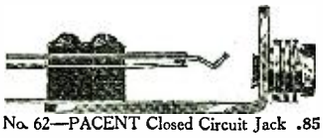
is the *original* radio plug. Unless it is PACENT, *it is not* Universal. It is the *only* plug providing a biting contact, essential where high amplification is used. Handles are of THERMOPLEX — (a heat-resisting, non-shellac compound). No tools necessary to make connections. Perfect Insulation. All parts precise and neatly finished.

Cat. No. 50 Price Now $1.00

A Perfect Radio Jack for Every Circuit

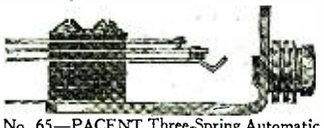


No. 61—PACENT Open Circuit Jack .70



No. 62—PACENT Closed Circuit Jack .85

No. 63—PACENT Double Circuit Jack $1.00



No. 65—PACENT Three-Spring Automatic Jack - - - - - - - - - $1.00

No. 66—PACENT Five-Spring Automatic Jack - - - - - - - - - $1.20

PACENT Jack Specifications

- Coin Silver Contacts
- Genuine German Silver Springs
- Nickel Plated Brass Frames (not Iron)
- Micarta Insulation (not Fibre)
- Extra Booster Springs
- Husky Nipples
- Rugged Construction Throughout
- All Details Precisely Accurate
- Provided with THREE WASHERS
- Will fit Any Panel from 1/8" to 3/8".

Important Considerations in Selecting Plugs and Jacks

The rest of your set may be perfect, but if the plugs and jacks do not function, the set is useless. It is obviously wisdom to choose dependable plugs and jacks.

PACENT is the pioneer plug and jack manufacturer. For fifteen years the PACENT organization has produced radio plug and jack equipment, developed upon the best radio engineering principles.

Every detail of PACENT plugs and jacks is planned for perfect results. Read the specifications carefully. The largest manufacturers of radio sets standardize on PACENT plugs and jacks. They are the choice of radio authorities and are stocked by the foremost distributors.

To be assured of perfect results from your radio equipment, choose your plugs and jacks with the utmost discrimination. The PACENT Trade Mark is your guarantee of SERVICE and SATISFACTION.

PACENT products are reasonably priced. Their superiority over the *ordinary* is apparent at a glance. In the long run, they will save you many times their cost.

PLAY SAFE!

LOOK FOR THE PACENT TRADE-MARK

Don't Improvise—"PACENTIZE"

Send for Descriptive Bulletins

Dealers and Jobbers: Write for Outline of the New PACENT SALES PLAN for 1922-23

PACENT ELECTRIC COMPANY

INCORPORATED

Manufacturers and Distributors of Radio and Electrical Essentials

EXECUTIVE OFFICES
22 Park Place
New York, N. Y.

BRANCH OFFICES
CHICAGO, 33 So. Clinton Street
PHILADELPHIA, Bourse Bldg.
WASHINGTON, D. C., Munsey Bldg.

Member Radio Section, Associated Manufacturers of Electrical Supplies

Canadian and British Licensees—COLONIAL RADIO Ltd., Hamilton, Ontario

Three Little Devices That Make a Big Difference in the Convenience and Pleasure of Operating Your Radio Equipment

PACENT

THE PACENT MULTIJACK

Three independent jacks in a single base. Three jacks for the price of ONE. When screwed to side of receiving outfit, allows plugging in three sets of phones, or two sets of phones and a loud speaker. Screwed to table or testing board, the MULTIJACK has many uses. Shaped so that two or more may be placed end to end. Takes any standard plug—but for the best results, use the PACENT UNIVERSAL PLUG.

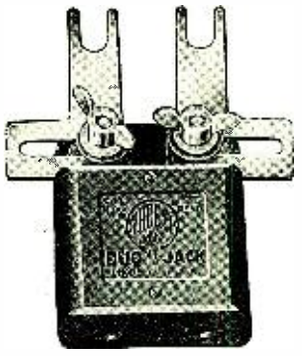
Cat. No. 52 List Price **$1.50**

THE PACENT TWIN ADAPTER

Receiving sets are usually provided with only ONE jack—and limited to the use of ONE head set. THE PACENT TWIN ADAPTER allows one jack to accomodate TWO plugs, providing for two phones, or one pair of phones and a loud speaker. Any standard type of plug can be used, but for best results, use the PACENT UNIVERSAL PLUG.

Cat. No. 51 List Price **$1.50**

THE PACENT DUO JACK



Two jacks with two adjustable connectors. Enables you to convert an ordinary receiving set (or any piece of radio equipment fitted with binding posts) to a plug and jack set or instrument. It replaces awkward binding posts and provides instant and convenient connections for head sets and loud speakers. The DUOJACK is also a ready means for rapid connections with laboratory or experimental apparatus.

Cat. No. 53 List Price **$1.50**

The above devices together with the PACENT UNIVERSAL PLUG provide for every conceivable combination of plug and jack connections. Every PACENT RADIO ESSENTIAL was designed to fill an important Radio need.

Don't Improvise—"PACENTIZE" - - - ***Send for Descriptive Bulletins***

Dealers and Jobbers: Write for outline of the new PACENT SALES PLAN for 1922-23

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EXECUTIVE OFFICES
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WASHINGTON, D. C., Munsey Bldg.

Member Radio Section, Associated Manufacturers of Electrical Supplies

Canadian and British Licensees—COLONIAL RADIO Ltd., Hamilton, Ontario

The New Sweeney Radio-Phone

Recognizing the demand for a set to receive the radiophone broadcasting of entertainment features as well as market reports and government information, our engineers have developed this receiver which incorporates simplicity of operation with its ability to receive long distance stations with clearness and sufficient volume to operate a loud speaking horn. The wave length range will cover those being used for the broadcasting of musical programs as well as the government live stock markets, grain quotations and weather forecasts. All sets are carefully constructed with the best quality of material and most careful workmanship. Each set is rigidly examined and tested before it is released. Radio frequency amplifications, one of the newest developments in radio reception, is used, which accounts for the extreme sensitivity of the instrument and enables the operator to pick up long distance stations. The audio frequency amplification increases the signal strength to such a volume that any type of loud speaking horn at present on the market may be operated. Write for special low introductory price.

Specifications Sweeney Radio-Phone

Cabinet: Genuine solid walnut, hand rubbed.

Circuits: Tuning circuit consists of an antenna inductance with four taps and a series variable condensers wave lengths from 175 to 550 meters. Two Radio frequency, detector and two audio frequency amplifying tubes.

Panel: Bakelite 7x20¾. 3/16 inch thick *Control Knobs.* Smooth running and easily adjusted. Only two adjustments required in tuning.

Terminals are in rear of the cabinet to which the aerial ground, A battery and B battery are connected.

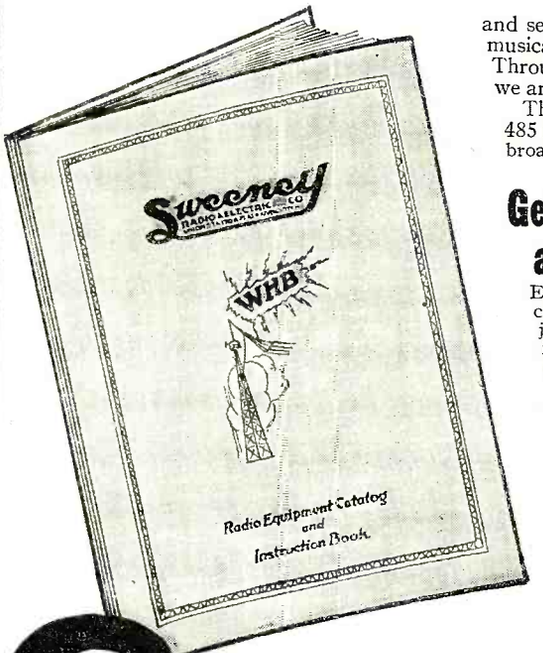
Wiring and connections substantially made with 1/16 inch brass rod with cambric tube sleeving.

SWEENEY BROADCASTING W. H. B.

This Is One of the Largest Inland Stations in the Country

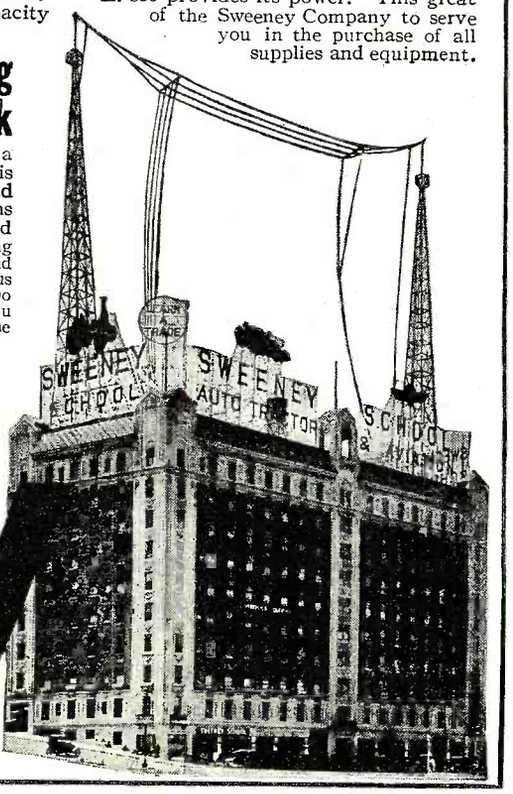
and sends out official Government market and weather reports every day, besides giving musical, educational and religious programs on Sundays, Tuesdays and Thursdays. Through the courtesy of C. G. Conn & Co., Elkhart, Ind., Makers of Musical Instruments, we are broadcasting some of their concerts.

This station cost $50,000 to erect. CALL IS—WHB—360 meters for concerts and 485 for Government reports. 500 watts W. E. set provides its power. This great broadcasting station is evidence of the capacity of the Sweeney Company to serve you in the purchase of all supplies and equipment.



Get This Radio Catalog and Instruction Book

Every radio enthusiast should have a copy of this valuable book which is just off the press. Contains new and interesting matter and descriptions and hints that will save you time and money, including hookups showing connections of crystal, regenerative, and high frequency amplification apparatus and give you much better results. Do not buy any radio supplies until you have seen this book as we have gone into this business on a great scale and are prepared to supply you with the best and most efficient new material at lowest prices. This book has has been prepared by some of the best known electrical and radio engineers and practical instructors. *Sent on receipt of twenty-five cents in stamps.* Get your copy today.



Sweeney

RADIO & ELECTRICAL CO

1028 UNION STATION PLAZA, KANSAS CITY, MO

EDITORIAL AND GENERAL OFFICES, 53 PARK PLACE, NEW YORK

Vol. 4 NOVEMBER, 1922 No. 5

Radio and the Beginner

WHEN radio was young and a man wanted to delve into the mysteries of the new art, he, as a rule, started with a simple crystal outfit, which he used to his heart's content until he had mastered the rudiments of the new eighth wonder. He was content to receive clear signals, and he took his time to become familiar with every part of his set.

Having mastered the first principles, he kept on adding to the outfit until he had a representative set that gave satisfaction to him because he knew all about it. After a while he plucked up sufficient courage to tackle a vacuum tube set, which he shortly worked to perfection, a thing he never would have accomplished had he not started first with the simple crystal set.

We can compare him to the man who drives his own car. As a rule, he does not start in with an imported car, costing anywhere from ten to fifteen thousand dollars. He starts in, generally, with a second-hand car, or, at least, a car that is not too costly. Then, after he has mastered the running of this machine, he feels that he can acquire a better and more powerful model.

In radio, nowadays, however, we do not work things that way. The merest novice must try a $300 vacuum tube set, and if you have lived at all in the United States during the past six months, you know the rest.

All of this is not said with the idea of discouraging people from using vacuum tube sets. There is, of course, no question at all that the vacuum tube is far superior to the crystal set in that it brings in stations from inconceivably greater distances, especially if we consider the radiophone, but thus far, and we may as well be truthful about it, *the average vacuum tube outfit has been beyond the novice.* Very few people have been able to get results that are worth while. We know of one apartment house in New York City where there were 15 vacuum tube sets last spring, nearly all of which have been taken out, and in some cases crystal sets have been substituted by the owners who could not work the vacuum tube sets.

The trouble here, of course, is with the dealer and with the tremendous advertising that radio has received. The average man thinks that a high-priced radio outfit is just like his phonograph, or like his player piano. Given a few instructions, he thinks he will be able to receive concerts from Paris and Honolulu, never stopping to think that so far few outfits have been perfected to such a degree where it is safe to place them in the hands of a total novice who has no idea whatsoever as to radio or electricity. The dealer is to blame because he, wishing to make a large sale, always urges his prospect to buy an expensive set, never thinking of the mischief he is doing all the while. If every dealer or manufacturer could afford to send a man with an outfit and instruct the owner in all the intricacies of radio, all would be well. Unfortunately, in the very nature of things, this is impossible, as it would take weeks of instruction, and even then the owner would not know all about it. The trouble is that the public, with few exceptions, do not care to learn. They wish to get results overnight, and if they do not obtain them, they blame the outfit, and, as usual, radio gets a black eye.

How much better it would be for the dealer to sell the novice a good crystal outfit. This would do several things. In the first place, as far as clearness of sound is concerned, if you are within range, there is certainly nothing better than a crystal outfit. Given a good detector and a good pair of phones, broadcasted radiophone entertainment comes in, as a rule, with wonderful clarity. There is practically no distortion to speak of, and while it is necessary to wear a set of receivers, the perfect condition of the entertainment amply repays the man who owns a crystal set, and makes him forget a noisy loud talker. On the other hand, nine out of ten vacuum tube sets, where several stages of amplification are used, in the hands of a novice, as a rule give poor results. How much better it would be, if a man insists upon a vacuum tube set, to sell him an outfit with a single tube, which certainly will give him results where the big outfit will not. And in the end, the dealer will be the winner, for a satisfied customer will come back and try to get a better set after he has become familiar with the operation of the simple one.

It is ever so much better, for the radio art right now, that every novice should be urged to buy a crystal set to start out with, for in the long run it will benefit the entire trade. It has been proven in the past that if you get a man really interested in the radio art he will stick to it for at least five years, on an average. Can this much be said of a man who rushes out to buy an expensive set and then fails to get satisfaction?

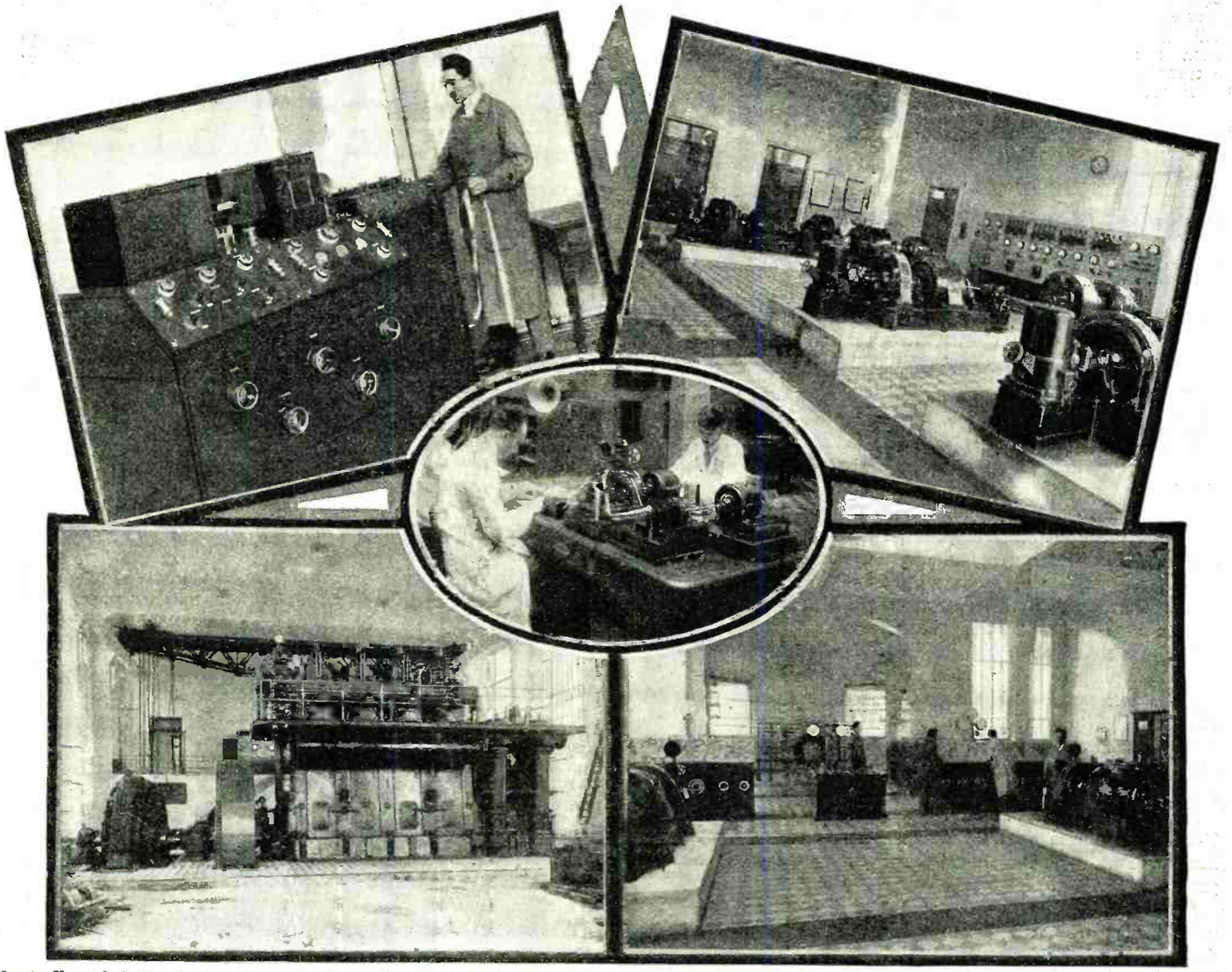
Since the advent of the vacuum tube, the crystal set seems to have sunk lower and lower in the estimation of the public, as well as the dealer, for no reason at all. Unless one wishes to receive from long distances, and receive an entertainment that is loud enough to be heard all over the house, the advantages lie with the crystal set. A good crystal outfit does almost everything that a vacuum tube set can do, is much easier to adjust, if it is designed properly, reproduces better, as a rule, is less expensive in operation, requires no batteries and is low in price. Also, the owner of a crystal set will get used to radio and will believe in it, whereas the novice owner of a vacuum tube set becomes easily discouraged and very often drops out of the game for good, after a few attempts. Following that, he denounces radio as a swindle, or worse. That is the problem which confronts us today and the sooner this is eliminated the better it will be for all concened.

Another thing that our manufacturers neglect sadly is instruction. We have seen very few instruction booklets that are given away with radio outfits. Few crystal-set manufacturers, as well as few vacuum tube-set manufacturers, take the trouble to instruct the public. The manufacturer knows all about the outfit, while the public knows nothing. Complete instructions should be given with every outfit and these instructions can not be too explicit. The construction of an aerial for the set should be described, as well as the size of the wire, length, number of insulators, etc.

Detailed illustrations showing the handling of the controls and all other vital parts should be given. An illustration is better than a thousand words of printed matter. Very few people like too lengthy instructions, and here is where the illustration fits in nicely. If every manufacturer of radio outfits would follow the example of the Kodak people, they would find that there would be much less dissatisfaction on the side of the public than exists today.

H. GERNSBACK.

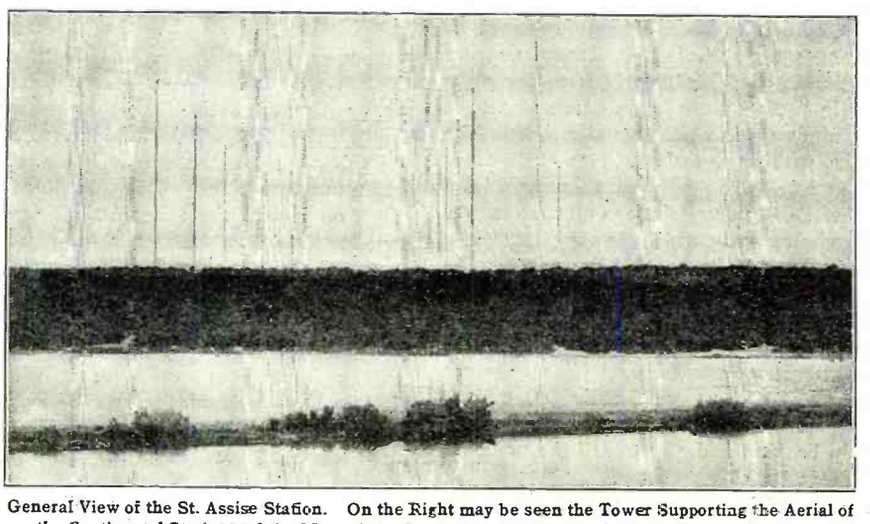
The French Radio Central



On the Upper Left May Be Seen One of the Photographic High Speed Recorders and on the Right the 25 K.W. High Frequency Alternators of the Continental Station. On the Lower Left is Shown one of the Diesel Engines for Driving the Generators and to the Right is the Control Room. Note the Lead-in Coil in the Background. Insert is of the Central Office in Paris Showing the Automatic Creed Recorder Which Types the Received Messages.

THE Saint-Assise station which was inaugurated recently, is France's most powerful radio station and will insure radio communication all over the world. This station has been built in less than two years, the first stone having been laid on January 9, 1921. At the present time, all the buildings are erected and completed as well as seventeen 800-foot towers and one 300-foot tower supporting the aerials of the trans-oceanic and trans-continental stations.

The station is composed of three units, two of which may be coupled together to increase the range if necessary. The trans-oceanic station is so designed that any amount of power from 200 to 1500 kilowatts may be put into the antenna system. The trans-continental station can radiate from one to one hundred kilowatts, according to the distance to be covered. Reception is accomplished by means of a system of loop aerials erected in groups of seven and equipped with the proper selective and amplifying devices of the latest design. All the traffic is controlled from a central office located in the business section of Paris. In this office, high speed sending and receiving apparatus are installed by means of which 100 words a minute can be sent.



General View of the St. Assise Station. On the Right may be seen the Tower Supporting the Aerial of the Continental Station and the Mast of the Special Station Handling the Traffic with England.

The power system of the station consists of three high frequency alternators each delivering 500 kilowatts in the antenna. These alternators may be used separately in the two sections of the antenna so as to permit two messages to be sent simultaneously. They may also be coupled together to reach the most distant stations. It is possible to use the three machines together so as to obtain a power of 1,500 kilowatts in one antenna, which power so far has never been used for radio communication.

The power supply is furnished either by the electric station located a few miles away or by three Diesel engines of 1.800 horse power each. The aerial which is supported by 16 towers is of the double flat top type with the lead-ins in the center. The antenna consists of 44 miles of cable and the ground of over 50 miles of copper wire and almost one mile square of copper plates.

The continental station, which is separated

from the trans-oceanic one has a special umbrella type aerial supported by one tower and is equipped with four 25-kilowatt high frequency alternators which may be used separately or in parallel.

All the equipment incorporated in this station is of the best design and permits the transmission and reception of messages to and from any high power within about 2,000 miles. The traffic is run almost all of the time at a speed exceeding 60 words a minute.

The first official message sent by the Saint-Assise station was addressed to the American station at Marion, Ohio, on a 14,300-meter wave-length. It read as follows:

"Dear Friends: It is with pleasure that we address you our first message with our compliments and regards."

The American station answered:

"Your signals very strong, manipulation very good, great regularity. Please send 80 words a minute."

During the afternoon of the same day, July 4th, 1922, Senatore Marconi, who received the first message while on board his yacht the *Electra,* sent the following telegram to the Saint-Assise station:

"Your first signals observed on board yacht *Electra* are much stronger than those of Carnavon. Regulation and manipulation good; excellent recording. At 80 words a minute, very good."

The next day, July 5th, Senatore Marconi sent an additional message with his congratulations to the new station.

Since then, good results have been obtained every day and have proved that the efficiency of the new station is as great as was expected. No station is received in the United States as strongly and as regularly as Saint-Assise. The following telegram from the *Havas News* at Buenos-Aires shows that the signals were received with incomparable clearness in South America.

"Have heard, last night and this morning, Saint-Assise station much stronger than any other station in the world. Much stronger than Bordeaux, working at high speed with North America. Must use new station for successful communication with us."

It is to be remarked that on July 11th, the above mentioned station tried in vain to receive from European stations during a thunder-storm, while the signals of the French station came in clear and strong.

Telegrams from all over the world were received by the officials of the France Radio Company which erected the Saint-Assise station and it is to be noted that the signals were heard with equal intensity in the Far East as proved by the following telegram received from Beyrouth:

"At Beyrouth, 8th of July, have heard Saint-Assise working WSO. Intensity of signals superior to that of any other station ever heard here."

These results are remarkable on account of the fact that the intensity in the aerial was only from 460 to 500 amperes which is about the same as that of the Croix-d'Hins station near Bordeaux, which varies from 390 to 480 amperes. It is also to be noted that in order to put 560 amperes in the antenna, the Saint-Assise station takes only 300 kilowatts from the supply while the Bordeaux station, for a smaller intensity, requires 1,000 kilowatts, which is over three times as much.

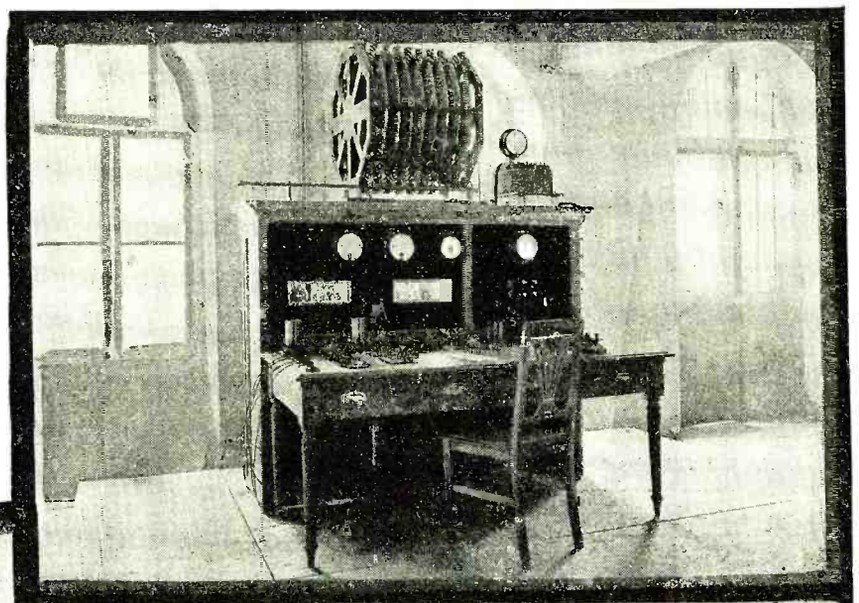
When the Bordeaux station was opened in 1920, it was claimed to be the most powerful station in the world. The power of the new Saint-Assise station, however, eclipses that of Bordeaux as it is three times as powerful. The new station is erected on the plateau of Saint-Assise, about 25 miles from Paris and is bounded by the road from Paris to Saint Leu, by the river Seine and by the railway from Paris to Fontainebleau.

The site is approximately level, and the earth is moist enough to insure a good ground.

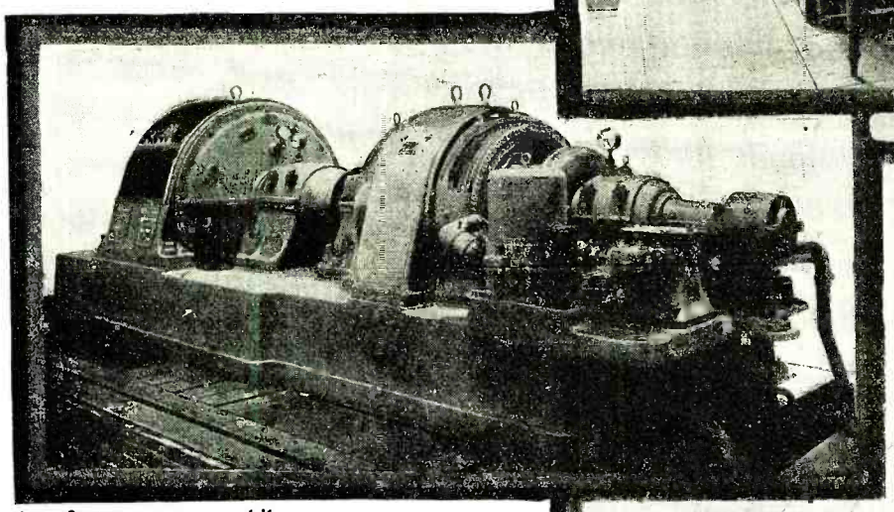
For short distance communications two tube transmitters of 5 K.W. each are used on a special aerial, built in two sections and supported by the 300′ tower. One of these transmitters using ten 500-watt tubes, is shown in the illustration.

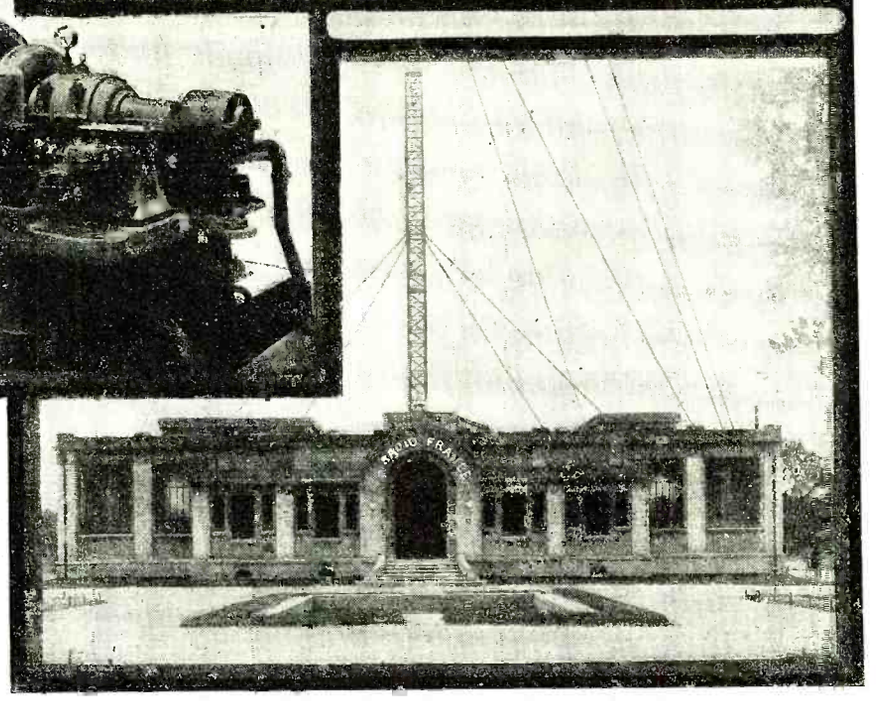
For continental communications, four high frequency alternators of 25 K.W. each are used. These may be used separately or in group, according to the range to be covered.

The entire traffic of all of the stations is handled by remote control from the Central Office in Paris. When all the stations are working on full capacity, a total of 36,000 words an hour may be transmitted. In addition to this Central Office, two extra extensions permit the traffic to be handled from the provinces so that no delays occur in the re-transmission of messages when these are sent from other towns. No expenses have been spared to make this station the most up-to-date possible, as the cables owned and operated by France are very few in number and become insufficient to handle the great amount of traffic which is now going on. By means of the new station, France becomes entirely independent for her communications and it is already foreseen that the competition between the two systems will be such that most of the traffic will be sent by radio as it will be possible to make the rates cheaper.



The 5 K.W. Tube Set which is used Almost Exclusively for Working Traffic with England.

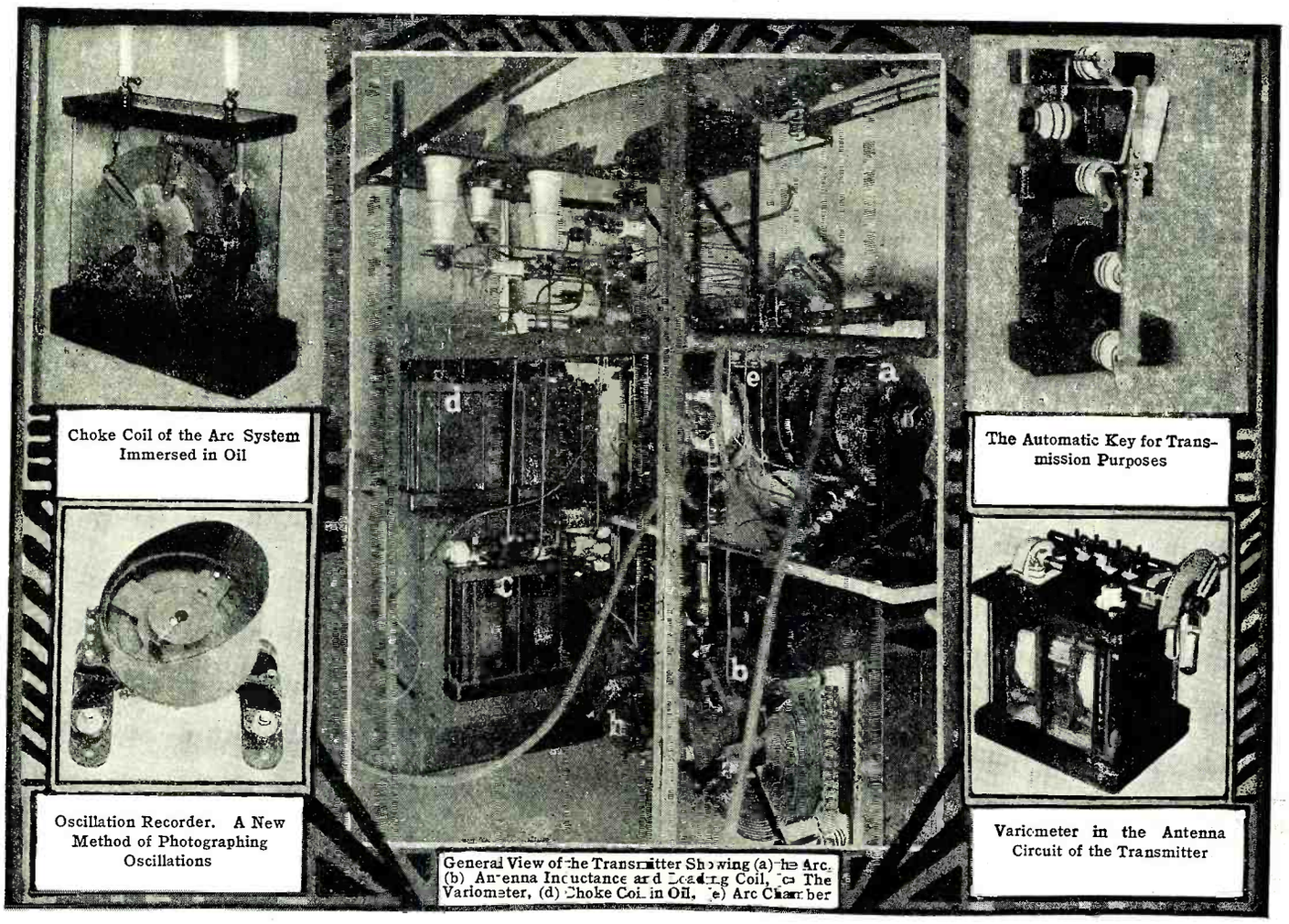




Below: One of the 500 K.W. Alternators at the French Radio Central. Right: View of the Continental Station at St. Assise. With a Separate Aerial this Building Houses the Apparatus for Communicating with the European Continent only.

Poulsen Plant of German Radio Station

By DR. ALFRED GRADENWITZ
Berlin Correspondent of Radio News



Choke Coil of the Arc System Immersed in Oil

The Automatic Key for Transmission Purposes

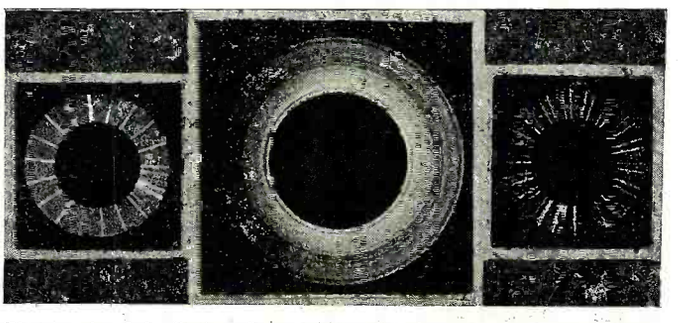
Oscillation Recorder. A New Method of Photographing Oscillations

Variometer in the Antenna Circuit of the Transmitter

General View of the Transmitter Showing (a) the Arc, (b) Antenna Inductance and Loading Coil, (c) The Variometer, (d) Choke Coil in Oil, (e) Arc Chamber

THE Königswusterhausen Radio Station, which during the war had been used for military purposes, was in 1919 taken over by the German Telegraph Department and is now used exclusively for commercial traffic. Its antenna system mainly comprises a huge L-antenna carried by five masts, each 500' high. Additional antenna, enabling several senders to be worked simultaneously, are being provided. In addition to two Poulsen arc senders designed by Messrs. C. Lorenz, of 32 K.W. and 5 K.W. antenna energy respectively, the station comprised two senders designed on the "sounding spark" system, which, however, were eventually replaced by tube and machine senders, the undamped system being now used exclusively in the internal service of German wireless stations. The power plant comprises three crude oil engines each of 150 H.P., and a small 50 H.P. engine, serving to operate the current generators. The whole of the machinery and apparatus is controlled from an elevated switch desk, comprising all the switches, instruments, fuses, etc., for controlling and checking the senders. Each sender can, by means of an antenna selector, with a few manipulations, be switched on to any antenna desired. The receiver plant was at first installed in a special room adjoining the sender room. The whole internal service was then carried out in the receiver room, each table comprising a key for controlling the sender and, at the same time, by a tilting motion, converting the whole plant from "receiving" to "sending" or inversely. Inasmuch, however, as the German Telegraph Department recently has adopted duplex operation of all its stations, thus making the simultaneous sending and receiving by several stations possible, the Königswusterhausen Central Station is now used exclusively for sending purposes, the corresponding receivers being installed about 20 kilometers away.

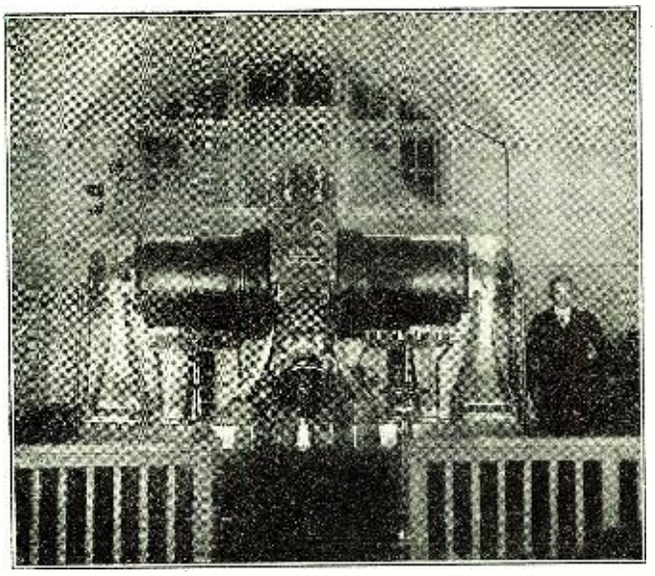
Working Principle of Poulsen Arcs.—The generation of undamped oscillations by means of electric arcs is based on their controlling an oscillation circuit composed of inductivity and capacity, in such a way as to maintain any vibration once started at constant amplitude. In the case of the Poulsen lamp the conversion of continuous current energy into high frequency energy is assisted considerably, first, by the arc gap being placed in hydrogen or some gas holding hydrogen, thus reducing the cathode gradient; second, by causing a magnetic field at right angles to the current to act upon the electric arc (magnetic air-blast), the arc thus constituting a movable conductor deflected and lengthened between the poles of the magnet; third, by cooling the positive copper electrode (by means of flowing water) and causing the negative carbon electrode to rotate slowly around its axis, burning continuously and insuring a constant length of arc. Inasmuch as the electric arc and the magnetic field arranged in series are dependent upon one another, the arc is controlled quite automatically, thus reducing any fluctuations of tension in the arc to a minimum. In the case of up-to-date Poulsen arc generators, a practically perfect constance of the period of vibration can be insured with capacities of some magnitude and wave-lengths exceeding 2,000 meters (6,500 feet).



Photographs of Oscillations Recorded by the New Instrument. Left Shows the Modulations Produced by Pronunciation of the Letter "o" and on the Right of the Letter "e".

The high frequency energy generated by the arc must be radiated by the antenna at the rhythm of Morse signals. Two sending methods have mainly been developed, one of which is based on getting the antenna out of tune, while according to the other, the arc is switched on to an artificial loading circuit at a rhythm corresponding to Morse signals. The former alternative, on account of drawbacks connected with the method, has for some time past been abandoned at Köenigswusterhausen.

The latest sending method, which is now used at Köenigswusterhausen, is based on reducing the antenna current to zero by an increase of damping. The switching arrangements so far in use have been replaced by a new arrangement comprising, apart from the key proper, no other movable parts. Inasmuch as the absorbed energy, during intervals in operation, drops to a figure corresponding to operation at no load, the mean efficiency in this case is increased considerably.



The 32-KW Poulsen Arc in Operation at this German Station.

Four-K.W. Poulsen Sender at Köenigswusterhausen. The 4-K.W. Poulsen-Lorenz sender is shown in Fig. 2. The generator and also the continuous current and high frequency switches are installed on the same three-sectioned iron tube frame. The *Continuous Current Switchboard* consisting of three marble panels, comprises at the top a current and tension gauge for the feeding current of the arc generator, and on the central panel the two block relays and diverse switches and fuses. The block relays are intended to prevent the sender operated, as long as the receivers are switched in.

The *Poulsen Arc Generator,* with its switchboard and accessories, is installed in the central section of the iron tube frame, shut off by marble slabs. It comprises the flame compartment and 12 magnet coils, the magnetic core adjuster and the motor-driven carbon feed with magnetic ignition. The upper panel carries a water flow and alcohol controller, a four-pole switch for parallel and series connection of the magnet coils, and the antenna current ammeter. The hand-wheel of the graduated arc shunt resistance, standing a maximum continuous load of 35 amperes, projects through the lower switch-panel. This resistance enables the intensity of the arc current, and accordingly the radiated energy, to be regulated between its full value and one-third of this figure. Choking coils fitted at the back of the shunt resistance are intended to keep any rapid oscillations away from the continuous current relay.

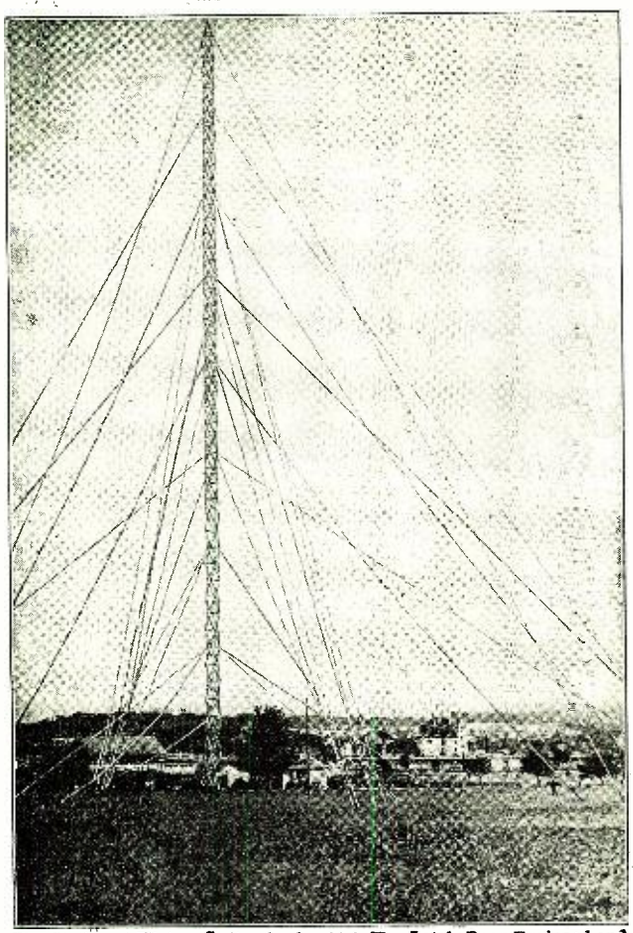
The high frequency switches are installed on the right-hand switchboard, likewise consisting of three marble panels. The upper panel carries the hand-wheel for operating the sender coil switch, the central panel comprises the variometer lever, three switches for the sending relays and connections for these relays, installed on the lower panel, above the lever for connecting the variometer in parallel and in series.

The sender variometer, in conjunction with the sender coils, insures a handy and continuous bridging of any steps in wave variations, as corresponding to the subdivisions of coils. It comprises two cylinders rotating inside of one another, and the coil sections of which can be arranged in parallel or in series. The variometer is installed in an oil bath, preventing any objectionable heating. The lever on the lower panel effects the parallel and series connection of the variometer by means of a flexible shaft,

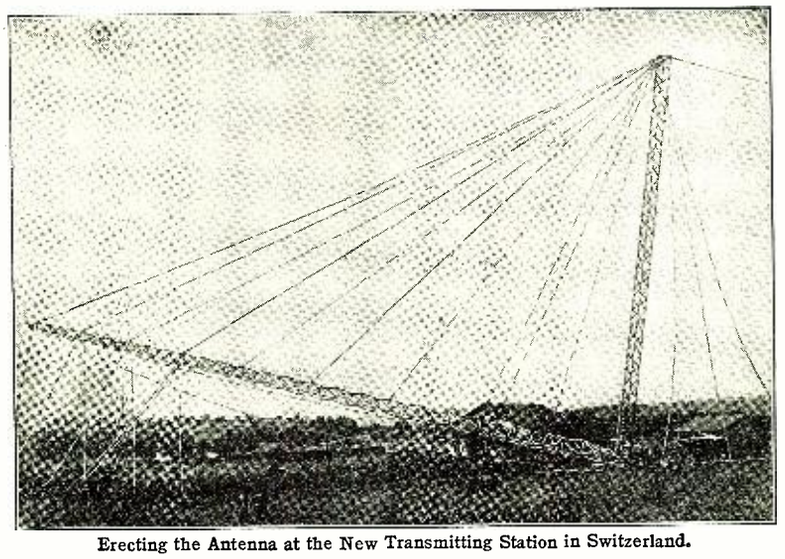
(*Continued on page* 936)

A Swiss C. W. Transmitting Station

By DR. ALFRED GRADENWITZ



The Station at Kloten, Switzerland, which Has Lately Been Equipped and Will Open Communication With Germany.



Erecting the Antenna at the New Transmitting Station in Switzerland.

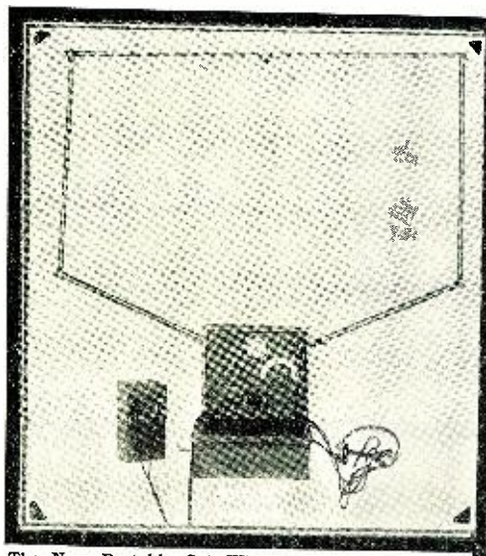
THE radio station installed by the Telefunken Co. at Kloten, Switzerland, is intended for the general Swiss radio service as well as for the special purposes of the Dübendorf flying ground, no regular aerial traffic being possible without wireless connections. While the sender is installed at Kloten, the corresponding receiver, which, in order to facilitate a duplex service, had to be separated from the sender, is located at Dübendorf. At the present moment Dübendorf is the only satisfactory landing ground of the country, with airplane hangar, staff and spare parts. The erection of a wireless station in that district, therefore, was an absolute necessity, to prevent the country being cut off from the rest of the continental aerial traffic.

The umbrella-shaped antenna is carried by a light iron girder mast 120 meters (400') in height, insulated from its surroundings, a smaller T-shaped antenna being provided for sending out short waves. The counterweight is partly dug into the ground to 50 cms. depth, the smaller part being carried overhead on poles. The motor plant comprises two sets, the first of which serves to convert the three-phase current

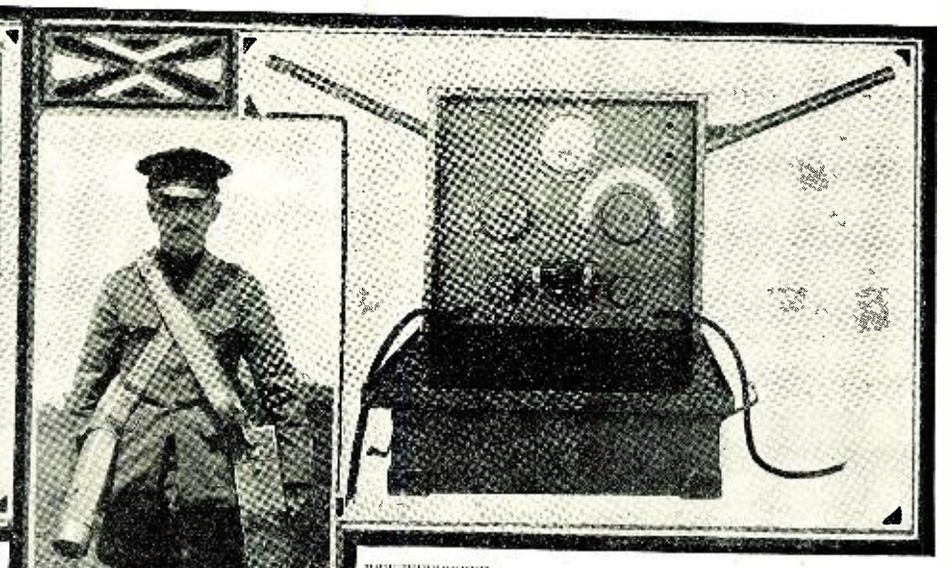
(*Continued on page* 940)

New Signal Corps Portable Set

By S. R. WINTERS



The New Portable Set With Its Unusual Type of Loop Aerial.



Above: Close up of the new portable combined transmitter and receiver. Left: The loop and set are easily portable when enclosed in their special containers. The batteries are carried in a special box.

MULES and trucks—conventional means for transporting wireless equipment for field service of the Signal Corps of the United States Army—are to be partially displaced in the future. The popular mercantile slogan, "Carry your own packages," may be broadened to include the injunction, "Strap your radio outfit across your shoulders." Not unlike the convenient way of carrying a haversack or a fisherman's tackle in a bag, suspended from the shoulders, a radio-telegraph set built by the Signal Corps of the United States Army lends itself to easy carriage by one, two or three persons.

Departing from the multitude of portable wireless apparatus, in which diminutiveness is a virtue especially emphasized, this design represents a duplex system—adapted to both the transmission and reception of communications by radio telegraphy. The complete equipment, labeled SCR-77-A (meaning Signal Corps Radio), resolves itself into three units. First, granting priority of reference to the unit of outstanding significance, there is the operating chest, including loop antenna, vacuum tubes, and tuning coils, for both sending and receiving undamped-wave radio-telegraph messages. Second, there is a battery box containing an 80-volt dry battery, upon which the operating unit can be mounted and clamped thereto. This arrangement facilitates ready electrical connections with the storage battery. And finally, the third piece of apparatus consists of two 4-volt storage batteries encased in a single container, subject to use one at a time as demands for electric power may dictate.

The loop antenna, in the absence of which the descriptive word "compactness" as applied to this portable wireless outfit would be a misnomer, weighs only nine pounds. The operating chest or base which supports the antenna when installed weighs 16 pounds, thus these two units total only 25 pounds. These units, when encased in compact formation and provided with straps, may be assigned for transportation by one man without his using the opprobrious terms "beast of burden" or "packhorse," as applied to himself. The loop antenna can be readily folded, and when deposited in a canvas case, is so abbreviated and compact in form as to cause a mistaken identity of its purpose. The dry-battery box alone weighs approximately 16½ pounds, which can be readily carried by one person without inflicting an excessive burden. When two storage batteries are contained in this box the weight is increased to 22 pounds, the load assigned the second person. The burden conveyed by the first man, it will be recalled, was 25 pounds. Thus, the aggregate weight of the three-unit duplex radio-telegraph set is less than 50 pounds, which may be shared by two or three individuals.

Necessarily, the operating range of this 47-pound duplex system of rapid intelligence is limited. Accurate communication is assured for a distance of 8,000 yards, and under pleasing environments, the range of transmission and reception may be enlarged to cover a distance of 10,000 yards. Of course, this narrow range limitation may be removed by enlarging the size of the loop antenna and thus contribute to the weight of the apparatus. For the original purpose to which this extremely compact radio-telegraph set was assigned, namely, the

(*Continued on page* 952)

Radio Lessens Lightning Danger for Aircraft

RADIO has demonstrated its usefulness on land, water, underground and in midair. Now, the principle of radio transmission is to be applied in the clouds as a means of counteracting the menace of lightning or static electricity to kite balloons and other types of lighter-than-air craft. A protective device invented by A. Crossley, a radio engineer of the Radio Division of the Bureau of Engineering, United States Navy Department, lessens the hazard of balloons catching fire from lightning when employed in meteorological observations.

The electrical contrivance was designed for use by the Aeronautical Division of the Navy Department, and was recently subjected to practical tests at the naval operating base at Hampton Roads, Virginia. An "R" type kite balloon was equipped with the apparatus, which weighs approximately 30 pounds, and the material and cost of installation was less than $350. The underlying principle of outwitting the lightning bolt, when the aircraft is 600′ or 1,000′ in the air, is by the use of an electric circuit. The excess static electricity in the vicinity of the clouds is relayed to the ground.

The preliminary tests involved the use of 1,200′ of cable which was purposely broken in the center and an Electrose strain insulator inserted at the breaking point. Another insulator was placed at the end of the cable in proximity to the winch, the latter unit being the controlling mechanism for raising and lowering the balloon. Insulators at these points served the purpose of insulating the balloon circuit from the anchor, thereby permitting the insertion of testing equipment. When the 1,200′ piece of cable was employed, the first-mentioned insulator was shorted by a braided copper conductor, thus facilitating a complete electrical circuit to the second insulator.

Upon flying the balloon to a height of 600′, a "ground" system had to be provided for the reception of the static electricity as it was relayed from the aircraft in the clouds. A ditch, 8″ deep, was dug in a circular shape, its radius being 10′. This ditch, of course, was dug around the anchor or base for raising and lowering the aircraft. No. 12 B. & S. gauge bare copper wire, common to radio installations, was interred in this freshly-made "grave." Rubber-covered No. 12 wire "leads" were linked to the buried conductor at two diametrically opposite points. These "leads" were extended over the surface of the earth to the ground post of the testing outfit.

The testing apparatus consisted of a vacuum-tube generator, having the capacity of delivering high-frequency current at wave-lengths ranging from 1,000 to 6,000 meters. A radio precision condenser of .0015 microfarads capacity, a radio resistance box, four inductance coils, and essential power equipment, constituted the other testing units.

The initial experiment sought to determine the capacity of the balloon circuit when the aircraft was soaring at altitudes of 600′ and 1,200′, respectively. The capacity, by the so-called substitution measuring method, was readily obtained when the balloon was only

(*Continued on page* 954)

Tremendous Possibilities of Radio

An Interview With Nikola Tesla

By J. P. GLASS

[Nikola Tesla, leading authority, electrical wizard and inventor, discoverer of alternating current, power transmission and induction motor, system of arc lighting, system of electrical conversion and distribution by oscillatory discharges, generators of high frequency currents, transmission of energy through a single wire without return, the Tesla coil or transformer, Tesla turbine, etc., has been studying the possibilities of wireless transmission of power since 1884. Dr. Tesla sleeps but two hours out of the twenty-four and eats only two light meals a day. Tall and gaunt, almost totally withdrawn from distractions that interfere with his work, his being seems fairly to burn with his intense purpose.

Dr. Tesla is an extremely hard man to approach as he is wrapped up in his work. Mr. Glass was able to arrange with Dr. Tesla to dictate answers to written questions, which makes the following extremely important and interesting material more of a direct report than the usual article. Most men whose imaginations have been stimulated by the keen radio interest that has gripped the country have no doubt felt that they would like to ask a great expert some of the questions that are answered in this timely article.—EDITOR.]

HERE, briefly, is an outline of the future of wireless transmission, as viewed by Nikola Tesla, the great authority. Dr. Tesla, who began his electrical investigations as far back as 1884, and has been steadily pushing them through the intervening thirty-eight years, does not expect great changes in the physical aspects of life as we know it in modern cities and closely settled communities. For such, the transformations wrought will be chiefly social in their nature, the beneficent results of increased communication and wider spread education. Mankind will be brought closer together, the dissemination of knowledge will be greatly multiplied, and a complete understanding is bound to result.

Business will be affected in the sense that its means of operation will be given increased facility and it will be afforded new avenues of endeavor. But life will move forward with little variation, with largely the same methods of living, occupation, transportation and amusement.

However, this will not be true of those portions of the earth now regarded as inaccessible. "Transportation of electrical energy in unlimited amounts to any point in the world" means that the desert will be made to bloom and the mountain range robbed of its bleakness.

Man, equipped with power and light and means of oral and visual communication, can penetrate to the most unfrequented places and speedily build for himself communities with all the advantages of the metropolitan centers. Railroads will not be necessary because airships and airplanes, availing themselves of the same energy which man will apply to the development of the earth, will afford him transit wherever he may wish to go.

To gain time and to insure accuracy, the interviewer submitted a number of questions to Tesla in writing. His replies were dictated. It is possible, therefore, to present what amounts to a stenographic report of the interview, as follows:

Question: Have you made any discoveries in connection with the wireless principle which have not been given to the public and, if so, would you care to state them?

MR. TESLA: I am glad to say I have, although I am not prepared to discuss them at present in a general way.

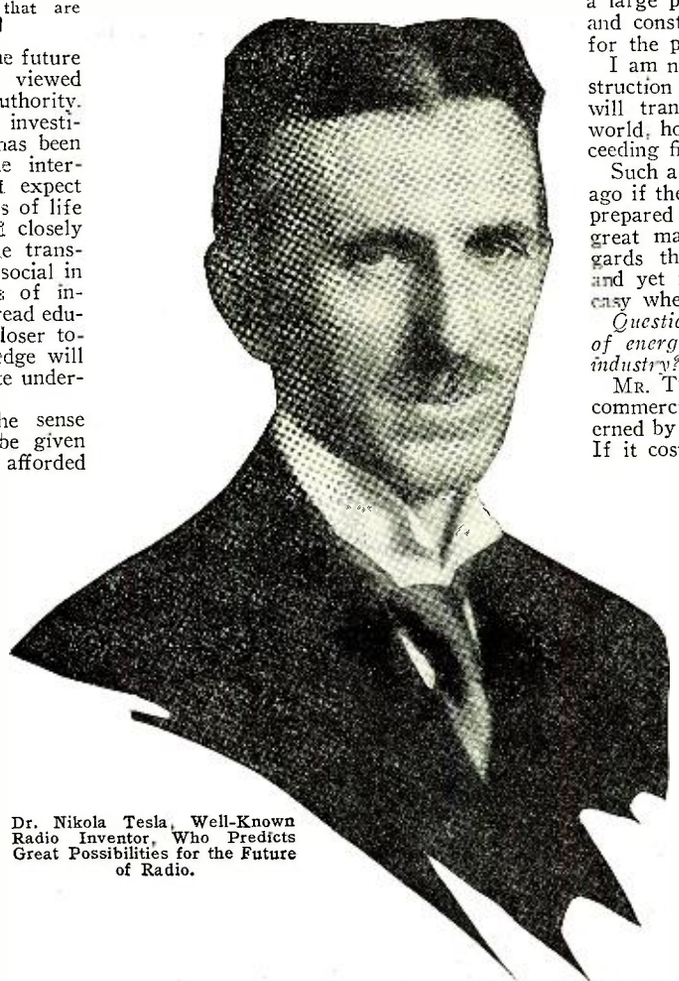
One of these inventions will enable us to condense the wireless transmitting apparatus to such an extent that the entire plant for carrying the human voice around the globe will be contained in a smaller space than that occupied by a little cottage. There will be no high towers.

In this connection I have made a discovery as interesting as it is important, which, when it is announced, will cause great surprise among engineers. This cannot be disclosed, now.

A number of other inventions relate to the control of the energy by delicate means, isolation of impulses, and their reception and recording at distance.

Question: What will be the effect of these inventions upon the wireless art?

MR. TESLA: I think that they will greatly facilitate wireless transmission in several ways. The transmitting apparatus will be very much cheaper and qualitatively superior by far to existing types. Especially in the use of such transmitters for purposes of broadcasting will great advantages be secured. The receivers will be much more responsive, too, and sharply differentiative. This means, of course, that more instruments can be operated simultaneously without interference and at greater distances.



Dr. Nikola Tesla, Well-Known Radio Inventor, Who Predicts Great Possibilities for the Future of Radio.

The compactness of the transmitter will greatly facilitate its installment, so much so, indeed, that I look confidently to the time when all leading newspapers and large institutions of business will possess equipment enabling them to communicate with any part of the world.

Newspapers, for instance, could maintain their own transmission plants, which could be used not merely for broadcasting news bulletins as an auxiliary service to their printed editions, but for gathering reports from their correspondents; and business concerns could have their own private systems by which they could have direct communication with their agents and customers everywhere.

Question: You have established the fact that electrical energy can be transmitted without wires—how soon will it be possible to carry on such transmission on an industrial scale?

MR. TESLA: I have been confident, ever since I gave the outline of my wireless system in scientific lectures delivered in 1893, that power could be transmitted without wires, and that ultimately we would establish plants for such transmission on an industrial scale. But it was not until 1899 that I obtained absolute experimental evidence that this could be done in a manner far more perfect than I had dreamed of before. Ever since that time I have devoted a large portion of my energy to the design and construction of the devices to be used for the purpose.

I am now prepared to undertake the construction of a wireless power plant which will transmit energy to any point in the world, however distant, with a loss not exceeding five per cent.

Such a plant would have been erected long ago if the profession (engineering) had been prepared for it. But, as a matter of fact, a great many engineers are in doubt as regards the possibility of this achievement, and yet it is as with everything else, very easy when you know how.

Question: How will wireless transmission of energy affect the present machinery of industry?

MR. TESLA: It must be remembered that commercial enterprises always will be governed by economic principles. To illustrate: If it costs less to propel an airship by fuel than it would if wireless energy were employed, then fuel will be used and wireless energy will be looked upon as a luxury.

The history of invention proves that new developments always take place along the lines of least resistance and that invariably time is given for the adjustment of existing conditions.

I have studied the subject deeply for many years and believe that the chief future of wireless power, for some time, at least, lies in the use of small quantities of energy in places which are inaccessible. I should think that an advance of this character can only be helpful, then, in the development of all branches of industry.

But, if my plans mature and turn out as I hope, aerial navigation will take enormous strides in advance, for it will be possible for the machines to be operated without carrying stored energy, which limits their cruising radius. It stands to reason that their carrying capacity and speed will be increased when wireless power becomes available. Of the two types of aircraft, the heavier-than-air and dirigible balloon, the latter will be more suitable for this new method of propulsion.

In certain other fields wireless transmission undoubtedly will prove revolutionary. For instance, when it is desired to light an isolated dwelling, more or less remote from centralized communities, this method will prove ideal, for a house can be equipped with a small and very compact apparatus at a ridiculously moderate price.

Suppose, too, that a man goes to the Adirondacks on a camping expedition. He supplies himself with the necessary receiving

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Short-Wave Directional Wireless Telegraphy

The Radio Lighthouse of the Future

By C. S. FRANKLIN

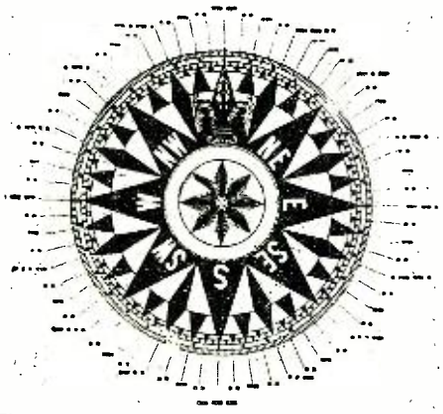


Fig. 5. The Revolving Reflector Transmits Radio Waves in the Same Manner As a Lighthouse Sends Out a Revolving Beam of Light. The Signals Above Are Transmitted Every Half Point of the Compass.

DIRECTIONAL wireless telegraphy is as old as the art itself, for Hertz made use of reflectors at the transmitting as well as the receiving ends in order to augment the effects, and to prove that the electric waves which he had discovered, obeyed, to a considerable degree, the ordinary optical laws of reflection. Senatore Marconi in his earliest endeavors to develop a telegraph system using electric waves, also employed reflectors to increase the range and get directional working.

The discovery by Marconi of the great increase of range obtained by the use of longer waves, and the earthed vertical aerial, practically stopped development on directional lines for the time being. The demand of the time was for increased ranges; and as the first practical application of wireless telegraphy, namely, working to and between ships, required "all round" working, there was very little call for directional systems.

Today the range has arrived at the maximum possible on the earth, and the wave-length has increased to such an extent that the frequencies proposed are within or near to the limits of audibility. The possible gamut of wave-lengths is becoming very fully occupied, and although the development, during the past four years, of nearly pure continuous wave transmitters and of receivers with vastly improved selective powers has eased the problem, the time will soon arrive when practically the only way of increasing the number of possible services will be by employing systems having good directional characteristics.

There are, broadly, two general classes of directional aerial systems:

A. Those having the general characteristic that their directional power or polar curves are nearly independent of their dimensions. The directional result is obtained by opposing the effects of a number of aerials, or parts of an aerial with suitable phasing adjustments; the degree of opposition being a function of the direction. Systems of this class may be made small compared with the wave length employed: for the purposes of position finding, and as receiving systems enabling interference to be eliminated from several directions, they have already been developed to a considerable degree. The simplest example of this class is the well-known frame aerial. By employing a sufficient number of aerials the system may, theoretically, be given any desired sharpness of directional power without making the dimensions large; this can, however, only be done with a large sacrifice of receiving or radiating power.

B. Those having the general characteristic that their directional power or polar curves depend on their dimensions relative to the wave-length employed. In this class the directional result is obtained by adding the effect of a number of aerials, or parts of an aerial, when working in the required direction. The underlying principle is that the effects, for the required direction, are integrated over a wide front in proportion to the wave length. Such systems can, therefore, only have small dimensions when using short waves, and this fact makes their development difficult.

As examples of such systems may be mentioned—

(1) Reflector systems in general.

(2) Systems composed of lines of aerials, at right angles to the working direction, correctly adjusted as regards phase. In this may be included the Alexanderson long aerial with its feeders.

(3) The Beverage long, horizontal receiving aerials. This aerial and equivalent arrangements form a class by themselves, but have the characteristic that the directional power is a function of the dimensions.

The reflector system was the first one that was tried for wireless telegraphy; it has been considered by several investigators, but very little research work on such systems has yet been published. Useful research work on these lines is not easy; the use of reflectors of reasonable dimensions implies very short waves of the order of a few meters. The very high attenuation of such waves over land or sea, and the difficulty of getting much power into them, tended to make early attempts very discouraging.

In this paper it is proposed to give some results of investigations made with reflectors and wave-lengths below 20 meters. It is also hoped to be able to give a demonstration with a continuous wave valve transmitter furnishing approximately a 1-meter wave, and a reflector having a 2-wave length aperture, so that some idea can be got of the order of the directional effect or beam obtained.

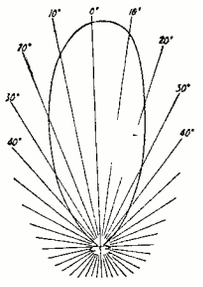
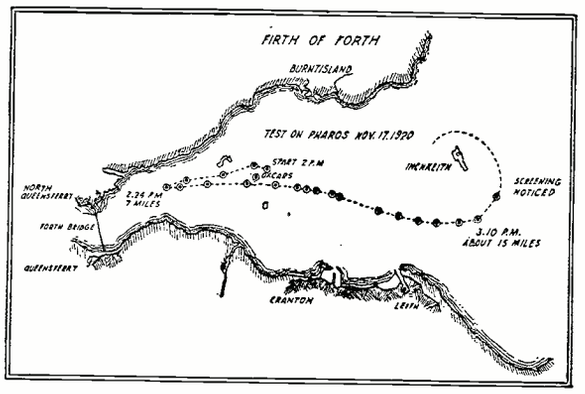


Fig. 2. To the Left Is the Polar Curve of the Reflector at Hendon Where Tests Were Conducted.

Fig. 3. Below is Shown Course taken by S.S. Pharos in Tests with Revolving Reflector at Inchkeith



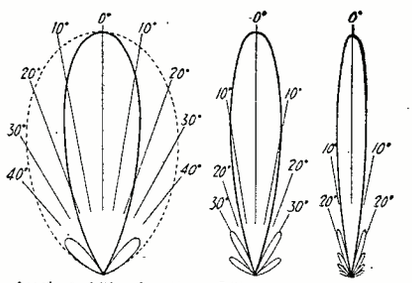


Fig. 1. The Transmitting Effects of Different Reflectors Were Studied With a Receiver and These Curves Obtained.

The investigation was commenced by Senatore Marconi in Italy in 1916, with the idea of developing the use of very short waves, combined with reflectors, for certain war purposes. The author assisted him there, and it was very interesting work, as it was like being back in the very early days of wireless when one had a perfectly clear field.

The waves used were two meters and three meters. The only interference experienced with such waves is from motor boats and motor cars. These machines apparently emit waves from near 0 up to 40 meters in length, and the day may come when they will have to have their ignition systems screened, as on some aeroplanes, or carry a post-office license for transmitting. Incidentally, if some of the motorists were to listen to the irregularity of their ignition they would have a fit. At Senatore Marconi's suggestion a coupled-circuit spark transmitter was developed, the primary having an air condenser and spark in compressed air. By this means a modern amount of energy was obtained, and the small spark-gap in compressed air proved to have very low resistance. The decrement of waves emitted was judged to be of the order of 0.03.

The receiver used was a carefully picked crystal, while the reflectors employed were made of a number of strips or wires tuned to the wave, arranged on a cylindrical parabola with the aerial at the focus. The transmitting system was arranged so that it could be revolved and the effects studied at the receiver.

Assuming that the waves leave the reflector as plane waves of uniform intensity, having a width equal to the aperture of the reflector, it is not difficult to calculate the polar curves of radiation in the horizontal plane, which should be ob-

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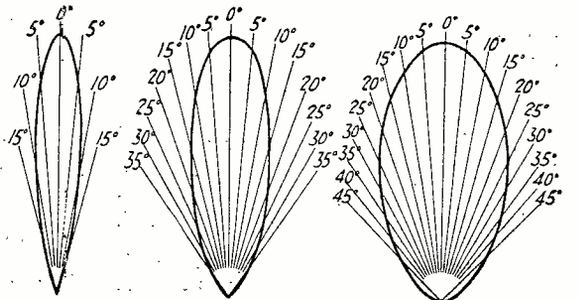


Fig. 4. Polar Curves Taken with New Reflector at Inchkeith. The Directional Effect Is Evident and Is Much Sharper with a Larger Aperture.

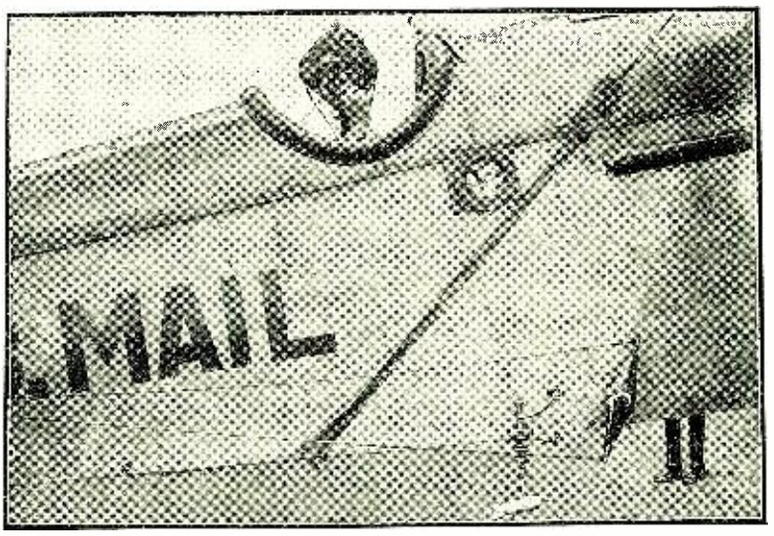
Fishing in Ponds of Electromagnetic Waves

By S. R. WINTERS

THE contemplated introduction of the carriage of the United States mail at night by aircraft further contributes to the constantly expanding uses of the radio-telephone. This swift medium of communication will be applied on mail-carrying airplanes whose course after nightfall will be more or less charted by radio-telephone stations located on the ground. The positions, landing conditions, and whether fair or foggy weather is in prospect, will be indicated to the air-going machines, with their postal burdens, from the network of 15 air-mail radio stations already being maintained by the United States Post Office Department.

Out at Bolling Field, Washington, D. C., the units of aircraft that will be introduced to night flying in the spring of 1923, as transports of postal matter, are being subjected to experimental installations of wireless apparatus. The duplex communication system will be employed—both the transmission and reception of radio-telephone messages being possible from airplanes for a radius of 100 miles or more. The 15 radio-telegraph stations, located between New York and San Francisco, maintained by the United States Post Office Department, obviously, will have to be provided with radio-telephone sets if this contemplated service goes into effect. The station in the National Capital has for some time maintained a radio-telephone for broadcasting service.

Compactness is one of the prerequisites of the duplex system of communication on aircraft. Toward that end, Government wireless experts and manufacturers of radio equipment are contributing their earnest thought. The antenna system takes its copy from existing radio-telephone installations on airplanes. A trailing antenna is employed, which ordinarily consists of a 4′ length of cord fastened to a reel at one end and secured at the other end to a 290′ length of wire. The latter, at its free end, is spliced to a 10′ length of hemp center phosphor bronze wire, having a lead weight resembling a fish at the end. The likeness of this piece of lead to a member of the finny tribe is responsible for this vein of humor from the press service of the Government Bureau:



The United States mail will be conveyed at night by the aerial mail service. Their position and route will be directed by Radio. The fish-like weight of the trailing antenna is shown in this photo.

"If the Post Office Department adopts night flying, its air mail planes will go trolling very often with a bait in the shape of a little lead fish on the end of a 300′ copper line. The air mail planes will not catch fish, but they do expect to fish ether waves from the air which will tell them where they are or whether there is a storm raging over the field on which they are due to land."

The radio amateur, who this past summer may have taken his receiving set and loop antenna aboard a canoe, and used artificial bait on his fishing hook for luring the finny tribe, will appreciate the subtle humor of the wit who would liken casting for fish to that of fishing for electromagnetic waves in the limitless "electric pond."

High-frequency electric currents for the operation of the radio-telephone will be generated by a fan-driven generator. The latter,

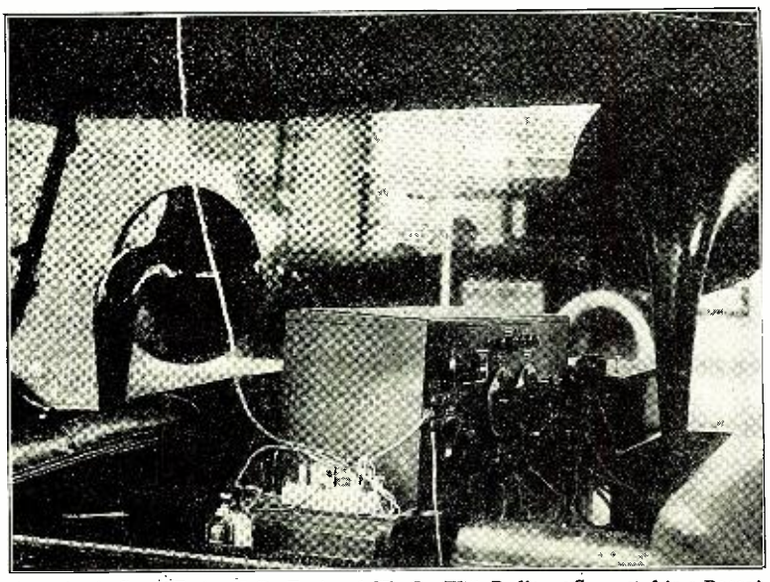
(*Continued on page* 1003)

Motorized Radio

By JAMES J. LAMB, A. I. E. E.

ALONG the lines suggested in the article which appeared in the July issue of RADIO NEWS, entitled "The Radio Car," a dealer in Grand Forks, North Dakota, had a Dodge car completely equipped with a radio receiving set as a stunt during the Grand Forks fair. The car was equipped under the direction of the firm's radio engineer, particular attention being paid the antenna, which was made up in the form of a flat loop, and contained in all 60 feet of stranded copper wire. The radio equipment proper consisted of a standard two-circuit tuner with detector and two-stage amplifier, a three-stage power amplifier and two loud speakers. The body of the car was used as a counterpoise, and proved very effective. The receiver was mounted on a shock-absorbing stand in the tonneau of the car, making it possible for the operator to sit in comfort while manipulating the set.

A local amateur 10-watter furnished the music and served as the transmitter for several novel stunts. One of these was an address made to the old Settlers of the county at their annual meeting by Judge Sullivan, the meeting being at the Fair Grounds, some five miles from the transmitter. The speech was received on the car equipment and reproduced on the loud speakers with sufficient volume to be heard several hundred feet from the car. Mr. Haney, of the International Harvester Company, also made a speech to the farmer boys encamped at the fair, making his debut as a radio orator.



A Dealer in Grand Forks, N. D., Equipped His Car With Radio, as Suggested in a Recent Issue of Radio News, and Obtained Excellent Results.

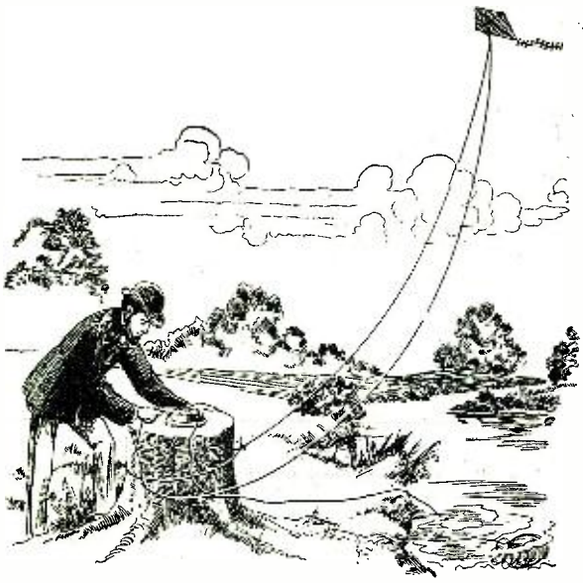
A number of radio concerts were given both about the streets of the city and the fair, the music being picked up while the car was running. In this connection a number of interesting phenomena were noted. The directional effect of the antenna was found to be very marked, the signals coming in with maximum intensity when the car was at right angles to the transmitter, facing towards, or away from the transmitter, and reaching a minimum at certain oblique angles. In making a 180° turn, there were two positions at which the signals were entirely lost.

Very pronounced absorption and wave distortion effects were noted in the neighborhood of certain structures, as well as when a passing trolley car altered the effective length of the trolley wire.

A light truck is now being permanently equipped with a demonstration set, so that in the near future it will be no uncommon sight to see the Radio Car threading the prairie roads of Dakota, and bringing the wonders of radio into even the most remote districts.

The Story of Mahlon Loomis Pioneer of Radio

By S. R. WINTERS



Copies of the Drawings Which Appeared in the Patent Papers of Mahlon Loomis. Left: Static Electricity Induced in an Elevated Wire Caused an Electrical Discharge. Right: At the Receiving End the Electrical Discharge Induced a Smaller Current in the Wire and Deflected a Galvanometer. Loomis Had Some Interesting and Visionary Theories of the Reasons for This Phenomenon.

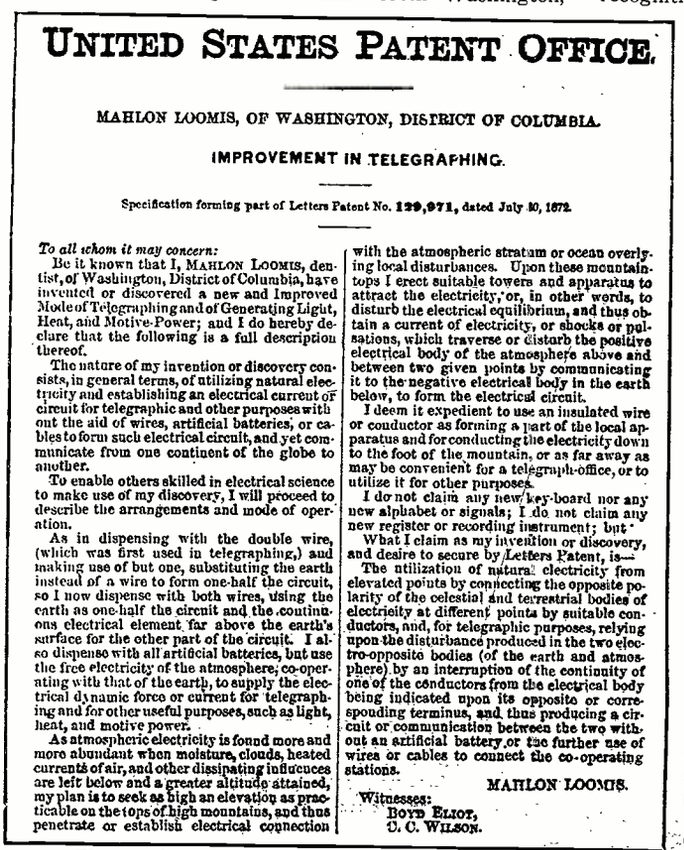
BLACK FRIDAY"—the ruinous Wall Street panic of 1868—the devastating fire of Chicago in 1871, and a Congress not kindly disposed towards an untried project, were an overwhelming series of untoward circumstances which probably delayed the benefits of radio-telegraphy for 30 years. For it was before the birth of Guglielmo Marconi, who successfully transmitted the first commercial communication by electromagnetic waves, and 32 years before he performed his masterly feat of sending a wireless message over a distance of nine miles, that Mahlon Loomis, a dentist of Washington, District of Columbia, had built an aerial in the Blue Ridge Mountains of Virginia for the transmission of communications in the absence of wires.

And, may it be said at the outset of this article, that this is no attempt to "rob Peter to pay Paul" with respect to the honors that have already been bestowed on the pioneers who have made possible the practical realization of the wonders of wireless waves. It is neither an effort to deprive of credit those to whom recognition has already been generously accorded, nor an attempt to challenge the cause of a scientist to whom the world has not seen fit to extend lavish and enduring recognition. The burden of this narrative, however, is concerned with a recording of the facts of the life and experiments of an American pioneer in the field of communication through space without the use of conventional telegraph wires. The basis for the data incorporated in this manuscript are printed records, frequently fragmentary to be sure, found in the Patent Office, Library of Congress, Smithsonian Institution, and the personal effects of the subject in the possession of his descendants.

The story of Mahlon Loomis, apart from his pioneering experiments to maintain intelligence between two mountain peaks and eventually between continents thousands of miles removed, is as gripping in events of romance and tragedy as any pages of fiction. He was born in Fulton County, New York, in 1826, one of a family of nine children. His father was Professor Nathan Loomis, a graduate of Amherst College, and one of the founders of the American Ephemeris and Nautical Almanac. A family of teachers, scientists, and literary lights—was that of Mahlon Loomis. When only ten years old, with his parents he moved to Springvale, a point 20 miles from Washington, D. C. Recorded knowledge of his early predilections and educational training is scant. Correspondence from a friend, however, reveals the fact that he taught school as a means of obtaining funds with which to study for his profession as a dentist, having attended a dental school in Cleveland, Ohio. He established dental offices at the corner of Ninth Street and Pennsylvania Avenue, Washington, D. C. His noteworthy contribution to dentistry was the invention of a plate for containing false teeth, in recognition of the value of which Queen Victoria of England conferred a medal expressing the sentiment that "it is of great benefit to mankind." The "Loomis False Teeth Plate" continues in existence.

The inspiring incentive, or exact year of occurrence, which prompted Mahlon Loomis to divert his attention and energies from the prosaic job of pulling teeth to that of delving into the then purely speculative realms of wireless telegraphy has not been definitely established. However, as early as 1865, when he was 39 years old, fragmentary evidence is to be found in the Library of Congress that he built a kind of radio-telegraph antenna. The more or less crude device for the reception and imparting of electric energy took the form of a kite aerial—probably the first ever constructed in the world. A. T. Story, an English author, in his book "Story of Wireless Telegraphy," published in 1904, avers that "with this scheme of Mahlon Loomis we first hear of the application of vertical conductors or antennae, as they are sometimes called, for the transmission of signals to a great distance." The same writer credits the Washington dentist with "the idea of utilizing electricity for the purpose of establishing electrical communication between distant places."

The original antenna which today is essential in the transmission and reception of electromagnetic waves whether in form of a



UNITED STATES PATENT OFFICE.

MAHLON LOOMIS, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN TELEGRAPHING.

Specification forming part of Letters Patent No. 129,971, dated July 30, 1872.

To all whom it may concern:

Be it known that I, MAHLON LOOMIS, dentist, of Washington, District of Columbia, have invented or discovered a new and Improved Mode of Telegraphing and of Generating Light, Heat, and Motive-Power; and I do hereby declare that the following is a full description thereof.

The nature of my invention or discovery consists, in general terms, of utilizing natural electricity and establishing an electrical current or circuit for telegraphic and other purposes without the aid of wires, artificial batteries, or cables to form such electrical circuit, and yet communicate from one continent of the globe to another.

To enable others skilled in electrical science to make use of my discovery, I will proceed to describe the arrangements and mode of operation.

As in dispensing with the double wire, (which was first used in telegraphing,) and making use of but one, substituting the earth instead of a wire to form one-half the circuit, so I now dispense with both wires, using the earth as one-half the circuit and the continuous electrical element far above the earth's surface for the other part of the circuit. I also dispense with all artificial batteries, but use the free electricity of the atmosphere, co-operating with that of the earth, to supply the electrical dynamic force or current for telegraphing and for other useful purposes, such as light, heat, and motive power.

As atmospheric electricity is found more and more abundant when moisture, clouds, heated currents of air, and other dissipating influences are left below and a greater altitude attained, my plan is to seek as high an elevation as practicable on the tops of high mountains, and thus penetrate or establish electrical connection with the atmospheric stratum or ocean overlying local disturbances. Upon these mountain-tops I erect suitable towers and apparatus to attract the electricity, or, in other words, to disturb the electrical equilibrium, and thus obtain a current of electricity, or shocks or pulsations, which traverse or disturb the positive electrical body of the atmosphere above and between two given points by communicating it to the negative electrical body in the earth below, to form the electrical circuit.

I deem it expedient to use an insulated wire or conductor as forming a part of the local apparatus and for conducting the electricity down to the foot of the mountain, or as far away as may be convenient for a telegraph-office, or to utilize it for other purposes.

I do not claim any new key-board nor any new alphabet or signals; I do not claim any new register or recording instrument; but

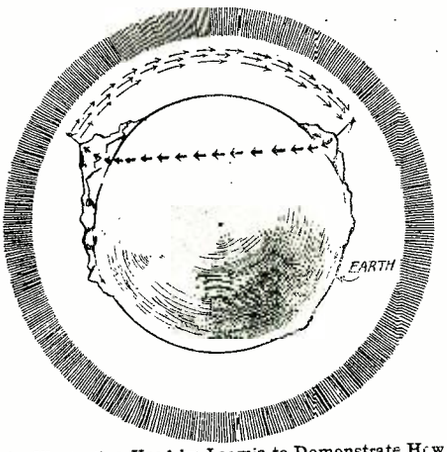
What I claim as my invention or discovery, and desire to secure by Letters Patent, is—

The utilization of natural electricity from elevated points by connecting the opposite polarity of the celestial and terrestrial bodies of electricity at different points by suitable conductors, and, for telegraphic purposes, relying upon the disturbance produced in the two electro-opposite bodies (of the earth and atmosphere) by an interruption of the continuity of one of the conductors from the electrical body being indicated upon its opposite or corresponding terminus, and thus producing a circuit or communication between the two without an artificial battery, or the further use of wires or cables to connect the co-operating stations.

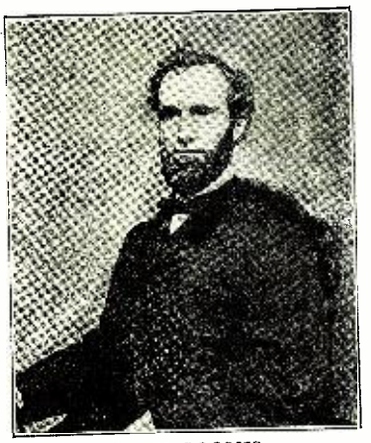
MAHLON LOOMIS.

Witnesses:
BOYD ELIOT,
D. C. WILSON.

Photograph of the Original Patent Issued to Mahlon Loomis, the Pioneer of Radio.



An Illustration Used by Loomis to Demonstrate How Communication Between Distant Points Would Be Possible. He Believed the Electricity in Air Surrounded the Globe and Extended to the Limit of the Atmosphere Beyond Which Was Vacuum.

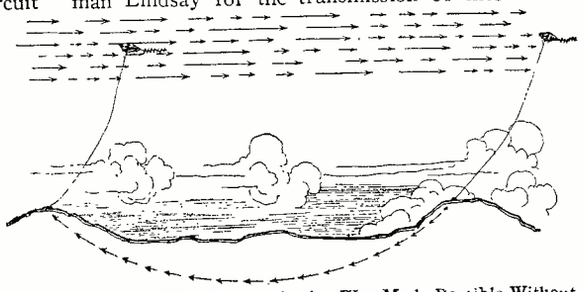


DR. M. LOOMIS

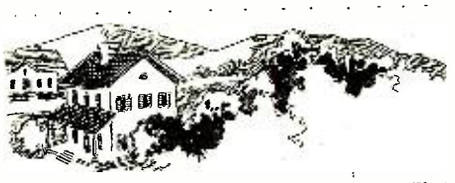
towering device or a "loop" or "coil" which may be carried in a suit-case, was designed and installed 57 years ago, if we are to attach credence to the dust-laden documents found in depositories at the National Capital. The kite-like antenna, which recently has been adopted by the United States Navy Department as emergency aerials on seaplanes, in this trail-blazing experiment of Mahlon Loomis merely consisted of kites covered with fine gauze wire of copper, held with an extremely delicate string or tether of the same material, the lower end of which formed connection with the ground by lying in a coil in a pool of water. Two galvanometers were in circuit connection at the two different elevated points on the Blue Ridge Mountains, 14 miles apart, and it is recorded that the wireless impulse was perfect when the apparatus was finely manipulated.

As early as 1868—54 years ago—the "Loomis Aerial Telegraph Bill" was introduced in the United States Senate by Hon. Charles Sumner. The *Congressional Globe* (the present-day *Congressional Record*) of January 13, 1869, carries an account of the debates favorable and unfavorable to the passage of this legislative measure. The original bill contemplated the appropriation of $50,000 as a means of aiding Doctor Loomis in making practical his discovery. Congressional action was deferred from year to year; meanwhile members of Congress dubbed the inventor a 'dreamer" and his discoveries as "moonshine" and "airy nothings." Finally, in 1873, the "Loomis Aerial Telegraph Bill" was signed by President Ulysses Grant, but for some inexplicable reason not made clear by the available records, Congress failed to appropriate the $50,000 originally indicated in the measure. Efforts to enlist the financial assistance of financiers in Wall Street, New York City, were alike unsuccessful, "Black Friday," the terrible panic in 1868, wrecking any contemplated plans looking to financial aid for the project. Oddly enough, an organization of promoters founded in Chicago for the purpose of realizing the practical value of the Loomis progeny was wrecked in the devastating Chicago fire of 1871. Somebody, in reviewing this series of untoward events, voices the viewpoint "That the 'fortuitous concurrence of circumstances' ordained—that all of his plans should come to naught—that not he, but another, should reap the rewards of his patient researches."

A one-page leaflet, minus the customary diagrams or sketches accompanying an invention, in the files of the United States Patent Office is probably the most conclusive and enduring testimony to the pioneering investigations of Mahlon Loomis in the field of wireless telegraphy. It is the first letters patent issued in this country relating to the art of radio-telegraphy, and, with the exception of a patent granted to James Bowman Lindsay for the transmission of messages over short distances by aid of artificial batteries near Dundee, Scotland, has priority the world over. Bearing the title, "Improvement in Telegraphing," this letters patent is numbered 129,971, and was dated July 30, 1872. The absence of a means for generating high-frequency currents in this invention of half a century ago is considered by wireless authorities as its outstanding weakness and a fault which deprived the subject of this article as being the inventor of the system of wireless telegraphy as we know it today. Adherents who would contend that this Washington dentist was the real pioneer in this field of rapid communication contend that if Congress had accorded support to his project, he would have developed a generator, so essential in the propagation of electric disturbance, as a means of conveying messages through space over long distances.



Loomis Believed That Communication Was Made Possible Without Wires Through the Strata of Electricity and Returning Through Earth. The Arrows Show His Conception of the Circuit That Was Formed.



This Pioneer of Radio Propounded the Theory That Electricity Existed in the Form of Strata, Increasing in Density as It Neared the Limit of the Atmosphere.

The Loomis Letters Patent No. 129,971, "Improvement in Telegraphing," was issued 16 years in advance of the announcement of Professor Heinrich Hertz of Karlsruhe, Germany, that he had produced, detected, and measured electric waves propagated through space, by which are conveyed radio-telegraph and radio-telephone communications. Inquiries to friends of Mahlon Loomis seeking information as to whether or not Doctor Loomis in the transmission of messages over distances ranging from 11 to 20 miles employed "Hertzian waves," are responded to with a counter inquiry, "If they were not electromagnetic waves what could they have been?" The original patent, which for the first time contemplates dispensing with wires and cables in the transmission of communications through space, bears reproduction in its entirety.

The experiments of Doctor Loomis were negotiated in the Blue Ridge Mountains of Virginia, scientists and other observers witnessing the then remarkable phenomena. A newspaper, published in Philadelphia, bearing the date of December 27, 1878, carries the following account: "His experiments are conducted from high hills or mountains, though he has telegraphed as far as 11 miles by having kites raised at each end of that distance, flying them with a fine copper wire instead of a string. The instant they reached the same exact altitude or got into the same current, telegraphic communication by aid of an instrument similar to the Morse instrument could be carried on as perfectly as if the two kites were connected with wires. The lowering of one kite, however, breaks off communication immediately."

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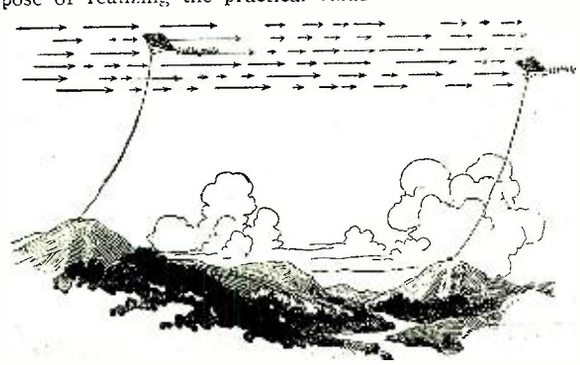
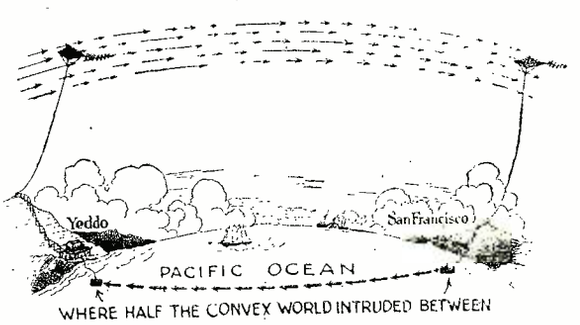


Left: Having Demonstrated the Communication of Current Without Wires, Loomis Expounded the Theory Illustrated in the Other Drawings on This Page. On the Left His Drawing Indicated That to Conform With His Theory, the Wires Must Be Erected as High as Possible. On the Right His Illustration Prophesied Transmission Across the Ocean.



Radio Messages Typed Automatically From Airplane to Ground

By S. R. WINTERS

A New Design of Teletype Recently Developed at the Bureau of Standards Which Automatically Transmits and Records Radio Messages. Below, the Complete Device Is Seen in Operation.

Photos by courtesy of the Morkrum Co., Chicago, Ill.

CHAMPION typists who now manipulate the keyboard of typewriters with incredible swiftness under the staid environments of offices may in the future qualify as speed demons when aloft in airplanes. The click of the typewriter keys may vie for supremacy with the din of noise of the magnetos of the aircraft engine. Moreover, the rapid depression of the keys of this form of printing machine may be faithfully recorded by means of radio telegraph on a printing unit in a wireless receiving station planted on the ground. Withal, this strange adventure marks the application of the mechanism now employed in the automatic transmission and reception of telegrams by the line-wire system of communication to the sending of messages by the medium of electromagnetic waves through space.

This radical departure, evidencing the constant and surprising developments in the application of radio-communication, is made possible by the adaptation of a modified form of the "Teletype," an instrument highly developed for telegraph stations in the transmission and reception of telegrams automatically. The electric impulse, however, in this instance, travels along a wire, and as the name might imply, the operator "tells it to the type" instead of some other vehicle of conveyance. It is almost human in its behavior, which habitual demonstration in land-line telegraphy probably occasioned the inquisitive scientific mind of John B. Brady, of Washington, D. C., to ponder its application to communicative purposes in the absence of wires—"space radio," to be explicit. Its service on board aircraft was only one of the several uses suggested, this application being given priority and prominence of mention in this article by reason of its spectacular tendency. The interchange of messages between two points on land, intercommunication between sea-faring vessels and between ships and shore, are among the potential services indicated when the "Teletype" and Hertzian waves form a unity of purpose.

The counsel and practical assistance of a formidable array of radio-engineering and mechanical talent was enlisted for the negotiation of the trail-blazing experiments, which have been conducted intermittently for a period extending over a year or more. The Morkrum Company of Chicago, inventors and manufacturers of the "Teletype," was committed to the plans of the innovation and contributed the services of J. O. Carr and Ronald S. Wishart in hopes of realizing the aims of the pretentious undertaking. The personnel and resources of the Bureau of Engineering of the United States Navy Department were pledged to the ends of achieving results, despite the skepticism expressed by one or two of the members of the radio-engineering laboratories whose conservatism despaired of the success of the radical departure. Among those whose cooperation has contributed to the relative triumph of the adventure are: Commander Stanford C. Hooper, head of the Radio Division of the Bureau of Engineering; Lieutenant-Commander E. H. Loftin; John B. Brady, an officer of the Naval Reserve Force; Alfred Crossley, expert radio aide; Commander A. H. Taylor, in charge of the Naval Air Station at Anacostia; Dr. L. W. Austin, head of the Radio Research Laboratory of the Navy Department; Dr. John M. Miller; Lieutenant H. W. Kitchen; L. C. Young; C. B. Mirick; and Messrs. Meyers and Judson.

The initial experiments were negotiated between the Radio Research Laboratory of the Navy Department, located at the Bureau of Standards, and the Naval Aircraft Station at Anacostia—approximately eight miles intervening. The "Teletype" for these tests

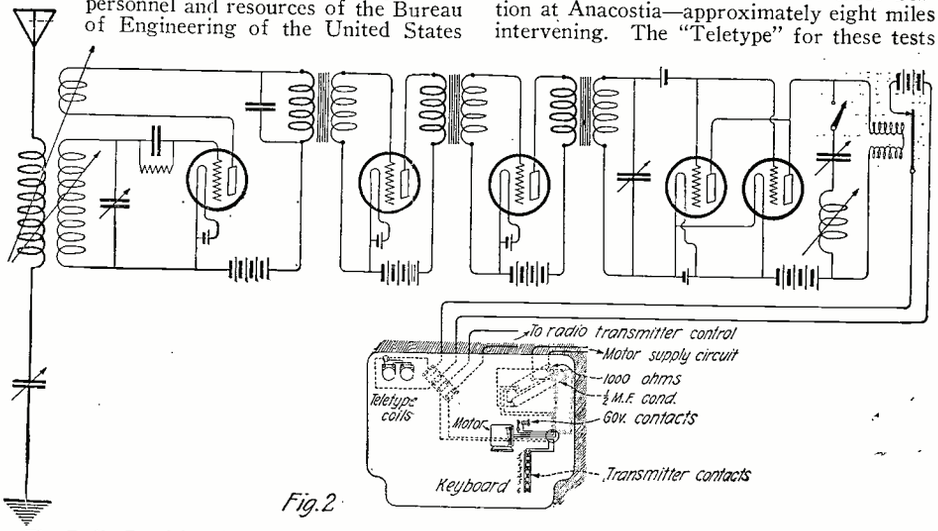


Fig. 2

The Radio Receiving System at the Bureau of Standards With the Connections for the Teletype to Permit Automatic Reception.

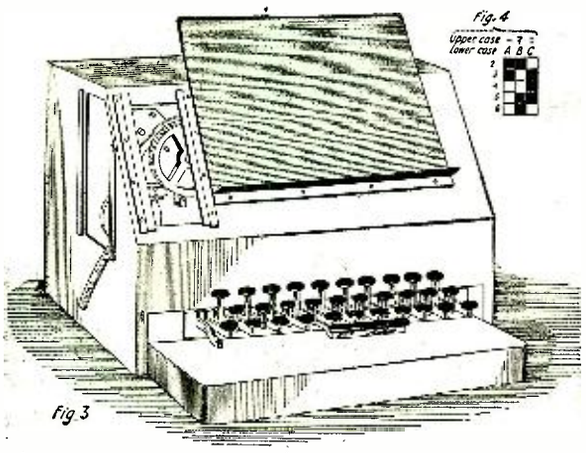
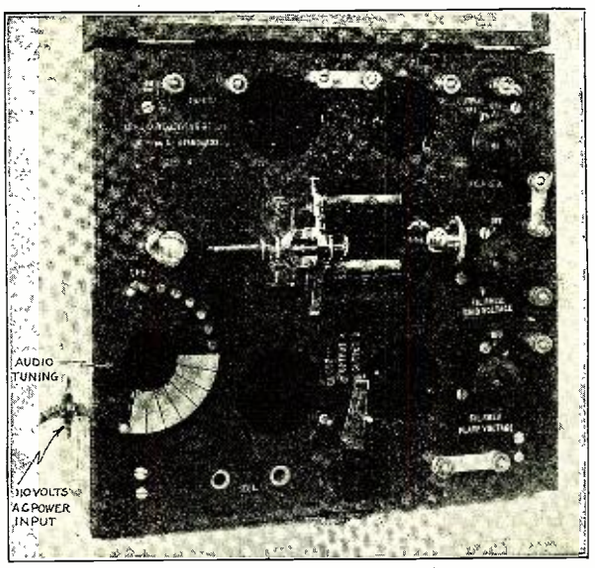
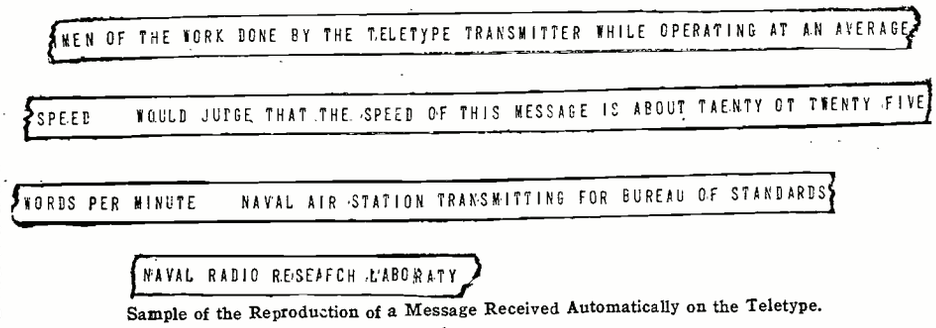


Fig. 3

The keyboard of the Teletype operates levers which control the opening and closing of contacts. Each letter is represented by a certain number of closings and spacings. On the right is the special relay used at the receiving stations.



was loaned to the Government by J. O. Carr and Ronald S. Wishart, respectively manager and assistant manager of the Sales Engineering Department of the Morkrum Company. The ultimate objective was to transmit wireless signals by manipulation of a keyboard bearing striking similarity to that of a typewriter, through space, for a distance of several miles in such a trustworthy manner that they might be faithfully recorded automatically at the radio-receiving station. The first attempt at communication in this way resulted in the jotting down of an unintelligible jumble of representations, which resembled more closely Chinese signs than the English language. Success was not despaired of since patience never ceases to be a virtue with scientists in their explorations to unfold new truths and clothe old principles in fresh garb. A series of efforts to effect intelligible communication by the strange combination of the "Teletype" and the "ether waves" brought order out of a baffling confusion, to employ a figure of speech. A speed of 45 words a minute was attained, in the transmission and reception of communications, without errors. The specimen of message transmitted from the Bureau of Standards and received at the Naval Air Station at Anacostia, exhibited as Fig. 5 in the group of illustrations herewith reproduced, substantiates the claim advanced.



Sample of the Reproduction of a Message Received Automatically on the Teletype.

The Morkrum Company loaned to the United States Navy Department a set of "Teletypes," an inventive product jointly realized by Charles L. and Howard L. Krum. Briefly, as applied to the communication system founded by Bandot, the "Teletype" is an automatic transmitting and receiving mechanism for dispatching messages over telegraph wires and setting down the signals at a distant receiving station. The apparatus comprises a base scarcely larger than that of a standard typewriter, and contains a keyboard closely resembling the office utility referred to. A set of transmitting contacts are mounted on a unit driven by an electric motor whose source of supply may be either 110 volts of direct or alternating current.

The design of "Teletype" employed on aircraft derived its electric power from a 6-volt storage battery, the unit of power commonly used in radio-telephone receiving outfits for lighting the filament of the electron tube, or "King Electron," as one radio engineer is wont to dignify the importance of this electric unit. The base of this automatic device likewise supports a discriminating or selective printing mechanism, operated by the same motor previously referred to and controlled by a pair of armature coils. The latter are actuated by incoming wireless signals as a means of setting in motion the selective mechanism by which the radio signals are recorded in printed form. One complete "Teletype" was assigned for service at the Radio Research Laboratory of the Navy Department, located at the Bureau of Standards, while another set was sent to the Naval Air Station at Anacostia.

The "Teletype" was connected to the radio-transmitting apparatus, as illustrated in Fig. 1. When the keys on the keyboard of the former instrument were depressed, the effect produced was that of modulating the electron tube of the wireless transmitter, causing the going forth of impulses of energy from the radio-communication system. The keyboard, shown in Fig. 3 of the group of diagrams, is provided with a standard set of key-levers pivotally mounted within the base of the "Teletype." A group of five horizontal selector bars is arranged within the latter automatic printing device, equipped with cam faces in such a fashion that the depression of a particular key results in the cam engagement with individual bars, pushing them laterally to control the position of locking latches. These, in turn, hook over a set of goose-neck levers, picturesquely described. The levers control the opening and closing of contacts, and are, in turn, manipulated by a group of differentially positioned cams, which are continuously rotated by the motor on the "Teletype." By pressing a particular key certain of the goose-neck levers release their contacts whereby the cams in their rotation cause the closing of the radio-transmitting circuit in a sequence of impulses.

The wireless transmitting circuit may be completed through the grid circuits of the electron-tubes, as described in Fig. 1. Oscillations may be started and stopped, as well as impulses of electric energy released from the antenna, in a sequence corresponding to the particular key depressed. Differing radically from other systems of communication is the innovation of employing an impulse code possessing five units to each character. This mode of transmission is obviously at variance with the dot and dash code, commonly employed by telegraphers. For instance, the letter "a," shown in Fig. 4, may be represented by two circuit closings and three spaces, governed by the releasing of the goose-neck levers on the "Teletype."

When flung into space, consigned to the increasing burdens of the electro-magnetic waves, these impulses of electric energy may be "picked up" at receiving points and automatically printed by a receiving "Teletype." A peculiar virtue by reason of the novel combination of the latter instrument with that of the "wonderful wireless waves" is the possibility of the secrecy enveloping the transmission and reception of radio communications. This desirable feature may be accomplished by providing the communicative system with several different types of wheels for use on the printer, and at the same time making provision for a supply of removable rubber caps on the keyboard to correspond with the types of wheels employed.

The radio receiving station, in operation at the Bureau of Standards, is represented in Fig. 2 of the series of schematic diagrams. Continuous-wave transmission was

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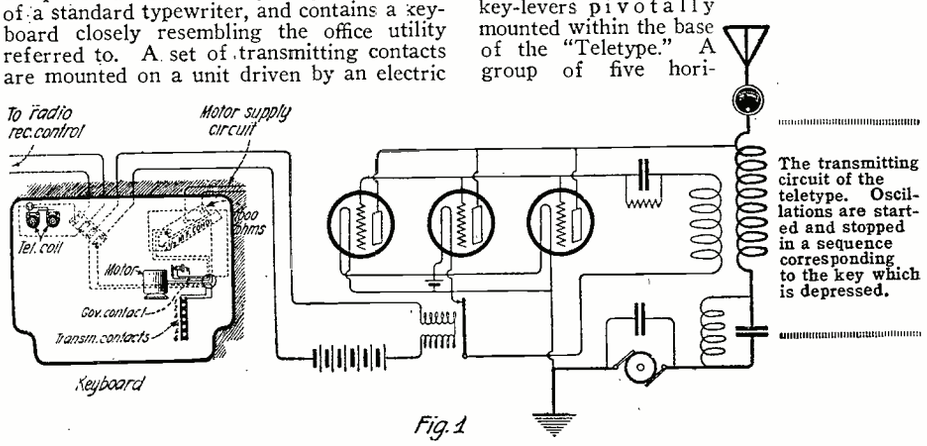


The transmitting circuit of the teletype. Oscillations are started and stopped in a sequence corresponding to the key which is depressed.

Fig. 1

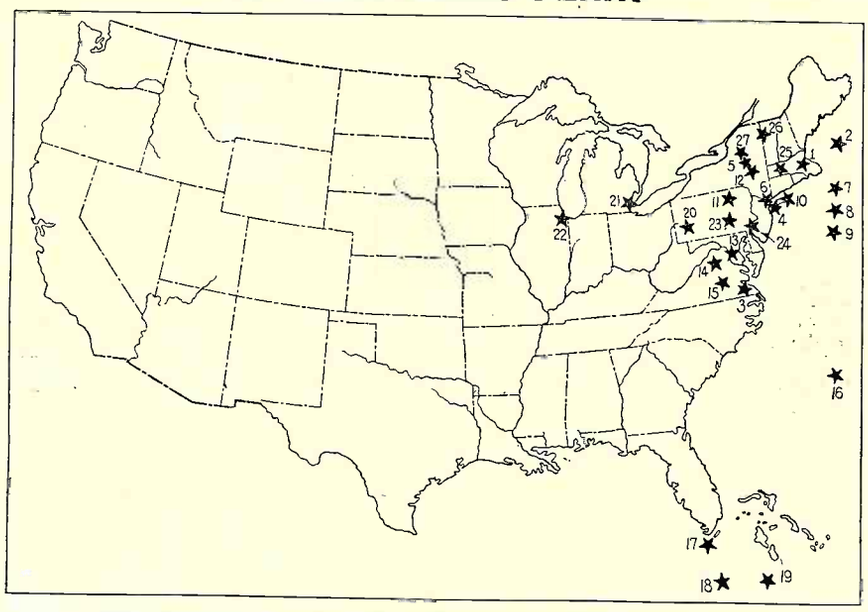
Start a Radio Chart and Double the Fun of the Game

By ARMSTRONG PERRY

THE least enjoyable part of an experience is the having of it. While it is happening there is often some irritating distraction, some fly in the ointment. It rains at a critical moment, or the new moustache makes an impression exactly contrary to what was expected, or something. Anticipation usually is longer and often keener than participation. But the part of a good time that you can have whenever and wherever you wish, if you have preserved it, is Memory. That is why I keep a radio chart whereon I place a star to mark each unusual radio experience.

The first star is at Salem, Massachusetts. That is where I lived, working on the site where Alexander Graham Bell perfected his telephone, when Marconi received his first transatlantic radio signals. The members of the Y. M. C. A. Boys' Department over which I presided were among the first to get excited about the new invention, and before long we had a wireless club.

An inventor named Brown had a laboratory just off Town House Square. He used to explain his electrical apparatus to me, including a raido receiver that he invented which was carried by the United States battleship fleet that circumnavigated the globe in 1908. Salem used to have an enormous bonfire on Gallows Hill the night before the Fourth and one of the largest of the immense crowds that came from all parts of the country to see it was drawn by Brown's stunt of lighting a pile of ties and barrels by radio.



EXPLANATION OF STARS ON ARMSTRONG PERRY'S RADIO CHART

1. Salem, Mass. Learned of Marconi's successful transatlantic test, 1901. Started radio club.
2. Trip to Europe on Cunarder "Ivernia," 1908, working in ship's print shop and keeping in touch with radio cabin.
3. Visit to Portsmouth Navy Yard. Listened to radio traffic.
4. Brooklyn, N. Y. Started radio club.
5. Boy Scout Camp, Palisades Interstate Park. Radio instruction from Marconi man.
6. New York City. Radio course at Y. M. C. A.
7. Trip to France on Transport "Walter A. Luckenbach."
8. Trip to France on Transport "Tiger."
9. Trip to England with Boy Scout Jamboree Delegation on Transport "Pocahontas," returning via Belgium and France on Transport "Princess Matoika."
10. Douglaston, N. Y. My first station.
11. My first vacuum tube set. New York City.
12. Canton, Pa. Started scouts on radio and demonstrated at high school.
13. Washington. Visited Government stations, had receiver in my room, and listened daily to all sorts of traffic and programs.
14. Waterford, Va. With temporary hook-up demonstrated Government time signal service for high school teacher.
15. Harrisonburg, Va. Listened to WGY, Schenectady, and learned of efficient methods of local radio dealer.
16. Bermuda. Heard occasionally in New York.
17. Navy station Key West. Heard in New York.
18. Santiago, Cuba. Heard in New York.
19. Cayey, Porto Rico. Heard in New York.
20. KDKA, Pittsburgh. Heard in many places.
21. WWJ, Detroit. Heard in several places.
22. KYW, Chicago. Also Great Lakes Navy Station. Heard occasionally.
23. Harrisburg, Pa. Interested Regional Scout Executive in radio and later inspected his station.
24. Chester, Pa. Interested Scout Executive in radio and later inspected his station.
25. Listened in at scout's station at Mohawk Village, Eastern States Exposition.
26. Visited University of Vermont station at Burlington.
27. WGY, Schenectady, heard in many places.

Many of the stars cover experiences too numerous to mention. The one at Salem covers Boston's Navy station and WGI at Medford Hillside, which have been listened to many times. Radio experiences around New York and Washington are too numerous to mention.

It was from Salem that I started on my first trip to Europe, in 1908. The Cunarder *Ivernia* on which I sailed from Boston was radio-equipped. By cultivating the deck steward I obtained an introduction to the ship's printer. This was a somewhat circuitous rout to the radio cabin which could not be approached directly by second-class passengers like me, but it was the best I could think of. Having been a printer in my earlier days I had no difficulty in getting on good terms with the setter of type and kicker of the press. As I had been sticking type in a French newspaper office at odd times for two years to acquire a working knowledge of the language of Paris, my hand was in. I set up the bills of fare in three languages and—what I was fishing for—the daily news received by radio and printed in a little sheet for circulation among the passengers.

One of the first pieces of copy that came down from "Sparks" had me guessing. It was an item saying: "The *Ivernia* got in touch with the Company's ship *Lusitania* at 4 p. m. yesterday and remained in communication twenty-

(*Continued on page* 926)

Does the Public Expect Too Much of Radio?

By HOWARD S. PYLE, R. E.*

ON a recent trip through northern Ohio and along the shores of Lake Erie, the writer gathered an impression which has since been growing steadily. This is in effect that the public expects too much of radio. Whether this condition is due to the dealer, or the various new publications which have entered the field, or to some other source, is problematical, but doubtless all have contributed their share to cause this regrettable condition.

The writer traveled in a radio-equipped touring car, and whenever we parked on any prominent street a small crowd soon gathered. Of course, we were questioned as to how far we could pick up signals, etc., and upon informing our questioners that we have plainly heard broadcasting stations at 25 and 30 miles, many seemed surprised, some saying that they understood that it was possible to hear from several hundred miles with an equipment installed in a motor car. Perhaps, under ideal night conditions, in a good location, with two or more stages of amplification, these freaks occur, but it is preposterous to expect long distance reception on a small flat-top antenna of four wires, 12′ long, elevated but 6″ above the car top, and employing no ground connection other than the counterpoise effect of the car chassis. We were using a Westinghouse Aeriola Sr., with no amplification, and considered that we were obtaining very good results.

It was found further that any number of people cannot understand why their equipment is subject to static disturbances, they having the best obtainable outfit on the market. It seems in some cases that the dealer from whom they purchased the equipment assured them that static would be negligible with their apparatus, regardless of how strongly it was apparent on other equipment. Similarly, the annoying "squeal" which is always audible from a nearby receiving set when your own tube is oscillating and the other station is hunting a signal, seemed to a number to be entirely superfluous and they were demanding equipment immune from such squeals. This meant non-regenerative sets, which, if purchased, they

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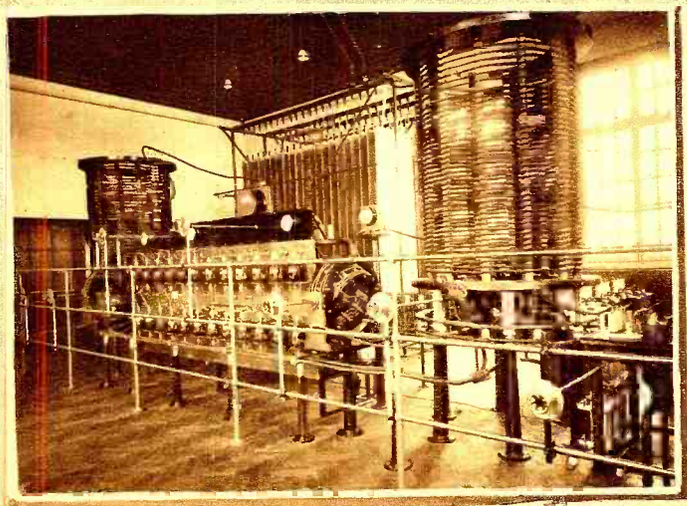
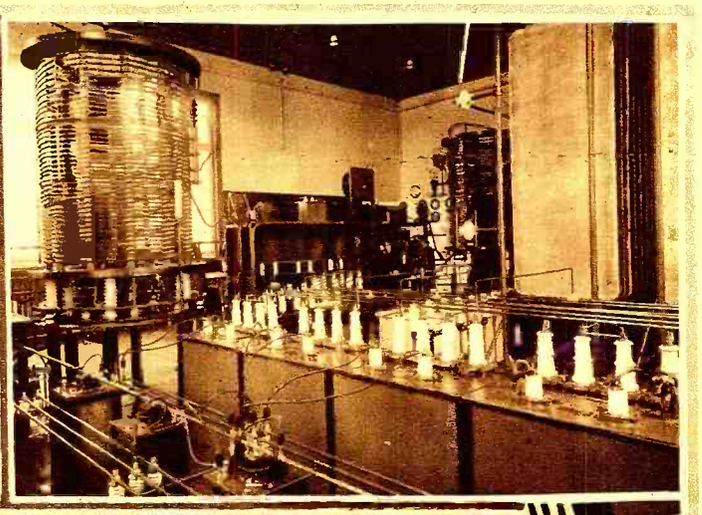
**Chief engineer, the Precision Equipment Company.*

Berne Radio Station

A Description of the Transmitting Apparatus of the New Swiss Installation





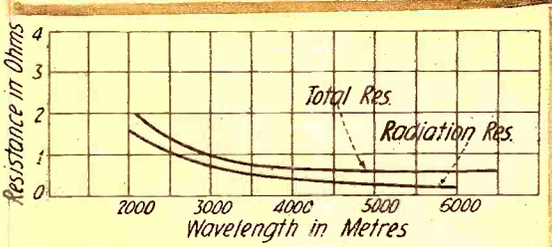
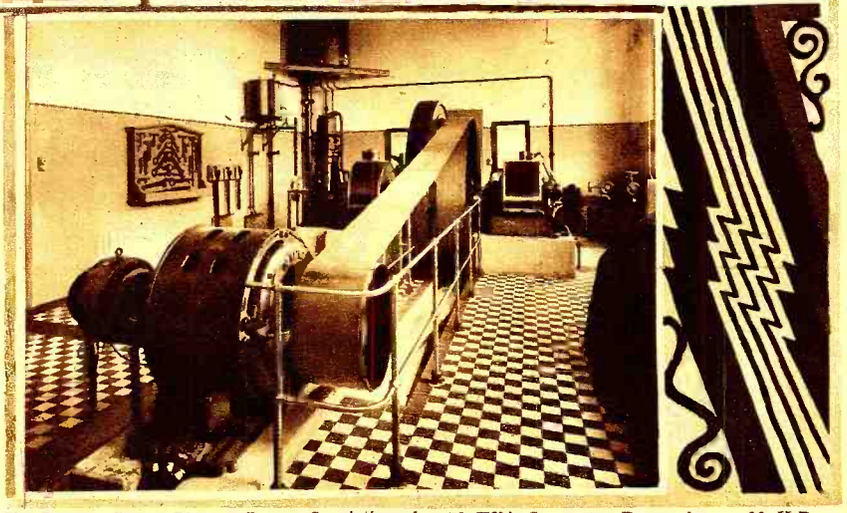


Fig. 3 Shows the Radiation Resistance of the Antenna Plotted Against the Wave-Length.
Above: Two Views of the Transmission Room at the Berne Station, Plainly Showing the Banks of Tubes, the Inductances and Air Condensers.



The Reserve Power Plant at Berne, Consisting of a 50 KVA Generator Drawn by an 80 H.P. Diesel Engine.

AS in most modern wireless stations the general arrangement is one of "central control." This system allows of direct duplex communication from one large center to another, when from technical and other reasons the transmitting and receiving stations are situated some distance from such a center; this arrangement also facilitates the handling of traffic. In the case of the Berne Station the control or operating office is contained in the main post office in the Swiss capital.

The transmitting station is situated on a plateau about 1,800 feet above sea level on the outskirts of the village of Munchenbuchsee. A good idea of the site can be obtained from the photographs, which give a general idea of the station.

The transmitting and receiving stations are located some 10 kilometers north and 5 kilometers west of Berne respectively.

The transmitter is a coupled circuit Marconi valve set, employing 12 MT6 three-electrode valves in parallel and a total input of 25 K.W. The electric supply for the station is taken from the Berne Power Supply Company at 16.000 volts three-phase 50 cycles, transformed down to 500 volts at a sub-transformer station, and brought in on to the main switchboard by underground cable.

The necessary H. T. D. C. voltage for the anodes of the oscillating valves is obtained by double rectifying the three-phase supply by means of 12 two-electrode valves, type MR6. For this purpose the main supply is led in to the primaries of three transformers, the windings of which are delta connected. The secondaries are star connected, the end of each winding being connected to the plates of two valves and the D. C. output taken from the filament circuit and the mid-point, see Fig. 1.

The characteristic of this three-phase double rectification is that the resultant consists of about 90 per cent D. C. component plus 10 per cent ripple of six times the original frequency; very little filtering is necessary to transform it into a constant D. C. supply.

The primary power input can be varied from eight K.W. to full power by means of variable iron core chokes, one being connected in each phase and capable of synchronous adjustment. The lighting of the rectifier and oscillating valve filaments is accomplished by transforming the three-phase main supply into two-phase by means of a "Scott" connected transformer, one phase each being used for the oscillator and rectifier filaments respectively. The connections of the oscillating valves is the usual top feed arrangement and the general scheme of connections of the oscillating circuit shown in Fig. 2.

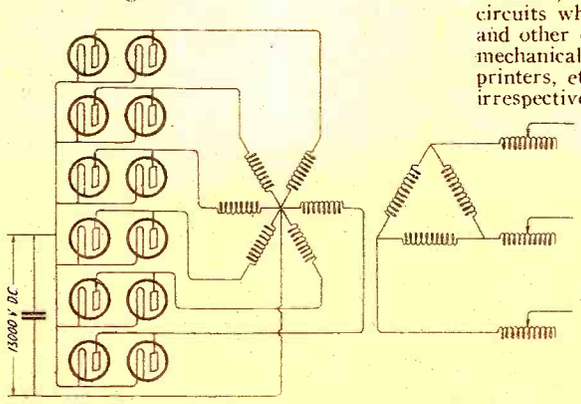


Fig. 1. The High Tension D.C. Voltage is Obtained With Full Rectification of Three-Phase Supply. The Main Supply is Led into the Primaries of Three Transformers As Shown in the Complete Circuit Above.

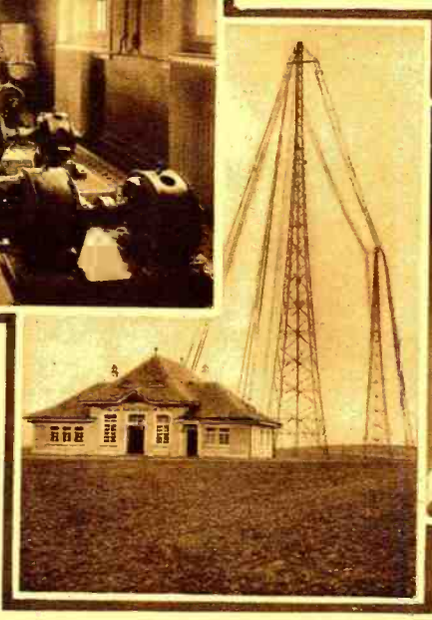
As will be seen from Fig. 2, a separate anode tap coil coupled to the closed circuit inductance is used; this arrangement on medium power is more satisfactory and also simplifies the design of the main inductance. The closed circuit is completed through an air condenser of 0.006 mfd., and is coupled to the aerial inductance by two adjustable coils which are normally in opposition.

Control of energy to the aerial is effected by shorting or unshorting one of these coils by means of a specially designed single contact key operated by a Creed compressed air engine.

It may be pointed out, that nowadays, if the transmitting wave can be kept absolutely constant, the receiving side has available circuits which greatly decrease atmospherics and other disturbances and allow the use of mechanical recording devices, such as direct printers, etc., also duplex conditions to avail irrespective of directional aerials. This is the reason why the somewhat novel method of keying described has been employed; it possesses this great advantage of giving steadiness of wave without bringing in any appreciable undertone or compensation wave. It is especially applicable to high speed signaling owing to the quick cut on and off of the signal, and almost complete absence of sparking at the key contacts.

By careful design of the closed circuit the high frequency resistance has been brought down to 0.6 ohms at

Left: Motor Generator Groups for Supplying Current for Signaling Keys and Various Relay Circuits.



Right: Exterior View of the Berne Transmitting Station. This Station is Controlled from the Berne Post Office But is Located Six Miles from the City on a High Plateau.

The Central Control Room at the Berne Post Office. Messages Are Received from the Receiving Station Three Miles Away and Transmitted from the Sending Station Six Miles Away. Duplex Operation at 150 Words Per Minute is Conducted.

the normal wave of 3,400 meters, thus giving an efficient transfer of energy to the aerial circuit.

The aerial is an inverted "L" made up of two four-wire cages, carried on two self-supporting towers, each 300 ft. high, spaced 600 ft. apart, the natural period of the aerial being 1,600 meters and the capacity of 0.0042 mfd.

In accordance with the latest practice the earth coming under the influence of the aerial field is efficiently screened by means of 18 wires supported on 30 ft. lattice steel poles, and which, connected to the lower end of the aerial tuning inductance, form the return path of the aerial circuit.

Resistance measurements taken show the efficiency of the aerial at 3,400 meters to be of high order.

The curves of the total resistance and radiation resistance of the similar aerial at Ongar (the English end of the service) are shown in Fig. 3, plotted against wave-length.

In case of any failure from the outside source of supply a reserve power plant is installed consisting of 80 H. P. Diesel engine, driving a 50 K.V.A. three-phase generator, 500 volts, 50 cycles, shown in the photographs.

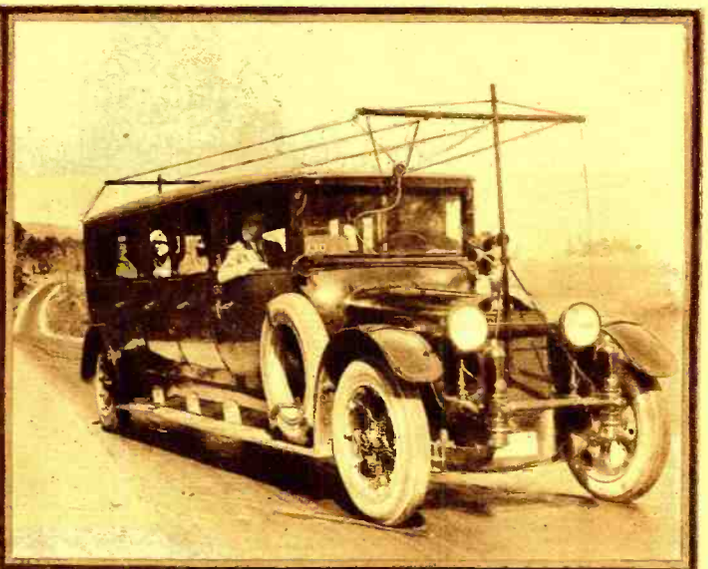
The necessary auxiliary machines are installed in a room adjoining the main transmitting room and consist of:

A.C. D.C. motor generator groups for supplying the necessary current for signaling keys and various relay circuits. Motor driven air compressors for supplying compressed air working the Creed engines, and blower motors for cooling the filament seals of the oscillating valves, and cooling key contacts. All the auxiliaries are in duplicate in case of breakdown.

The central control and operating office is on the third floor of the Berne main post office, and has direct telephone communication with all the principal towns in Switzerland and also Milan. Control of the transmitting station is arranged for both hand and high speed working. The high speed apparatus consists of three Gell automatic perforators for punching up the Wheatstone slip and two Creed Wheatstone transmitters, capable of working up to 150 w.p.m. The high speed received signals are passed on from the receiving station over ordinary land lines, and the signals are recorded on Marconi undulators, which are capable of speeds up to 120 w.p.m. For normal hand speed working the received signals operate a P.O. type sounder, but provision is also made for receiving by the ordinary method of aural reception by telephones, during bad

(Continued on page 958)

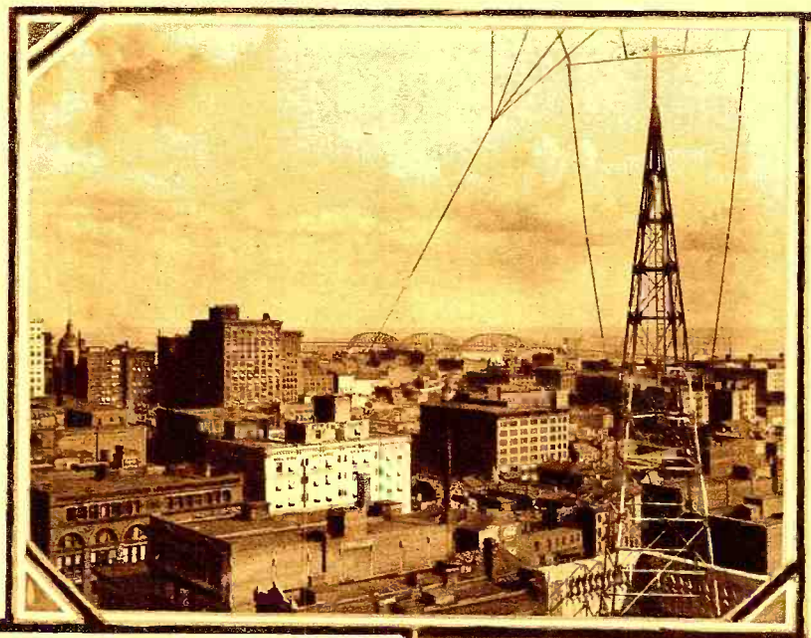
Radio Concerts for Bus Passengers

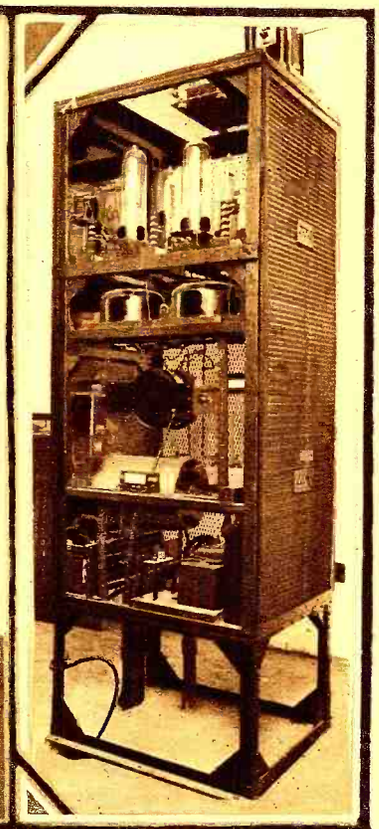


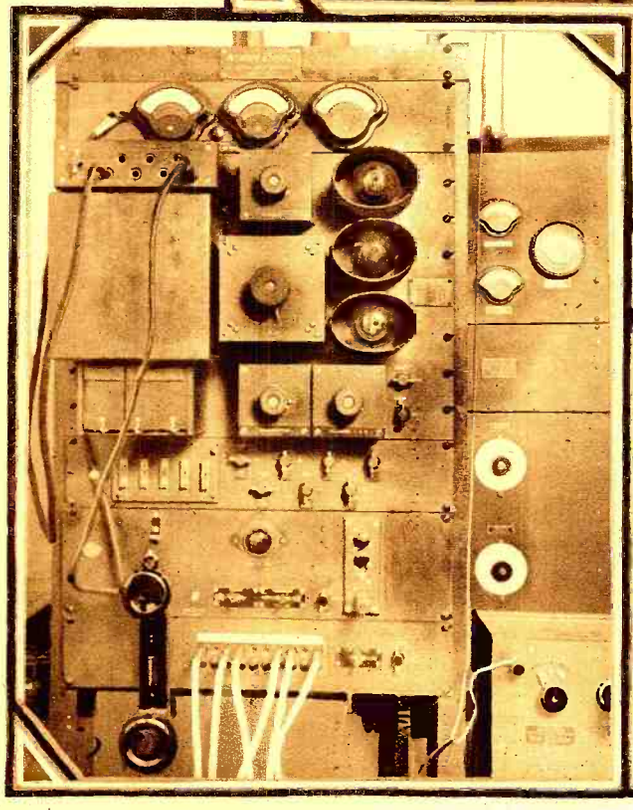
Should Tests Which the California Transit Co., of Oakland, Cal., Started Recently, Prove Successful, Many of the 85 White Buses Operated by This Line Will Be Equipped with Radiophones to Pick Up Daily Radio Concerts in the Bay Region. With Only a Two-step Short-wave Receiving Outfit and Handicapped by the Necessity of Operating with a Low Antenna, the Bus Was Able to Pick Up San Francisco and Oakland Concerts as Far as Martinez.

The First 400-Meter Broadcasting Station

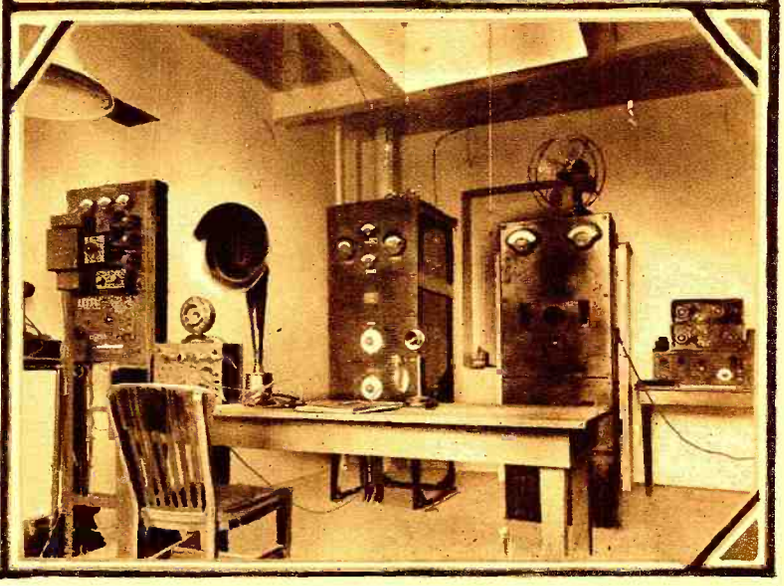
Right: The antenna taken on top of the St. Louis Post-Dispatch building. Below: View of the speech amplifier at K S D which magnifies the voice or music before it reaches the transmitter proper.







Right: Inside View of the New 500-Watt Transmitter at K S D. Below: General View of the Transmission Room. The Microphone Is Visible Between the Loud Speaker and the Speech Amplifier.



STATION KSD, the St. Louis *Post-Dispatch,* was the first broadcasting station in the United States to be authorized by the Department of Commerce to transmit on a wave-length of 400 meters.

This priority in the new "Class B" radio field was possibly merited by the record KSD had made in July and August in the transmission of news bulletins and market reports by day and varied programs of a high order at night.

The most notable achievement of KSD was the sending out, three times a week, of the entire operatic performances of the series of light operas given in the open-air Municipal Theater, Forest Park, by the organization of public-spirited citizens of St. Louis who guaranteed the expenses of the season. These performances—orchestra music, dialogue, solos and chorus singing—were sent out so exquisitely that those listening on radio sets heard everything as well, and often better, than those seated in the auditorium. Only those in the very front seats, in the open-air theater, heard the dialogue as well as those who formed the radio audiences.

The broadcasting of these operas was accomplished by the use of a single microphone on the stage in Forest Park, with a speech-amplifying panel just off stage. From here the circuit ran through cables of the Bell Telephone Co. to the roof of the Post-Dispatch Building, into the speech input panel for further amplification, and then into the transmitter.

These operas, three times a week for six weeks, were broadcasted over a large area of the United States. One was even heard on a steamer in the harbor of Tampico, Mexico. Reports were received from provinces across the Canadian border and from all along the Atlantic coast.

In August, 1922, the huge radio map in the studio of Station KSD showed that their programs had been picked up in 42 states.

In addition to these 42 states, reports had been received from Cuba, from four provinces in Canada—some of the stations well up towards the Hudson Bay country—and from Mexico. The most southern report in August came from Yucatan, 630 miles from New Orleans straight down across the Gulf.

This station was recently equipped with a new 500-watt Western Electric transmitter which is shown in the photographs.

The transmitter proper is panel type and about six and a half feet tall. The various pieces of apparatus that make up each unit are mounted on a black finished angle iron framework, rectangular in shape, in order to provide a rigid and compact structure. The vacuum tubes, coils, filters, relays, resistances and other auxiliary apparatus which ordinarily do not require observation are mounted inside the frame.

(*Continued on page* 1003)

A Wonderful Station

By FRED W. MERGANTHALER

WERE Benjamin Franklin still serving as postmaster of Philadelphia, he would most likely, at the close of a day's work, start a dozen cars of mail on their way and spin to his suburban home for the evening meal.

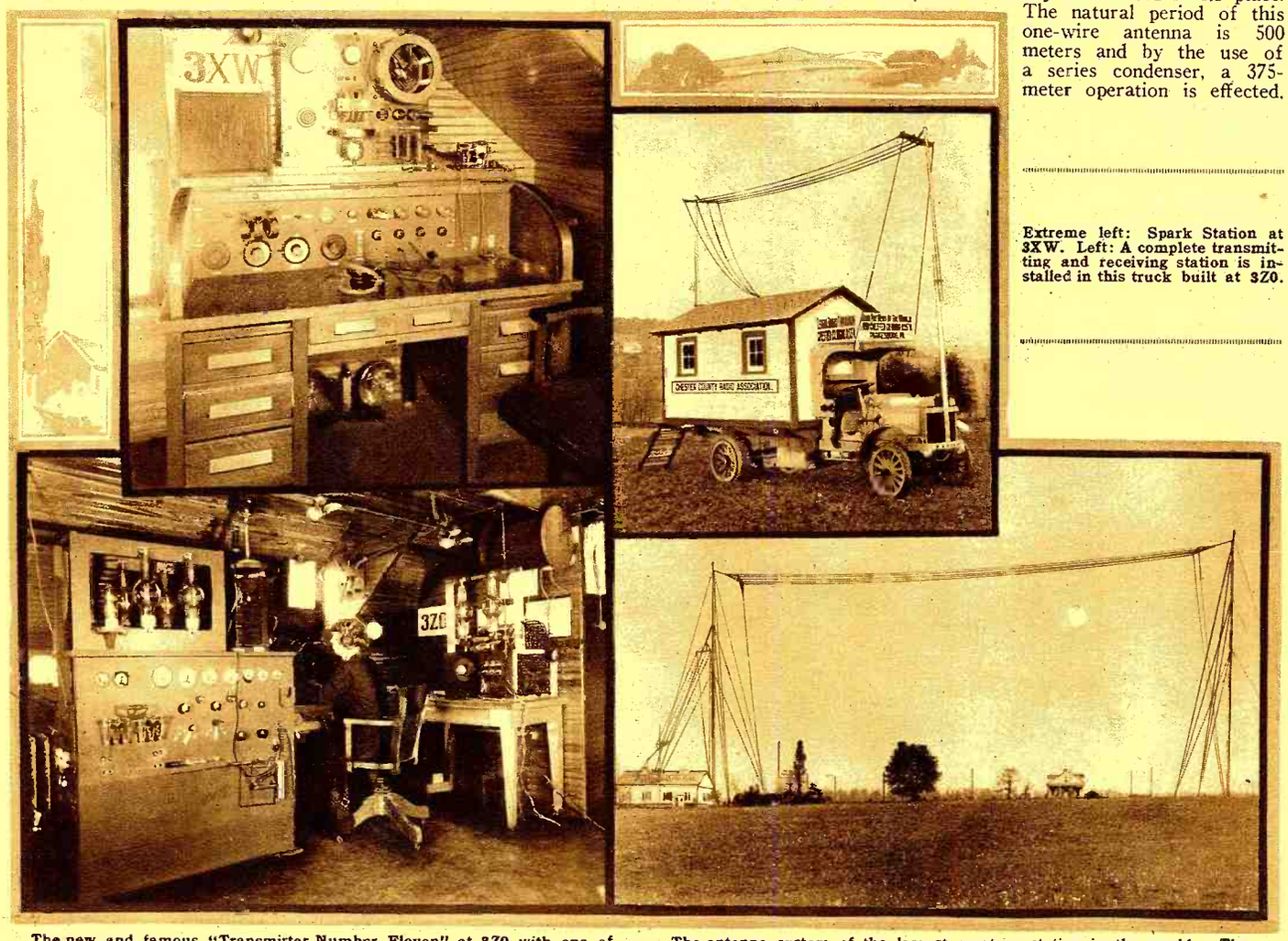
Following this he would probably replace his broad-brimmed hat with a snug helmet and crawling into the cockpit of his private plane mention "Parkesburg as usual, James," to his pilot and take off. His speedy carrier would head into the sunset and within a few minutes would be over the Main Line tracks of the Pennsylvania Railroad to the west; these he would follow.

From his 2,000′ perch, the panorama of eastern Pennsylvania would slip by with quiet speed for 30 minutes, while a small white speck to the left of the railroad miles ahead takes on the form of a thin circle. James would throttle the motor and head for this mark, while through the headphones fitted in the passenger's helmet, would come a "Good evening, Mr. Franklin."

The white circle now stands out with prominence and across its diameter in letters 15′ high, "Parkesburg" is easily read. The engine is cut and the ship heads in a gentle glide for a wide lane with a line of trees on one side and two high masts on the other. The wheels roll across a smooth landing field and as the ship comes to a dead stop, directly on the marker itself, Mr. Franklin would be assisted out of the ship, and after a walk of but a few minutes, would enter a two-story white building, near one of the masts which he had just passed. There with Horace A. Beale, Jr., he'd go into the latest phases and experiments of the science which has lately become so popular—radio.

This great amateur experimental station, the largest in the world, is owned and operated by Mr. Horace A. Beale, Jr., solely for the development and advancement of the radio art. In the handling of this station, Mr. Beal has surrounded himself with a very efficient staff, as follows: A radio engineer, who designs most of the equipment used, a construction engineer and assistant, a stenographer and record keeper, and two operators, whose tricks are such that a constant watch is kept from 1:00 p. m. to 5:00 a. m. and in addition there are available for special work, a first class electrical engineer and two electricians.

The main antenna system is supported by two steel masts 185′ high and 400′ apart. These high supports consist of sections of heavy steel tubing which are welded at the joints and have a diameter at the bottom of 16″, tapering to a diameter of 4″ at the top. The total assembled length is 200′, 15′ of the lower end being set in large concrete bases which in turn rest in bed rock. The masts are braced by three sets of cable guys, which are secured to concrete anchor blocks. Nearly three months of daily operation were required in the erection of the poles alone. The original antenna between these masts consisted of five wires, flat top, the horizontal portion being 350′ long. The natural period of this large antenna was too great for a 375-meter operation, so a slanting four-wire antenna, having a space of 100′ between spreaders, was erected. This antenna is inclined at an angle of about 40 degrees from one mast, to which it is fastened at its upper end, 105′ above the ground, and the lower end is anchored to a short wooden pole. Several months ago the large antenna was taken down and one wire, 200′ long, with a lead-in of nearly 200′ raised in its place. The natural period of this one-wire antenna is 500 meters and by the use of a series condenser, a 375-meter operation is effected, with much better results than with the slanting one. There is also a small two-wire receiving antenna 80′ long and 40′ high.



Extreme left: Spark Station at 3XW. Left: A complete transmitting and receiving station is installed in this truck built at 3ZO.

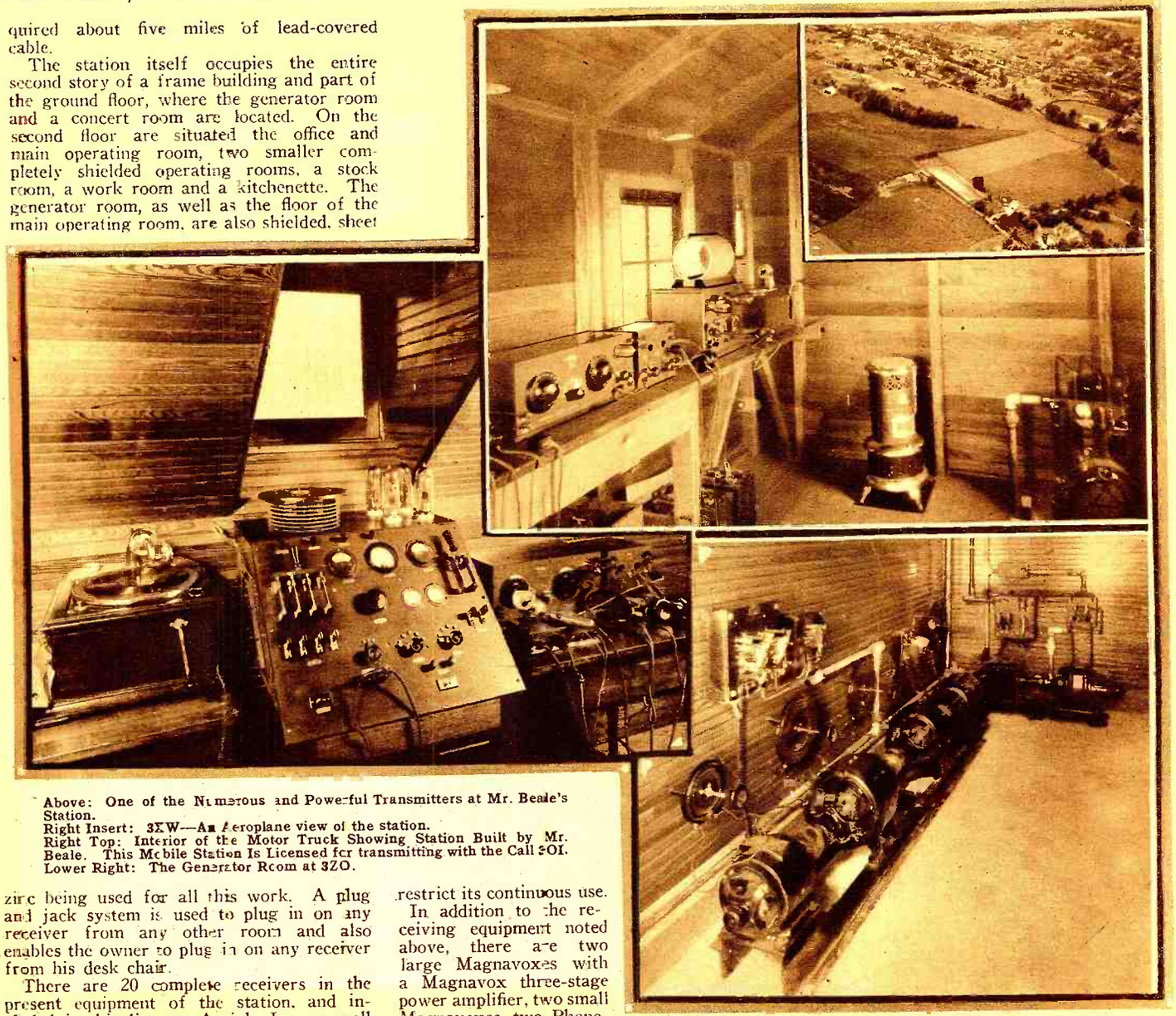
The new and famous "Transmitter Number Eleven" at 3ZO with one of the operators on duty. The signals of this transmitter have been heard at great distances.

The antenna system of the largest amateur station in the world. The masts are 185 feet high and 400 feet apart.

The ground system is rather elaborate, and due to the solid rock underlying this locality at the depth of about 15′ below the surface, it was a matter of great concern. Counterpoise arrangements were found to be unsatisfactory because of the necessary area which would have to be covered, and the objectionable features of low strung wires in the vicinity of an aviation landing field adjoining the station. Finally a counterpart of the large antenna was buried directly beneath it in trenches about 4′ deep, and the wires surrounded with charcoal dust to absorb and retain the moisture. In addition to the buried wires, the two masts and their guys, as well as a number of large zinc plates which were buried near the station were connected to the ground. It was found advisable later to connect the metal shields of the various receiving and generator rooms, as well as the steam heating system of the station, to the grounding system. While considering the ground system, mention should be made of the placing underground of various high and low tension power leads, signal wires and telephone and telegraph wires, which re-

quired about five miles of lead-covered cable.

The station itself occupies the entire second story of a frame building and part of the ground floor, where the generator room and a concert room are located. On the second floor are situated the office and main operating room, two smaller completely shielded operating rooms, a stock room, a work room and a kitchenette. The generator room, as well as the floor of the main operating room, are also shielded, sheet



Above: One of the Numerous and Powerful Transmitters at Mr. Beale's Station.
Right Insert: 3XW—An Aeroplane view of the station.
Right Top: Interior of the Motor Truck Showing Station Built by Mr. Beale. This Mobile Station Is Licensed for transmitting with the Call 3OI.
Lower Right: The Generator Room at 3ZO.

zinc being used for all this work. A plug and jack system is used to plug in on any receiver from any other room and also enables the owner to plug in on any receiver from his desk chair.

There are 20 complete receivers in the present equipment of the station, and included in this list are Aeriola Jrs., as well as an Armstrong Super-Heterodyne receiver. In the main operating room is a Grebe CR-3 and Grebe detector and two-stage amplifier. This is the receiver that is used in almost all relay work. A honeycomb coil receiver, including all necessary condensers and a detector and three-stage audio amplifier, is mounted in a desk. Several receivers similar to this one, but mounted in cabinets, have been constructed at the station. Recently a receiver comprising two stages of radio amplification was built, and is used either on a loop or with the antenna and gives excellent results.

In one of the smaller rooms is an Aeriola Sr.; a two-stage amplifier employing the 1 1/2 volt dry cell tubes was constructed for use with this set. The amplifier cabinet was made large enough to hold both "A" and "B" batteries for the whole receiver, and a real portable receiver is the result. In the other small operating room is a Grebe CR-5 which is used for longer wave receiving. A Westinghouse RC set and the Armstrong Super-Heterodyne set complete the receiving equipment of this room. The Super-Heterodyne is the most elaborate of all the receivers at 3ZO and 3XW. It is made up of 51 de Forest panels and has a master oscillator, detector, five stages of resistance coupled radio frequency and five stages of audio frequency amplification. The other panels of this set contain the necessary coil mountings, condensers, rheostats and switches and jacks. Very good results have been obtained with this receiver, but the many controls and complicated tuning restrict its continuous use.

In addition to the receiving equipment noted above, there are two large Magnavoxes with a Magnavox three-stage power amplifier, two small Magnavoxes, two Phonetrons and several other types of loud speakers. A Western Electric loud speaker and amplifier was also recently added.

The transmitters are likewise many and varied, and include all types, spark, C.W. and arc. There is a de Forest 1-K.W. open arc transmitter in the main operating room, which formerly worked on 2,500 meters. This set is not used at present. No. 4 is a 1-K.W. non-synchronous rotary spark set which operated on 375 meters, but which was dismantled early this year. No. 8 was a self-rectified C.W. transmitter using four UV-203's, operating on 375 meters also. No. 8 was replaced a few months ago by 8 A, using a 250-watt tube in a self-rectified circuit. This transmitter gives a low but rather pleasing note, which carries very well. No. 13 transmitter using two UV-204's also self-rectified, has very recently been remodeled and now is No. 15, using four UV-204's on direct current. It is used either on straight C.W. or chopper.

No. 11 is by far the most important of all the transmitters and is also better known than any of the others, as shown by the correspondence received. It is shown in one of the pictures and is only temporarily mounted as yet, but will be built into a permanent cabinet in the near future. It employs four 250-watt tubes, two modulators, and two oscillators and one 50-watt tube, used as a voice amplifier. The tubes shown on the lower part of the panel are Kenotrons, used as grid leaks. Ten meters are shown on the panel, but only nine are used, as the tenth was found to be unnecessary. They include an output ammeter, input ammeters to all the plate circuits and filament volt meters. Transmitter No. 11 employs Heising modulation with a form of grid bias, invented at this station, which uses instead of a "C" battery a tab taken from the oscillator grids and led to the modulator grids. This system has been found to work very efficiently. The set is arranged to use chopper as well as voice.

In another room is No. 5 radiophone transmitter which was used for broadcasting all last year. It uses four 50-watt tubes, two modulators and two oscillators for telephony, and by throwing a four-pole double-throw switch, the four tubes are used as oscillators. This set has almost the same circuit as No. 11 transmitter. In the other smaller room is No. 14, a self-rectified C.W. transmitter employing two UV-203's the circuit of which is shown. A de Forest radiophone using four 5-watt tubes and two rectifier tubes is in the same room, and is known as No. 2. There are several other de Forest sets as well as several constructed at the station, all using 5-watt tubes. These are frequently set up for various tests and experiments.

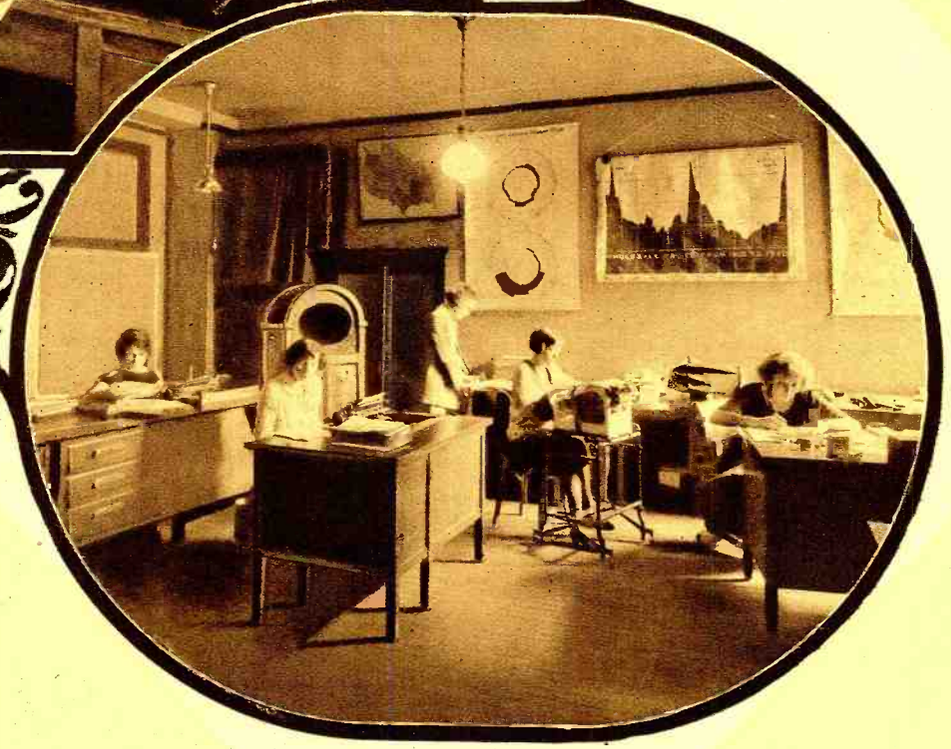
Mention should be made here of the generator room, which is a young power plant. At one end of this room is a Westinghouse 17-K.W. 110-volt D. C. motor generator unit, which is used for various purposes. Next to it is a Crocker-Wheeler 600-volt D. C. unit. The largest machine is an Eck unit and consists of a 3-phase 220-volt motor, separate field excitor and two gen-

(*Continued on page* 956)

Radio in the Business Office

By J. GEORGE FREDERICK

Radio is Being Used by Business Men in Their Offices to Obtain the Stock Quotations.



Music While They Work. An Up-to-date Office Installs Radio For the Employees.

AS the greatest activity of the American people is business, it is inevitable that a great invention like radio (regarded as the greatest invention since the telephone or the electric light) should be adapted to business uses.

Speed and service are the first laws of business; and no method of intercommunication which has the universal application that radio possesses long escapes practical business use. At first business men were bewildered by this new marvel and scarcely knew what to do with it. The radio telegraph or wireless signalling systems had been applied by a few business houses prior to the development of the radio telephone. John Wanamaker in New York had maintained a wireless station for communication with his Philadelphia store. It was an economy and proved to be a splendid business move, since an executive in the New York store could communicate within a few minutes to anyone in the Philadelphia store a message of any length and in detail, without waiting for the mails or trusting to the purely verbal nature of the telephone. Recorded messages by wireless were transmittable with great ease and became definite business records, just like letters. A chain of hotels also used it for communication between the hotels for making reservations rapidly, and freer conduct of managerial business. Naturally, also the business uses of the wireless telegraph for messages in the same manner in which the telegraph is used, are an old story, and are now a regular part of business communications, but are naturally outside the scope of this article.

While the novelty of the radio-telephone was still quite fresh, an enterprising New York business house in the clothing field, whose offices are gathering places for the buyers from all parts of the country, installed a radiophone with various purposes in mind. It was not for any precise business purpose, but for the advertising value and convenience of its customers. These customers heard during the day, as they were transacting business in the office, the weather reports, Government reports of various other kinds, music, etc. It tended to make the buyers linger longer in the office, and when they went away they credited this concern with being particularly up-to-date. The psychological impression in business is often of greater value than anything else which might possibly be accomplished. Good will and reputation for up-to-dateness has a very definite value in business, even though it cannot be cashed in a bank for gold at will.

The general business office is just now beginning to experiment with radio, and in various instances they have found it very interesting. Individual business heads have installed receiving cabinets in their offices for a variety of reasons, some of which are business, and some personal. The range of informational services coming over the radiophone is increasing constantly and so are the lectures on business subjects. The class and types of business offices which can directly profit by having a radiophone installation is naturally increasing as the broadcasting of vital information proceeds. The completion of several large broadcasting enterprises now under way will no doubt rapidly facilitate the business uses in view of the universal desire among up-to-date business men to possess the latest and finest means of speed and intercommunication.

The musical side of broadcasting has also interested business men in various ways. It is well known among broad-minded employers that a change and a fresh atmosphere at some period during the day is beneficial to the efficiency of employees. Rest rooms among some business concerns have been fitted up with radiophones and greatly interested the employees, giving them a new stimulation for the other half of the day's work.

An even more interesting application has been the use of radio music for "speeding up." Years ago the experiment succeeded of introducing music constantly or occasionally during the working day as a stimulation to certain types of office and other routine labor. Experiments left no doubt that music introduced during working hours among employees, who were doing repetitional, manual work or monotonous labor, increased the pace. They enjoyed it and the music unquestionably took away the monotony of routine. A radiophone installation has acted of course in precisely the same way, with the added difference that the

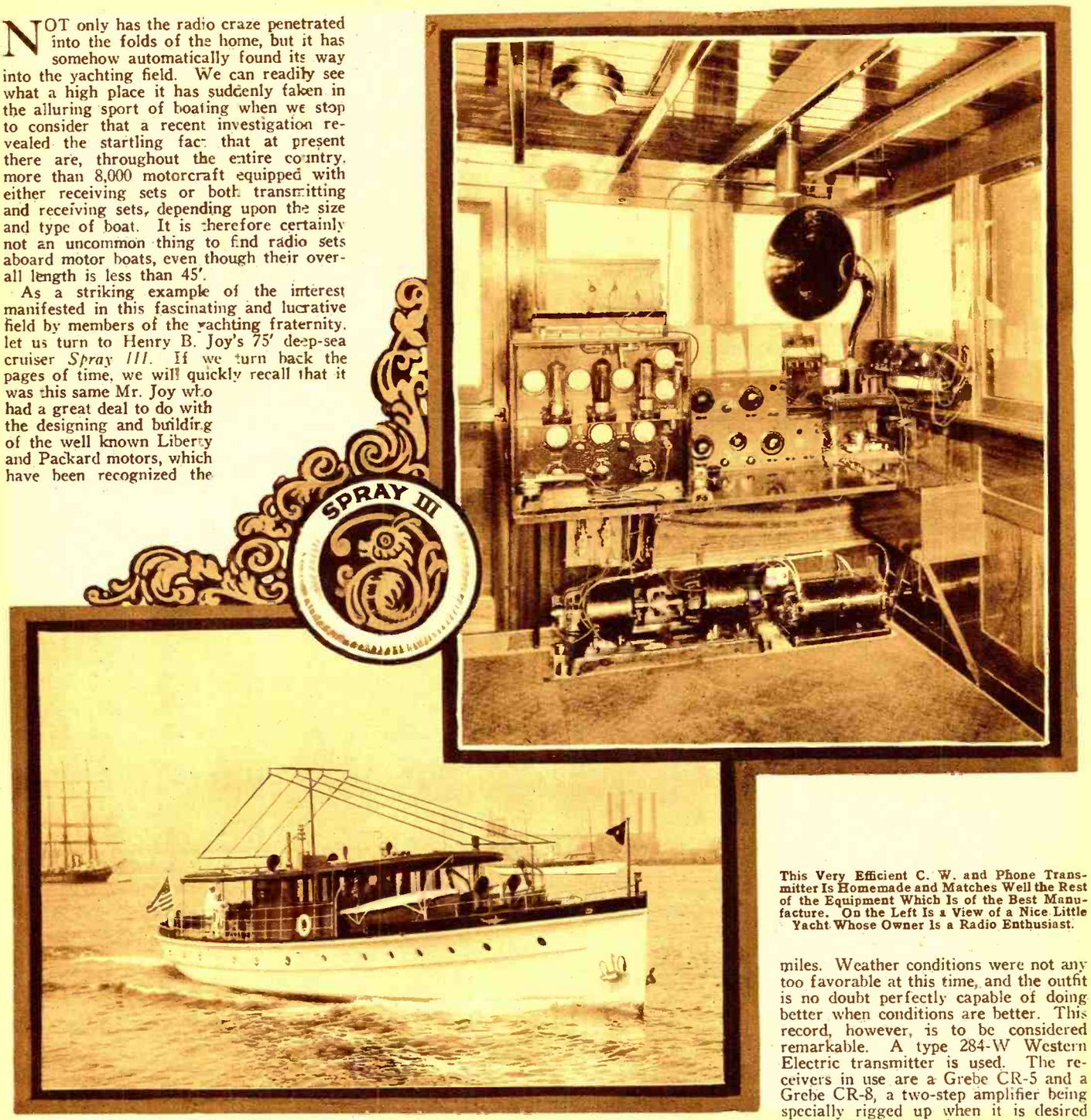
(*Continued on page* 960)

Radio Enters the Yachting Field

By C. A. REBERGER

NOT only has the radio craze penetrated into the folds of the home, but it has somehow automatically found its way into the yachting field. We can readily see what a high place it has suddenly taken in the alluring sport of boating when we stop to consider that a recent investigation revealed the startling fact that at present there are, throughout the entire country, more than 8,000 motorcraft equipped with either receiving sets or both transmitting and receiving sets, depending upon the size and type of boat. It is therefore certainly not an uncommon thing to find radio sets aboard motor boats, even though their over-all length is less than 45'.

As a striking example of the interest manifested in this fascinating and lucrative field by members of the yachting fraternity, let us turn to Henry B. Joy's 75' deep-sea cruiser *Spray III*. If we turn back the pages of time, we will quickly recall that it was this same Mr. Joy who had a great deal to do with the designing and building of the well known Liberty and Packard motors, which have been recognized the world over for their dependability, power and sturdiness.



This Very Efficient C. W. and Phone Transmitter Is Homemade and Matches Well the Rest of the Equipment Which Is of the Best Manufacture. On the Left Is a View of a Nice Little Yacht Whose Owner Is a Radio Enthusiast.

Spray III is one of the season's finest yachts. No expense has been spared to make her such. From stem to stern she represents the last word in boat construction; her outside appearance is exceptionally pleasing, and she is radio equipped. Mr. Joy was keen about having his little vessel fully outfitted and her radio installation was given no small amount of consideration, the results being that this sturdy motor yacht carries a powerful radiophone set and sensitive receiving units. Wherever she goes, she is greatly admired and her radio is the topic of much discussion by those who cast envying eyes upon her, or get the opportunity to make a complete inspection.

The telephone transmitter was made personally by Mr. Joy, and presents an attractive appearance, as can be seen from the accompanying photograph. He always had a craving for experimenting and it is not surprising that he should undertake to build his own outfit. The transmitter was made from circuit 6, full details of which are given in the Radio Corporation of America's catalog. Three U.V.-203, 50-watt transmitting tubes are employed, necessitating a plate voltage of 1,000 volts supplied by a D. C. generator, conveniently installed under the operating table. Current for lighting the filaments is derived from a bank of storage batteries, which are kept charged by the 5-K. W. Winton generating plant, located in the engine room. This same plant also supplies current for lighting the vessel, power for operating windlass, etc. In experiments carried out, it was possible to converse over a distance in excess of 1,000 miles. Weather conditions were not any too favorable at this time, and the outfit is no doubt perfectly capable of doing better when conditions are better. This record, however, is to be considered remarkable. A type 284-W Western Electric transmitter is used. The receivers in use are a Grebe CR-5 and a Grebe CR-8, a two-step amplifier being specially rigged up when it is desired to intercept signals from a great distance. When the Magnavox is connected in the circuit, incoming signals or music can be plainly heard anywhere on the vessel.

The antenna aboard *Spray III* is made up of four wires 55' long. By a combination of gears located in the "radio shack," it may easily and rapidly be raised or lowered, an advantage when passing under bridges. This feature is found on very few radio equipped yachts and when the aerial is fully raised it is well over 30' from the water line. The operating room is located in the after end of the deck house, an ideal place, considering that the owner and guests spend much of their time in this location.

However, *Spray III* is not the only boat that boasts of such a fine outfit. Any

(*Continued on page* 999)

"The Radio King"*

Novelized by George Bronson Howard From the Universal Chapter Play of the Same Name by Robert Dillon

Here Are Those Who Will Give You a Thrill When You Read the Story and See the Picture on the Screen at Your Favorite Movie Theater. You Will See How Bradley Lane, the Detective Shown Here in the Center, Rescues Jimmy, the Boy Prisoner of Marnee. They Are Shown in the Upper Right-Hand Photograph in the Subterranean Laboratory Where the Crime Master is Perfecting His Master Wave. Ruth Leyden, the Detective's Sweetheart, is Here Shown Talking With Him by Radio. In the Lower Left-Hand Corner is Again Marnee the Wizard With His Infernal Machine.

CHAPTER I
"A CRY FOR HELP"

"Br-rr. S-sput—! Crack. Br. 2430 Membling Avenue, sub-cellar, Prisoner of Marnee, Help." Br- Crack— —.

Two exceptionally sensitive receiving sets recorded the startling message for understanding ears. One set was in the wonderful radio laboratory of Bradley Lane, international radio detective and the other was in Police Headquarters. Marnee's whereabouts had been eagerly and fruitlessly sought by both for years. Marnee—what a name—what a man.

Ever since the war, anarchy had stalked through exhausted disheartened countries; sometimes in cellars and garrets, secret, silent, insidious; sometimes openly, boldly, on the streets.

From the great Mother of Anarchy, Moscow, its tentacles were groping slowly but surely after bigger game. In America the strongest, most astute, most daring, and yes, even the most learned, of all the Anarchist group had gathered. For did not the Central Group there hold "Marnee," the so-called "Wizard of the Electrons," the scientific malcontent, the international scourge; doubly, trebly, quadruply dangerous because of his undoubtedly high attainments in applied physics and chemistry? And did not "Marnee" have for his right-hand man Ivan Renally, "Ivan of the Silver Tongue," whose persuasive, illogic and mesmeric speech brought men to the slavish state where they were ready to risk life and liberty to do his will?

Behind the locked and bolted doors, the nailed-down, close-shuttered windows, of an ancient house in one of the greatest of American metropoli, Ivan Renally addressed a committee of the chosen, on a certain day of December in the early years of the third decade of the twentieth century.

They listened, eyes aglow, lips parted as though drinking his words thirstily; while he concluded a peroration that had already lasted long:

*A Super Serial Photoplay, Published in Collaboration with the Universal Film Corp.

WORLD DOMINATION

". . . And so, comrades, the world shall be divided up into provinces, each with one of the Brethren for Commissar. The General Strike shall be declared all over these States. Not a wheel shall move on the railroads to bring soldiers against us, while we at our leisure loot the Exchanges, seize the Mints, and with these at our command—the reins of Power. But two dangers threaten us. Bradley Lane, the equal even of Marnee, in scientific powers, is only awaiting his chance to get evidence that will commit us to prison before our great plans go into effect. And if this John Leyden invention of recalling from the air those messages already sent is ever adopted and put in use, Bradley Lane will have the evidence he seeks; the evidence of the messages that have been exchanged between the Brethren of the various cities; the instructions sent out by Marnee and me. . . ."

Even as he spoke, beneath his very feet, in the subterranean chamber hewn out of the rock beneath the sub-soils a misshapen deformed creature, who, for all the height and breadth of his white forehead, seemed hardly human, with his glaring eyes and twisted mouth, leaped from his seat before one of the most elaborate radio sets ever devised and, flinging off the receivers, executed a weird dance of triumph. In the ghastly white light that poured itself into a pool on the concrete floor, his shadow was like that of a giant jumping-jack.

He was of the stuff of which nightmares are made, this grotesque misshapen bird of prey—the feared and hated "Marnee."

"I've jammed him again," was the burden of his screech. "He's jammed again—again—again! ! !"

Not half-a-mile away, old John Leyden, whose invention Renally had told the Brethren they had so much cause to fear, also tore the receivers from his ears.

"I can't understand it, Ruth," he muttered, as his daughter came into the room on tip-toe. "The air seems full of static. Nothing intelligible can get through. And yet, it isn't possible. My invention has been so thoroughly tried. . . . I just don't understand. . . ."

Had he seen and heard Marnee, and watched his manipulation of a certain switch, he would have understood. As it was, he tried and tried again without avail, and finally discontinued his efforts with a weary shrug.

Marnee, satisfied, recalled the food he had allowed to grow cold on its tray, brought an hour before; and began munching and crunching like an animal. As he ate, he fell into a rapt retrospection, his eyes glowing insanely.

THE GREAT OPPORTUNITY

It was the chance for which the boy had been waiting; the boy who shared that subterranean prison with him: a prison, indeed, to the pale-faced lad of twelve, a victim of one of Marnee's insane whims. For Jimmy's mother had rejected Marnee in favor of the boy's father, and, believing it was because of his misshapen form, Marnee had bided his time and stolen her child, swearing his mind and morals should be as misshapen as Marnee's body—or his mind, for that matter.

So far he had not succeeded. The boy's sturdy honesty had prevailed. But he remained a prisoner of hate, watching his chance to be free.

Jimmy had pieced together the talk he heard; knew Bradley Lane was the enemy Marnee most feared. He had watched the wireless, memorized codes and calls. Now, seizing his first opportunity while Marnee sat, staring vacantly, he tiptoed to the shining radio corner, and began jamming down the key.

The hissing sparking call brought Marnee back to the present but not before the boy had broadcasted the message that both Lane and the police had picked up.

"2430 Membling Avenue, sub-cellar, Prisoner of Marnee, help."

Marnee sprang across the room, hurling the boy backward, spread-eagling him against the concrete wall. As he seized the receivers the answer came:

"Bradley Lane. Coming! Courage!"

For a moment, Marnee's rage was a terrible thing to see. Then, with a wolfish snarl, he sprang to the wall, pressed a button, let down a flight of stairs, and ascended to the room where Renally addressed the Brethren:

"Bradley Lane is coming here. We must prepare his welcome—adequately."

THE OLD FIGHT

Bradley Lane had matched wits with Marnee before, when, as a high ranking officer of Military Intelligence during the Great War, he had believed he had him trapped in Paris. But, in the end, Marnee had escaped, and Bradley Lane believed that, until he had him safely jailed for life, the peace of the world was in danger.

He had sought him far and wide. This curt message from Jimmy was his first intimation of Marnee's presence in the same city with himself, and he was quick to take advantage of it. He did not pause to ask for assistance from any of the great departments ready to aid him. He was afraid, if he delayed, his enemy would escape.

So rising from his wireless instruments, he caught up his hat and stick and was about to leave when a whirr and a click, warned him. He glanced at his "stairway detector"; someone was on the way up. He pressed a button; a slide—fashioned after a periscope mirror—showed a man in a military cape buttoned up above the chin, making his stealthy way up the stairs. Undoubtedly an enemy. Friends did not approach in this fashion.

Bradley Lane pressed another button, pulled a switch. Outside, in the hall, it seemed as though Lane, himself, walked out of a hitherto masked door.

Silently, the Man-in-the-Cloak grappled with the figure. For figure it was, as he soon learned—an electrically controlled automaton that fastened its arms about the intruder with the crushing grip of a gorilla.

As he struggled, Lane made his exit by a second door and hurried to fulfill his promise to "Marnee's prisoner." But, as he passed, he snatched away the cloak from the helpless one and noticed that he wore the same shape of hat. The disguise was perfect and deceived the hapless spy's chauffeur. Lane was conducted immediately to the place he wanted to reach.

But if he had hopes of surprising the band he was mistaken. As soon as the spy had freed himself he radioed to Renally, "Lane coming in my disguise and in my car."

Cool, resourceful, prepared, Lane walked into the trap, and as he did so he momentarily withdrew the cloak to take a picture of the "group" in a camera whose lens projected from his belt buckle. Then he advanced fearlessly to the standing anarchists.

"Comrade of mystery, what have you to report?" asked Renally.

"All is well" came the answer.

"Go below and report to Marnee, that all is well."

So far so good, now for Marnee.

He descended. As his foot touched the concrete floor below, Jimmy, the boy, ran to him with a glad cry. But Bradley's eyes had traveled to the misshapen twisted thing he knew for Marnee; who, with a loathsome leer, had moved toward a burlap bag tacked to the wall.

Quickly he tore it away, revealing a sphere, somewhat of the shape of a schoolroom globe. His other hand traveled toward a switch.

"It's my turn—this time—Mr. Bradley Lane," he screeched in wild triumph, and pulled the switch!

Bradley had barely sufficient time to hurl the boy out of danger before the globe became one of living flame; which, as Marnee pressed the accelerator, began to shoot out flashes a foot long, increasing in intensity.

Bradley's weapon dropped from his suddenly nerveless hand. He heard it drop. Then, all over his body, he felt a thousand stabs. His knees weakened. Gradually, he sagged—finally collapsed, pitching headforemost to the floor.

Still the living flames played about him! His last conscious remembrance was the gloating face of his enemy.

Chapter II.

THE SECRETS OF THE AIR

"Something terrible has happened to Bradley Lane, father," gasped Ruth Leyden, as she came rushing into her father's laboratory on the morning after Lane's encounter with Marnee. She pointed to the newspaper headlines that told of the lurid happenings to Membling Avenue the night before.

". . . Bradley Lane, the former Assistant Chief Intelligence Officer, U. S. A. and later a sub-Chief in the Bureau of Chemical Warfare, whose research work and inventions, particularly in the line of radio, were of such material help in the closing days of the war, lies at death's door as a result of his encounter with that international criminal, the mad scientist and anarchist who chooses to masquerade under the monaker of 'Marnee' . . ."

"God's mercy on him," Leyden breathed;

(*Continued on page* 1008)

We are pleased to announce to our readers the first combination photo-play and novelization ever attempted by any radio publication. A super-serial photoplay, entitled "THE RADIO KING," has been produced by the Universal Film Company in collaboration with RADIO NEWS, and the scenario is by Robert Dillon. Serial stories have been run in fiction magazines while the photo-serial itself was being produced at the picture theatres, but this is the first time that it has been attempted in a radio magazine.

The film has been produced under the supervision of RADIO NEWS and is a double-barreled melodrama in which radio plays a wonderful role. There is hardly a second on the screen when something or other is not being accomplished by radio. The story takes place in the future and is exciting enough to satisfy the most blasé movie fan.

"THE RADIO KING" will be produced all over the country, beginning in October, and will run serially at the better moving-picture houses for ten weeks, one episode a week. The entire story will run in two installments in RADIO NEWS, of which this is the first.

A novel idea in connection with this production is that at all the moving-picture houses showing "THE RADIO KING," every patron will be handed a question blank on which certain simple radio questions are printed. For the best answer, the manager of each theatre will give the winner, as a prize, a yearly subscription to RADIO NEWS.

EDITOR.

The Radio Patent Situation

By JOHN B. BRADY*

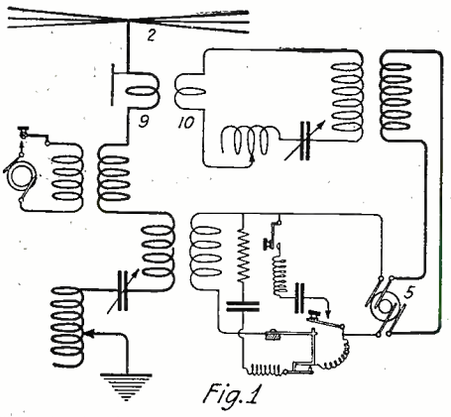


Fig. 1

This Circuit of a Heterodyne System Was Applied for in 1905 by Fessenden and Patents Issued in 1913. It Was Later Sustained by the Courts.

WHAT A PATENT IS

THE Congress of the United States was given authority under one of its powers derived from the Federal Constitution

"To promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

Congress has exercised its authority by passing a general law empowering the Commissioner of Patents to grant in the name of the Government letters patent for inventions.

A patent for an invention is a contract between the inventor and the Federal Government pursuant to which a disclosure of the invention is made by the inventor in his application for patent, in consideration of which disclosure and after proceedings required by the Patent Office a grant of letters

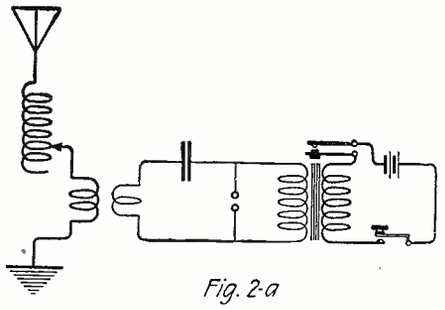


Fig. 2-a

This Transmitting Circuit Was Covered by the Marconi "Four-Circuit" Tuning Patent.

patent is made to him by the Government for a period of seventeen years for the right to exclude all others from manufacturing, using and selling the invention covered by the patent.

It should be carefully noted that the Government does not attempt to give to an inventor the right to make that which he has invented, for this right is inherent in the individual who creates or makes the invention. The right which the Government grants is the right to exclude others from making the thing covered by the patent.

It is not easy for the layman to understand why the Government would grant a patent to an inventor for an article which the inventor could not make without infringing a patent of prior date granted to another. But since the government does not grant the right to make, but only the right to exclude others from making, it follows that an inventor may even with his patent be ever liable for infringement of some other patent. It therefore behooves one who anticipates manufacturing radio apparatus, whether it is patented or not, to have a search of all existing radio patents made to see if he would infringe the patents of others in the making of this apparatus.

*Patent lawyer and radio authority, Washington, D. C.

APPLICATIONS FLOODING PATENT OFFICE

The enormous increase in the number of users of radio apparatus is having its immediate reflection in the work of the Patent Office in passing upon the applications for patents which are filed in daily increasing numbers for radio apparatus and systems. The work of the examining corps of the Patent Office has increased far in proportion to the number of skilled examiners added to the staff, and this is especially true in the division charged with the examination of inventions in the art of radio telegraphy and telephony. The principal examiner of this division and his force of scarcely a half dozen skilled assistants are struggling under the mass of patent applications filed in this subject, and despite their efforts to keep up-to-date, the work is growing by leaps and bounds.

This activity in the field of radio patents is an index to the rapid manufacturing growth which is bound to come. Time has been the test of the fundamental business principle that activity in the construction of patent situations has been the forerunner of large commercial growth and substantial business enterprises. Where monopolies are being planned today, stable business conditions may be expected in the future. It may be said that the Patent Office at Washington has been the principal instrument in providing the business foundation in radio today.

GROWTH OF MANUFACTURERS BASED ON PATENTS

Such companies as the Marconi Wireless Telegraph Company of America, the General Electric Company, the American Telephone and Telegraph Company, the Western Electric Company, the De Forest Radio Telegraph and Telephone Company, and Westinghouse Electric and Manufacturing Company would never have been in position to contribute to the strength of the Radio Corporation of America if they had not looked ahead and constructed a patent situation. The very existence of the Federal Telegraph Company of California was due largely to the patents drawn around the arc radio transmitter.

Among the smaller companies, the potential value of a patent situation may not be so apparent. Yet there exists such examples of businesses fostered by patents as the Vreeland Apparatus Company; the Dubilier Condenser Company; the former Atlantic Communication Company, operating under patents in this country of German patentees and former owner of the well-known radio station at Sayville, Long Island, to which most of us listened each night prior to the war for press news; the Lowenstein Radio Company; the Liberty Electric Corporation and Independent Wireless Telephone Company, together with the Cutting and Washington Company; Emil J. Simon, Inc.; Kilbourne and Clarke Manufacturing Company; Miller Reese Hutchinson; the Wireless Specialty Apparatus Company, and the Wireless Improvement Company.

We might go back to the first successful radio communication by Marconi and note the entire absence of radio patents of any great importance. Following the success of Marconi many applications for patents were filed on which to form a monopoly for the commercial development of the art. Many other inventions contributed to the situation founded by the American Marconi Company, including the inventions of the loading coil by Lodge, the many syntonization or tuning patents of Marconi, the application of the two electrode valve to radio by Fleming, the carborundum detector by Dunwoody, circuit patents by Eisenstein, Franklin, Weagant, Butcher, Marriott, Bellini-Tosi, Shoemaker, and numerous others.

In the early days the patent records recorded many companies endeavoring to gain a foothold in the radio art through the establishment of a patent situation, such as the Clark Wireless Telegraph Company, Collins Wireless Telephone Company, United Wireless Telegraph Company, and many others, not to mention hundreds of individuals.

The patents of John Stone Stone relating to coupled circuits, syntonization, antennae systems, direction finders, radio telephony, and other important inventions, together with the inventions of Ehret on radio telephony and other circuits, those of De Forest, Smythe, Clark, Kent, Simon, Seibt,

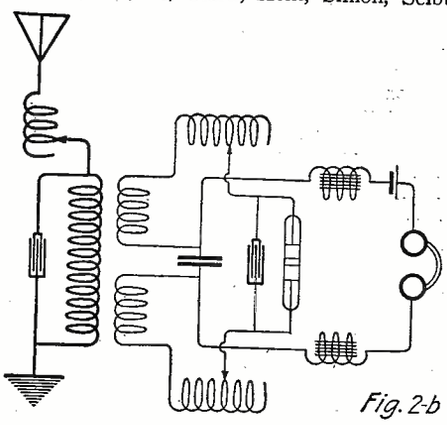


Fig. 2-b

The Famous Marconi "Four-Circuit" Patent. The Patent Covered Any Loose-Coupled Tuning Arrangement. This Patent Lately Expired.

Hudson, Cabot, Cram, Laughter, Ducretet and others, formed a basis for the establishment of the De Forest Radio Telephone and Telegraph Co., having as probably their most important holding the De Forest patents on the electron tube amplifier and the third electrode or grid for the electron tube.

The National Electric Signaling Company was dependent largely for its growth upon the patents of Fessenden, including important inventions on continuous wave transmission, radio telephony, the heterodyne, interference preventors, antennae systems, and numerous circuit patents. Many other inventions contributed to the growth of the National Electric Signaling Company which became the International Radio Telegraph Company, forming its monopoly under numerous additional inventions such as those

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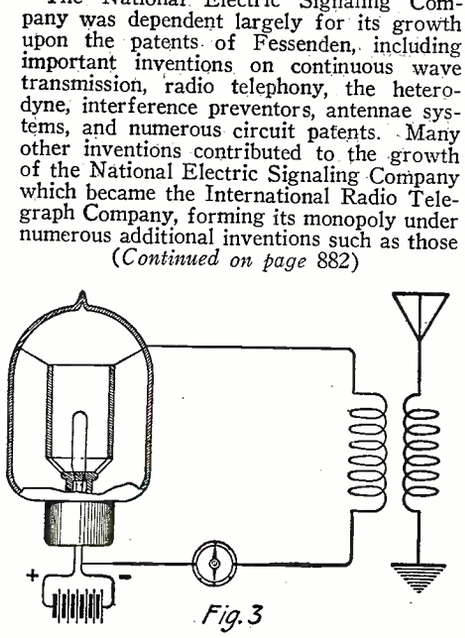


Fig. 3

The Circuit of the Well-Known Fleming Valve Patent. This Patent Was Broad Enough to Cover the Three-Electrode Valve, But the Ruling Was Later Made That the Audion Could Be Used As Oscillator or Amplifier Without Infringing.

Religion and Radio

By E. F. SUTHERLAND

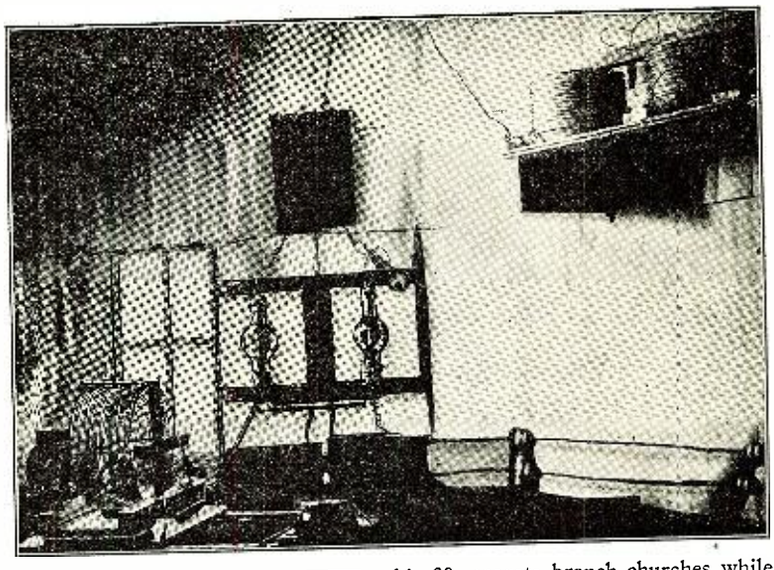
THE Church is putting new vim and life into radio. Already demonstrating its value in the social, commercial and military world, radio is now once again clearly demonstrating its practical usefulness and that it has become a permanent and powerful agent of the religious world.

The First Presbyterian Church of Seattle, Wash., has installed and is regularly operating one of the most powerful radio broadcasting stations on the Pacific Coast and it is no doubt the most powerful church set in the United States, if not in the entire world.

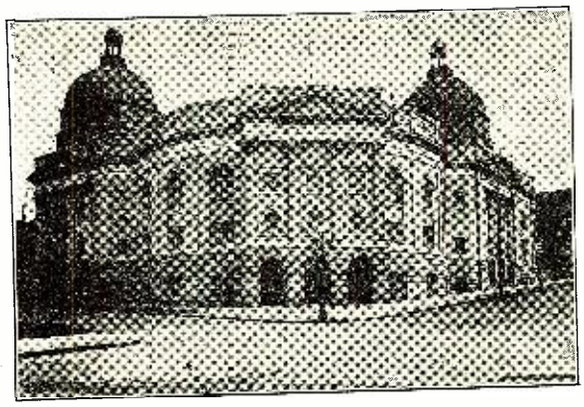
That this occasions no great surprise and is fitting and proper can be seen from the character of the man, Dr. Mark Allison Matthews, who for 21 years has steadily, earnestly and forcibly lead the First Presbyterian Church from a small struggling membership of about 300 to a membership of over 7,500 housed in a magnificent structure already too small. The seating capacity of the structure is 3,700. This church maintains and supports 30 branch mission churches in the city, county and state. It has not added these 2,000 members of the branch churches to the membership roll of the First church, for as rapidly as they become self-supporting they are started as independent churches. This church has already 12 to 15 independent churches. It supports seven foreign missionaries. This takes no account of the great number of other activities that are daily carried on.

Is it any wonder that such a pastor and leader should be among the first to grasp the opportunity that radio affords to reach his many congregations and the general field that radio opens?

Dr. Matthews' first idea was to reach and to speak simultaneously to his 30 separate branch churches while at the same time addressing the main church. He called to his assistance Mr. J. D. Ross, Supt. of the City Light, and Mr. J. G. Priestly, the City's Chemical Engineer, an active radio student. Together these men designed and worked out the plans for radio broadcasting station KTW, First Presbyterian Church, Seattle, Washington.



View of the Transmitter Installed in the Seattle Church Shown Below. After Overcoming Many Diffi ulties the Apparatus is Now Functioning Well.



In describing the history and operation of the station, Mr. Priestly, radio director of the church, stated it was originally planned to reach only the 30 mission churches. A 50-watt transmitting set was thought powerful enough, but such was the enthusiastic demand for the service that the set was later increased to 250 watts with sufficient reserve power to double the size of the station whenever it was deemed proper.

The station as it now stands holds the following complete apparatus: two 250-watt power tubes, one 50-watt power tube, four 5-watt power tubes, one 10-h.p. direct current motor, four 500-volt D. C. power generators, two large 5-cell Edison storage batteries, eight dry cell batteries, 550 volts reserve; four wet cell B batteries, 200 volts; one oscillation coil, 24 inches by 12 inches; one oscillation coil, 9 inches by 7 inches; and a large assortment of condensers, resistance rods, grid leaks and other apparatus too

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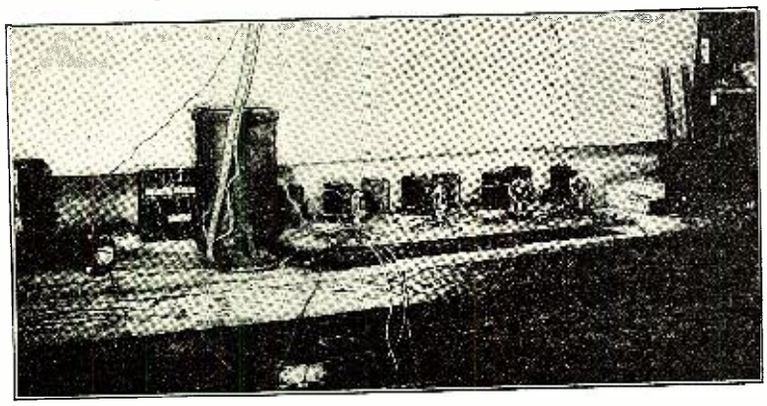


The Speech Amplifier. As is Evident, the Work of Installation Was Voluntarily Done by Radio Amateurs.

Alternator Versus Arc

By. C. C. CHAPMAN

WHILE the above heading has been written "Alternator vs. Arc," it is not the intention here to draw any comparison between the arc and any other system of radio telegraphy; this has been written for the purpose of correcting the misstatements that have been made concerning the arc, as the writer is well aware that, in a fair field, the arc is quite competent to take care of itself without the necessity of resorting to comparisons detrimental to other systems.

The author of a recent article entitled "Arc Versus Alternator" made particular mention of the emission of undesirable frequencies from the arc stations at the Eiffel Tower and at Salonica, operating on 7,000 to 10,000 meters and 6,300 meters respectively. Concerning the interference caused by these stations no comments are offered here, as the writer has had no opportunity of observing at close range the signals from either of them.

Granting, however, that the interference exists, it is assumed that the two chief offenders are the arcs at the stations named above, which, according to the best information at hand, are equipped with arc transmitters of about 100-KW. capacity.

Both of these transmitters were manufactured in Europe and probably do not have embodied in them the improved design given the arc converters manufactured in this country. In the absence of information concerning the matter, this would seem to be borne out by the fact that the 1,000-KW. Federal arc transmitter at the Lafayette Station is not named as causing undue interference. Being of ten times the rated power of the Eiffel Tower Station, it would seem reasonable to anticipate enough interference to cause it to be named in the interfering class with the other two.

It is freely admitted that receiving stations using modern receiving apparatus and one or more steps of amplification when operating in the vicinity of high power arc stations will be subjected to a certain amount of interference from extraneous noises, but this is not confined to arc stations, as will be testified to by operators who have heard the interference caused by high power valve stations. Furthermore, interference from arc stations of American

(*Continued on page* 996)

A New Type of High Power Vacuum Tube

By W. WILSON

Mr. W. G. Housekeeper With the 100 K. W. Tube Which He Materially Assisted in Developing.

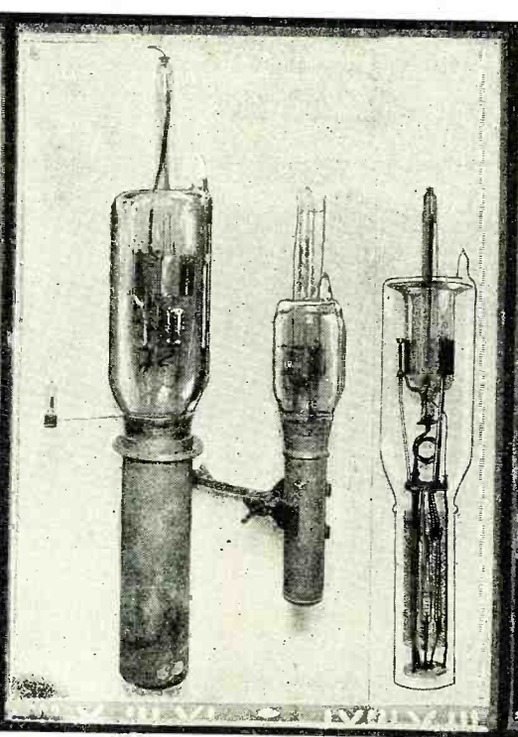
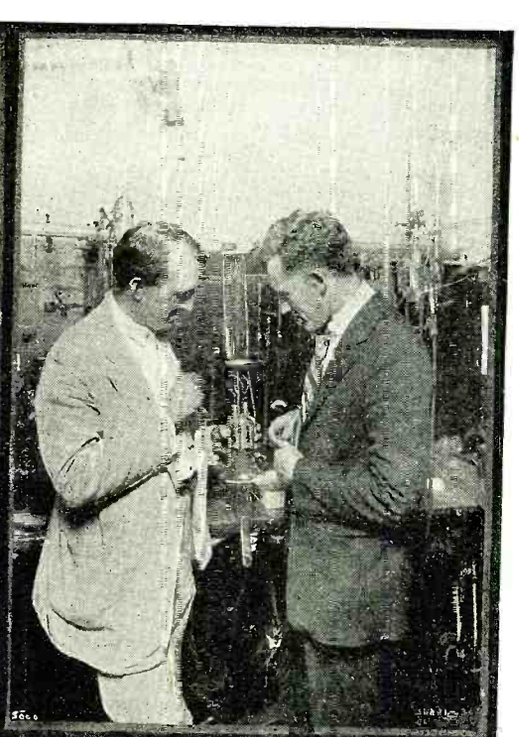


Fig. 6. The New 100 K. W. Tube Compared on the Right With the Smaller 12 K. W. Tube and on the Left With the "Peanut" Receiving Tube.



Mr. Housekeeper Indicating the Interior Construction of the Tube. The Tube is Inverted with the Grid and Filament Plainly Visible.

THE development of wireless telephony and the use of continuous wave transmission in wireless telegraphy have led to the general adoption of the vacuum tube as the generator of high frequency currents in low power installations.

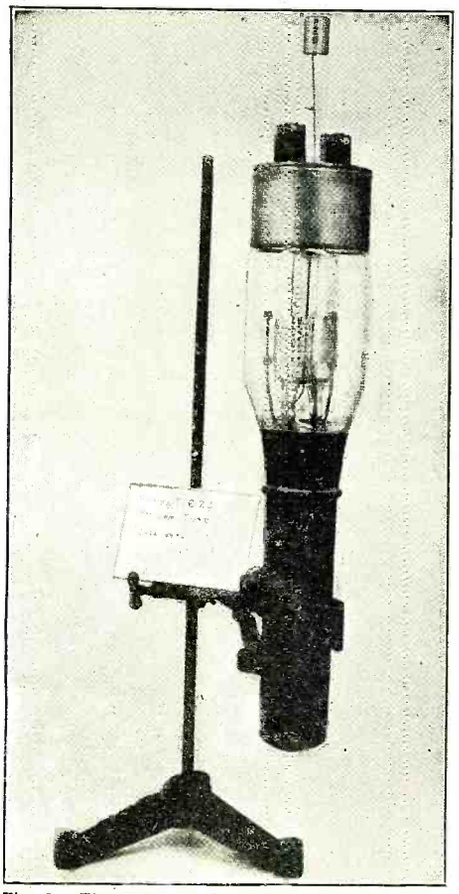


Fig. 5. The Final Form of Tube Adopted, After Various Developments. 12 K. W. Were Obtained With This Type.

The ordinary form of vacuum tube is, however, ill suited for the handling of large amounts of power, and at the large wireless stations where the plant is rated in hundreds of kilowatts either the arc or the high frequency alternator is used.

The undoubted advantages to be derived from the use of vacuum tubes, especially in the field of wireless telephony where the output power must be modulated to conform to the intricate vibration pattern of the voice, has led to a demand for tubes capable of handling amounts of power comparable with those in use at the largest stations.

That the development of such tubes was of great importance was recognized by the engineers of the Bell Telephone System in the early days of the vacuum tube art. The experiments at Arlington, Virginia, in which speech was first transmitted across the Atlantic to Paris and across the Pacific to Honolulu, required the use of nearly 300 of the most powerful tubes then available, each capable of handling about 25 watts, and the difficulties encountered in operating so many tubes in parallel gave added impetus to the development of high power units.

It is the object of the present paper to deal with the various steps in the development of high power tubes as carried out in the Bell System research laboratories at the Western Electric Company.

The usual type of vacuum tube consists of an evacuated glass vessel in which are enclosed three elements, the filament, the plate, and the grid. When the tube is in operation an electron current flows between the filament which is heated by an auxiliary source of power and the plate, the magnitude of this current being controlled by the grid.

The passage of the current through a thermionic tube is accompanied by the dissipation in the plate of an amount of power which is comparable to the power delivered to the output circuit and which manifests itself in the form of heat. This causes the temperature of the plate in the usual type of tube to rise until the rate of loss of heat by radiation is equal to the power dissipated. Some of the heat liberated by the plate is absorbed by the walls of the containing vessel which consequently rise in temperature. These factors, together with a consideration of the size of plate that can be conveniently suspended inside a glass bulb and the size of glass bulb that can be conveniently worked, set a limit of about 1 to 2 K.W. for the power that can be dissipated in the plate of a commercial vacuum tube of this type. The plates are generally constructed of molybdenum or some other re-

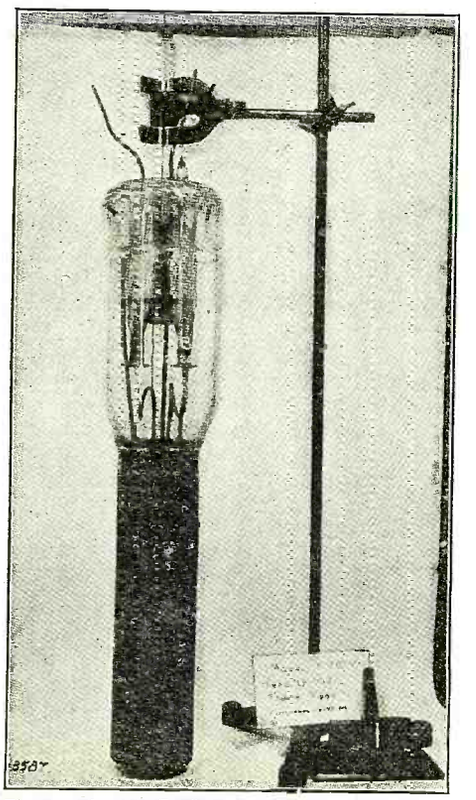


Fig. 7. The 100 K. W. Tube. The Filament Alone Measures 63 Inches and Consumes 6 K. W. The Exterior Plate is Water Cooled.

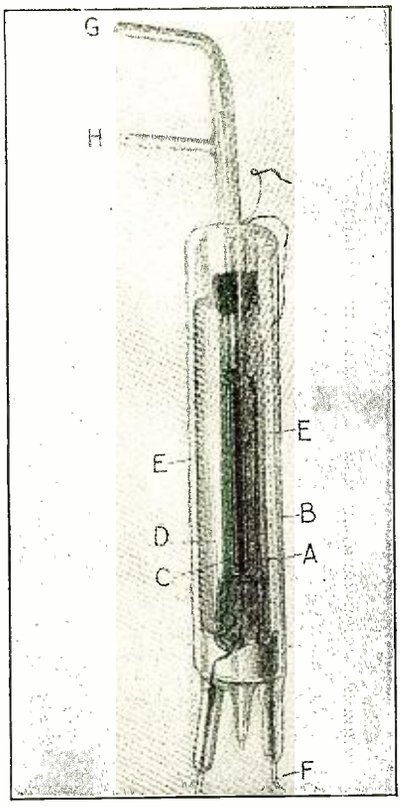


Fig. 1. The First Step in the Development of High Power Tubes. The Plate Was Sealed Into a Glass Vessel and Kept Cool by Passing Water Through It.

fractory metal and the containing vessel made of hard glass.

The use of quartz as the containing vessel offers certain advantages which tend to raise the power limit somewhat and this material has been used for power tube purposes in England.

It is apparent then that in the development of vacuum tubes capable of handling large amounts of power means other than radiation must be used for removing the heat dissipated at the plate, and development of tubes along these lines was undertaken by Dr. E. R. Stoekle and Dr. O. E. Buckley.

Dr. Stoekle had already worked for some years on the problem of removing the heat dissipated at the anode of a thermionic tube by making the anode a part of the outside wall of the vessel and thus making it possible to convey the heat directly away from it by means of circulating water. This was clearly the right principle but as is obvious to those who are familiar with these devices, great difficulties presented themselves in the mechanical construction of large tubes in which vacuum tight joints must be made and maintained between glass and large masses of metal. The importance of the problem, however, was such that Stoekle and Buckley pushed on in the face of difficulties to the construction of tubes which could handle kilowatts where previous tubes could only handle watts.

A step in the direction of overcoming these difficulties was made by Messrs. Schwerin and Weinhart, who were working with Dr. Buckley on the problem, and who suggested that the anode might be made in the form of a tube or thimble of platinum sealed into a glass vessel and kept cool by passing water through it.

This suggestion led to the development of a tube which, although not the one finally adopted, is discussed in some detail since it was the first one to be pushed to such a point as to give promise of economical commercial manufacture.

The tube is shown in Fig. 1. The anode consists of a platinum cylinder A, 7" long and .625" wide, which is sealed into the center of the glass cylinder B. The end of the platinum cylinder remote from the seal is closed. The anode is surrounded by the grid C and by the filament D, which are supported by the glass arbors E. The current for the filament is led into the tube through the platinum thimbles F.

The anode is kept cool by means of a supply of water passing into the anode through the tube G and leaving by the tube H.

A number of tubes having this general type of construction were made up and it was found possible to dissipate as much as 15 K.W. in the anode.

As soon as the pressure of work more directly connected with the necessities of the war would permit, Mr. W. G. Housekeeper and Dr. M. J. Kelly undertook the further improvement of the water-cooled tube, the former assuming the task of developing the mechanical structure, and the latter that of determining the electrical design and the process of tube exhaust.

Mr. Housekeeper adopted into the construction of the tube a remarkable type of vacuum seal which he had previously developed. These seals are made between glass and metal and can be made in any desired size. They are capable of withstanding repeated heating and cooling over wide ranges of temperature, from that of liquid air to 350° C, without cracking and without impairment of their vacuum holding properties.

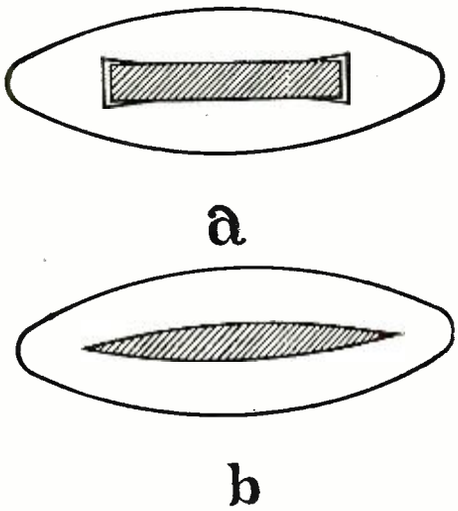


Fig. 2. The Method of Sealing Glass and Metal to Hold Vacuum Invented by Mr. Housekeeper, Solved One of the Greatest Problems.

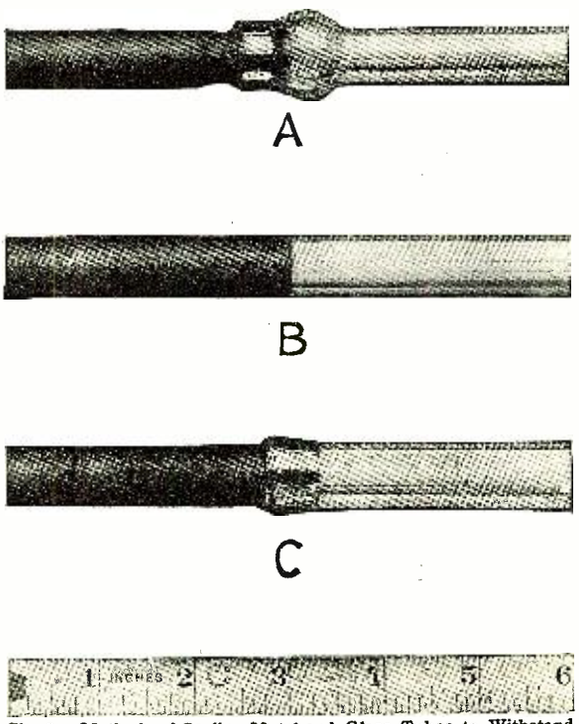


Fig. 3. Methods of Sealing Metal and Glass Tubes to Withstand Varying Amperatures.

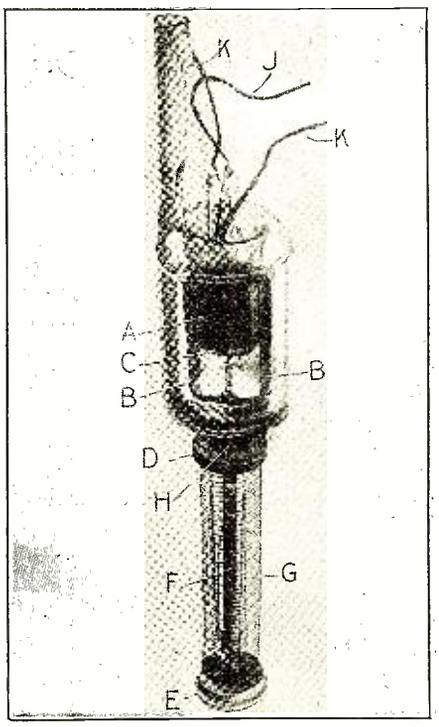


Fig. 4. The First Thermionic Tube to Use the New Method of Vacuum Seal. This Tube Gave About 5 K. W. Output.

It is no exaggeration to say that the invention of these seals has made possible the construction of vacuum tubes, capable of handling in single units, powers of any magnitude which may be called for in wireless telegraph and telephone transmission.

The underlying principle connected with the making of this seal consists in obtaining an intimate connection between the glass and metal, either by chemical combination or by mere wetting, and in so proportioning the glass and metal portions of the seal that the stresses produced when the seal is heated or cooled will not be great enough to rupture either the glass or the junction between the glass and metal.

The three principal types of seals developed by Mr. Housekeeper are known as the ribbon seal, the disc seal and the tube seal.

If a copper ribbon is directly sealed through glass it is found that the glass and copper adhere along the flat faces of the seal but that ruptures occur along the edges as shown in Fig. 2 (a). This is due to the fact that as the seal cools after being made, the glass in contact with metal is capable of resisting the shearing and tensile stresses that occur along the faces, while the glass wrapping round the edges of the ribbon is called upon to withstand much greater tensile stresses and gives way. If the edges of the ribbon are sharpened as shown in Fig. 2 (b), a tight seal results, the reason being that the forces of adhesion between the glass and copper acting along the flat contact faces are sufficient to stretch the thin copper at the edge and prevent its drawing away when cooled. There is a definite relation between the elastic properties of the metal and glass and the angle of edge that can be used for a successful seal.

By proper shaping of the metal ribbon, seals have been successfully made

(*Continued on page* 946)

INSTALLING BROADCAST RECEIVERS ON SHIPS

THE job of chief operator on a trans-Atlantic passenger liner threatens to become interesting. In fact, he will have a fair chance of competing with the purser as the social lion and chief entertainer of the ship.

Take a look at S. M. Brown, chief on the Mauretania, "doing his stuff" in the salon and then get out some brass polish to take some of the green off the old buttons. You may be entertaining the ladies next trip!

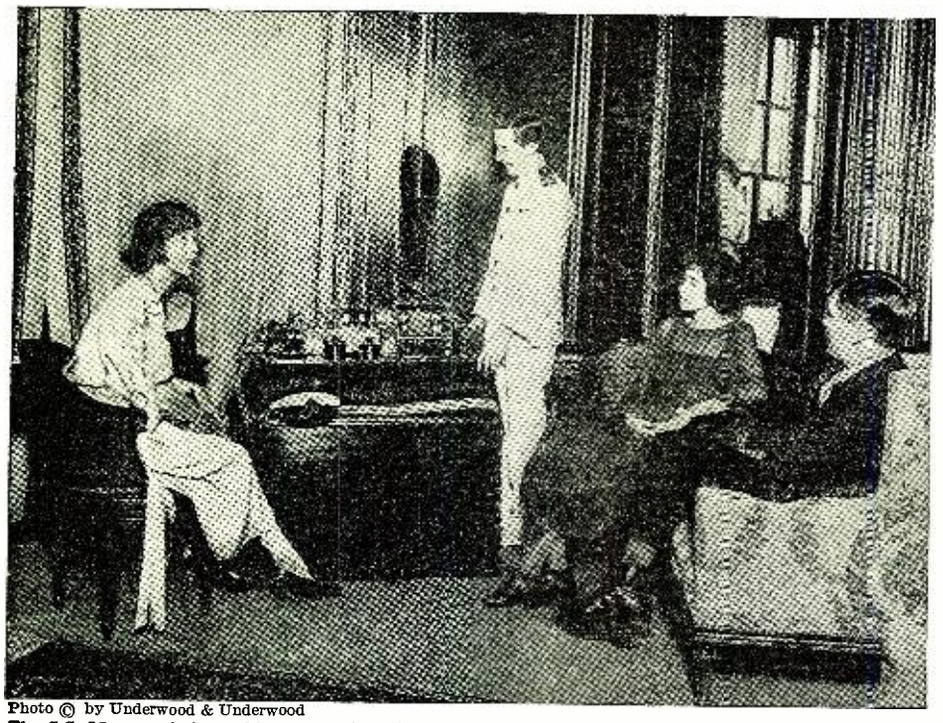


Photo © by Underwood & Underwood

The S.S. Mauretania is the First Trans-Atlantic Liner to Install a Receiver That Will Entertain Passengers While at Sea With Concerts Broadcasted by Radio. S. M. Brown, Chief Operator, is Shown Tuning the Receiver, While Miss Florence Dixon, Left, Irene Lee, Right, and Mr. Patterson, Passengers, Are Listening to WJZ.

At last the steamship companies are realizing the enormous possibilities of radiophone broadcasts as a means of entertaining passengers. The Mauretania has led the way by installing a complete and independent receiver in one of the salons. Its sole object is to receive the programs of broadcasting stations from either side of the water. It may be difficult to keep in constant touch, especially in midocean, but we feel confident that, in the future, certain ships will be recognized as the broadcasting stations of the sea. If our beliefs are realized, the Mauretania and other ships which will undoubtedly follow her lead will be able at all times to afford their passengers radio entertainment either from shore or from one of the ship broadcasting stations.

The installation of radio broadcasting receivers on ships is the logical development of the popularity of radio in this country and in Europe. Hitherto restricted to amateurs, radio on shore has spread with alarming rapidity to the homes and meeting-places of the uninitiated public. Hotels and restaurants stage public radio dances. Broadway shows have radio songs. The newspapers are full of it. Is it any wonder that passengers traveling on ships, where radio has existed for years as a commercial utility and assistance to navigation, express surprise that they cannot hear the radio broadcasts? Of all the places where one would expect to hear radio and hear it well, passenger ships are the most likely. A sea voyage is more or less of a bore to a passenger. To relieve this boredom the steamship companies have provided their vessels with orchestras, swimming pools, smoking rooms, deck-games, Turkish baths and a thousand other attractions. It has taken them a long time, however, to realize that they have neglected one of the greatest attractions of modern times—radio.

The "wireless" has always been the most interesting thing on board ship to the passenger. With the knowledge that the ship is equipped with radio apparatus the passenger experiences a sensation of contact with the far-off shore and knows that, in case of danger, the wireless will mysteriously summon aid from passing ships. How much more will he be conscious of this feeling of security when he is able actually to hear voices and music from the shore. We feel certain the installation of a broadcast receiver on the Mauretania will meet with the approval of the passengers and we believe that Mr. Brown and his associates will be the most popular men on the ship.

We hope the other steamship companies will not delay in similarly equipping their ships. Our reason for expressing this hope is mainly because radio will be advertised and be made still more popular, but as the popularity of radio increases the more work there is for radio men. A special operator will possibly be required to take charge of the reception of broadcasts.

We know a number of vessels sailing up and down our own coast which are still not equipped with apparatus for receiving the radio broadcasts. These ships are at all times comparatively close to broadcasting stations and reception is a simple matter. Hitherto the argument of the shipowners has been that the radio operator is supposed to be assisting navigation and handling commercial messages rather than entertaining passengers. However, they may realize from the example of the Mauretania that it is possible to install an entirely separate receiver in one of the ship's salons, independent of the commercial apparatus in the radio room. It is our opinion that if some such means of entertaining passengers were provided on board coastwise vessels there would be less complaint of railroad competition on the part of shipowners. We know of several coastwise vessels that do not even boast of a phonograph with which to entertain their passengers.

The cost of installing a broadcast receiver on board ships is small and the upkeep is negligible. The only other requirement is a separate aerial or, in the case of coastwise ships, a loop aerial should serve. The latter arrangement with suitable radio frequency amplification would be best, as interference would be almost entirely eliminated.

S. E.

THIS new Department of RADIO NEWS will appear each month and will be conducted as a meeting-place for the commercial and Naval Radio operators, at sea or on shore. Matters of particular interest to operators will be discussed every month and contributions from the operators themselves are welcome. These contributions may contain technical or useful information, suggestions for working traffic in general and with particular stations, or they may relate interesting experiences. When a ship operator submits his material he should give the name of his ship. Photographs of stations or apparatus may be submitted. These photographs should not be smaller than 5"x7" although those of post card size which are good may also be used. Address the Editor, *With the Sea-going Operators Department*, RADIO NEWS.

HATS OFF TO A REAL SPEED-ARTIST

In case some of you boys think you know how to copy, we are showing a sample of the kind of stuff T. R. McElroy turns out on a mill while receiving at over 55 words a minute.

The occasion on which he made this extraordinary exhibition of his skill was at the Radio Marathon Speed Contest for the Carlson-Diamond Medal, held Sunday morning, August 6th, at 10 a. m., in Congress Hall of the Pageant of Progress Exposition on the Chicago Municipal Pier. It was a speed contest for radio operators in receiving straight commercial press in the Continental Code and simultaneously transcribing the message on regulation Western Union typewriters.

Contestants were present from other cities and included Mr. T. R. McElroy of the Western Union Telegraph Company from Boston, holder of the previous world's record of 56½ words per minute with three errors; Mr. B. G. Seutter of the New York *Times* Radio Department from New York; Mr. Benedict D. Brankey of the Western Union Telegraph Company from Chicago, and Mr. M. Swartz, assistant radio inspector, Ninth District.

T R MCELROY
TEST SEVENTH (55 WPM)

STATES ARMY CORPS WILL BE RECEIVED BY THINKING FOLK EVERYWHERE AMERICAN LEGION OFFICIALS RECENTLY STARTED ON GENERAL SAWYERS TRAIL THEY ACCUSED HIM OF HASTENING AND HOLDING UP THE PROGRAMME OF FEDERAL HOSPITALIZATION GENERAL SAWYER IS CHIEF COORDINATOR OF THE HOSPITALIZATION BOARD THEY HAD BETTER INVOKE PUBLIC SENTIMENT BACK OF GENERAL SAWYER INSTEAD OF HOBBLING HIM ASSERTED MR DAWES THEN HE WENT ON TO SAY THAT THERE WAS ALTOGETHER TOO MUCH RUNNING TO COVER BY GOVERNMENT OFFICIALS EVERY TIME THE AMERICAN LEGION GROWLED AT THEM FEARING THAT THE SEEDLESS PUBLIC WOULD ALL TOO QUICKLY ASSUME THAT THE LEGION WAS RIGHT WHATEVER THE FACTS MIGHT BE MR DAWES ASSERTION OF HIS

55 1/10 wds per min.

Perfect Copy.

This Copy Was Made by T. R. McElroy, the World's Champion Transcriber of International Code, at a Speed of 55 1/10 Words Per Minute. Five Characters Are Taken to Represent One Word. The Copy Had No Errors.

The test was conducted by Mr. Lawrence R. Schmitt, formerly United States radio inspector, Ninth District. The judges were Capt. Alfred Thomas of the Radio Corporation of America; Mr. E. A. Beane, U. S. radio inspector, Ninth District, and Mr. Schmitt.

At 10 a. m. the contestants were seated at the test table on the stage of Congress Hall, wearing the telephone head sets and at attention with their

typewriters, ready for the signal to start. The automatic sending machine clicked off the dots and dashes from a tape delivered under seal for this contest. The starting speed was 40 words a minute. Succeeding tests were run for two minute intervals, increasing the speed two words per minute at each test.

The rules for elimination provided that after a speed of 46 words a minute was reached the contestant having the greatest number of errors be eliminated, and that this method be followed by successive tests at a higher speed. Brankey was eliminated at 46 words a minute, Swartz at 48. The contest was then between Seutter and McElroy. Seutter was eliminated at 52 words a minute. McElroy was presented with the solid gold diamond medal by George E. Carlson, commissioner of gas and electricity of the city of Chicago, when he copied 52 1/5 words per minute, perfect copy.

McElroy attempted to beat his world's record of 56½ words a minute with three errors. He succeeded in copying 55 1/10 words per minute perfect copy, and in another test copied 58 words per minute with five errors. This is considered by all operators to be little short of marvelous. In commercial work manual speed is usually limited to not more than 45 words per minute. A machine is used for copying greater speeds and the message as copied on a tape is repeated at a slower speed to permit its transcription. McElroy's skill places him in a class as a human machine. To add interest for the spectators, the dots and dashes were sent through a loud speaker. Many of the audience expressed surprise that anyone could be able to decipher the code. McElroy's record message at the rate of 55 1/10 words per minute is shown in the photograph.

The time was started with the word "will." Five letters were taken as the average word. The word "seedless" was checked by the judges and found to be correct with the punchings on the sending tape.

After Mr. McElroy had won the contest by copying 52 1/5 words per minute perfect copy, Commissioner Carlson offered a prize of $50 additional in case the world's record was beaten. As stated above, Mr. McElroy established a world's record of 55 1/10 words per minute perfect copy. Before awarding the prize and to remove all doubt as to whether or not 55 1/10 words perfect copy was superior to 56½ words per minute with four errors, which was the previous record, Commissioner Carlson obtained an opinion from a commission of five experts relative to this record. The commission consisted of Mr. E. J. Nally, president of the Radio Corporation of America; Mr. E. R. Shute, operating engineer of the Western Union Telegraph Company; Capt. Alfred Thomas, district manager of the Radio Corporation of America; Mr. E. R. Beane, U. S. radio inspector, Ninth District, and Mr. L. R. Schmitt. The entire commission was uniformly agreed that perfect copy is the standard for consideration, and are therefore agreed that 55 1/10 words per minute perfect copy is a new world's record.

SENSITIVE RECEIVING APPARATUS ON THE PAN AMERICA

The most sensitive receiving outfit ever installed on an American merchant vessel is that on the steamship Pan America, operated for the United States Shipping Board by the Munson Steamship Line between New York and South American ports. It was installed for the benefit of Secretary of State Hughes, who sailed recently on the Pan America as the United States representative to the opening of the Brazilian Centennial Exposition at Rio.

During the entire trip to the Brazilian capital Secretary Hughes was able to keep in touch with official Washington. Communication between Washington and the ship was held through the powerful wireless station at Arlington.

The outfit on the Pan America is one especially developed by the Bureau of Steam Engineering in Washington and is designed for Naval Communication Service.

It consists of a special three stage radio frequency amplifier, a detector and two stages of audio frequency amplification. The tuner has a wave length range of 150 to 30,000 meters. The vacuum tubes used in this amplifier are the Western Electric peanut type of tubes, which have recently been developed by the Western Electric Company for the United States Government.

In connection with this outfit a radio frequency driver for heterodyne reception, covering a wave length range of from 6 to 30,000 meters is used. For receiving wave lengths from 150 to 6,000 meters the ordinary feed-back circuit is used.

The vessel is equipped with the latest type of arc transmitter, with a transmitting range up to 5,000 miles, and in addition a 1-K.W. Navy standard spark transmitter. L. K. Meriweather is chief operator on board.

Mr. L. K. Meriweather, Chief Operator, in the Radio Room of the S.S. Pan America. This ship was recently equipped with a highly sensitive receiving apparatus using peanut tubes. The R. F. amplifier is visible on top of the Navy tuner.

If radio men don't take a more active interest in their future they may lose their gold braid. The next stop after that is the fo'c'stle. Look out, fellows!

ANNOUNCEMENT FROM THE U. R. T. A.

Mr. Claude C. Levin, president of the National United Radio Telegraphers Association, sends us the following information, which will be of great interest to all radio men:

Owing to the widespread unemployment which forced so many men to seek other occupations, the membership of the U. R. T. A. was so reduced that it became impossible to maintain the association as in former times. On April 1st we were forced to give up our Broad Street offices and were permitted to keep our records, etc., at the offices of Ocean Association, 15 Whitehall Street, New York City. We realized that if we were to cease to function at this critical time the radio operators would have no recognition in future conferences and a drop in both wages and status aboard ship would be inevitable.

On May 21, 1922, the grave situation of the radio telegraphers was placed before the American Ocean Officers Conference, and it was decided by the member associations of the conference that all possible help should be extended to us. The conference appointed the Ocean Association of Marine Engineers to act as representatives of the U. R. T. A., with the complete right of the U. R. T. A. to control its own affairs, under its own officers. The full use of the club rooms, office staff and other advantages of the Ocean Association is thus extended to us.

The agents of the Neptune Association in the ports of Philadelphia and Baltimore were appointed to be agents of the Ocean Officers Conference instead, and authorized to transact the business of the Neptune Association, Ocean Association of Marine Engineers, and the United Radio Telegraphers Association in these ports. It is planned to extend operations to Norfolk, New Orleans, and other ports, as soon as conditions warrant.

The expenses of these offices will be borne by the other two associations until such time as we are able to pay our proportionate share. By special arrangement in New York, we pay a minimum amount of the clerical expense. We will have practically no other expenses as our officials are either at sea or employed elsewhere ashore.

Due to this arrangement we are enabled to reduce our dues to 75 cents a month, or $9 a year. Owing to the need of simplicity, all accounts will re-commence June 1, 1922. All men are requested to send in at least one-half year's dues in advance, namely, $4.50.

This co-operation with the Deck and Engineer Officers Associations should enable us to rally our men together, and to enjoy decent conditions, and to retain our status as officers on board ship.

I trust that the men will realize the gravity of this situation, namely, that if they do not take an active interest in this association radio will be "GONE" forever; for if we drop to the rating of a petty officer on board ship, and there are many interests that want to see us there, it will be a long, hard road coming back; and you fellows at sea, tossing around in inferior quarters and taking abuse from all sides, will realize this when it is too late.

You are at the crossing, men. Stop, Look and Listen; the decision is up to you.

WE ONLY HAVE WIRELESS HERE

Davison on the Lenape appeals to us for sympathy and protection. You all know the Lenape—KVL. She is the "Queen of the Ferryboats" or something and runs between New York and Jacksonville, Florida, carrying large loads of inquisitive passengers each way. Davison has our sympathy because we once sailed the seas on his sister ship, the KVC, and know what he is up against. If a passenger has any questions to ask—and he invariably has many—for some reason or other he always heads for the static room and asks the op. It depends on the op. how long he can keep it up. After answering the same fool question 642 times, the natural tendency is to go Berserker, tell the old man what he can do with his ship and jump overboard.

(*Continued on page 961*)

Has this one been sprung on you? Davison on the Lenape has this question to answer a few hundred times every trip.

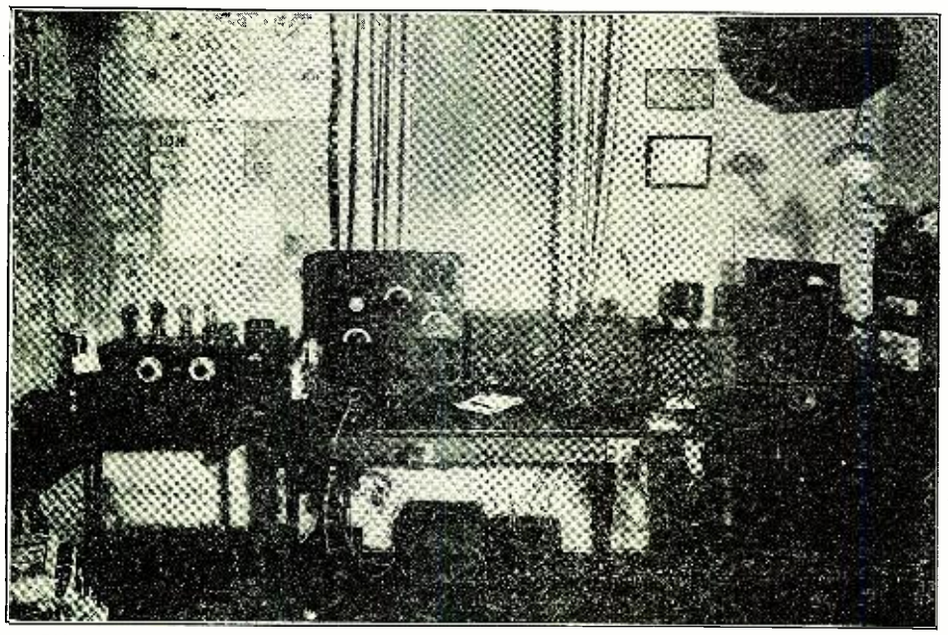
THIS Department is open to all readers. It matters not whether subscribers or not. All photos are judged for best arrangement and efficiency of the apparatus, neatness of connections and general appearance. In order to increase the interest in this department, we prefer to publish photographs of stations accompanied by a picture of the owner.

We prefer dark photos to light ones. The prize winning pictures must be on prints not smaller than 5 x 7". We cannot reproduce pictures smaller than 3½ x 3½". All pictures must bear name and address written in ink on the back. A letter of not less than 100 words giving full description of the station, aerial equipment, etc., must accompany the pictures.

PRIZES: One first monthly prize of $5.00. All other pictures published will be paid for at the rate of $2.00.

Station 2LH at White Plains, N. Y.

THIS MONTH'S PRIZE WINNER



This Well-Equipped Amateur Station is Owned and Operated by W. S. Halstead and Frederick Sipp. Exceptional Results Have Been Obtained With Their Home-Made Apparatus.

RADIO 2LH is located at 31 Greenridge Avenue, White Plains, N. Y. The location is ideal for an amateur transmitting station, as this spot has a higher elevation than any other in the vicinity. The remarkable results obtained at 2LH, even with low power, are due to this fact and an excellent antenna system.

The aerial consists of a seven-wire cage 15" in diameter, 65' long and 85' high. A 4" cage lead-in connects with the instruments.

A counterpoise 100' long, of eight wires, and 8' above the ground, extends radially from the station. Location is directly beneath the aerial with an effective separation of about 80'.

It may be stated here, for the benefit of those who have doubts as to the superiority of the cage over the old flat top, that a radiation of five amperes is obtained with the cage against three amperes while a flat top was used. Practically every form of aerial, from a one-wire "L" to a 12-wire cage, has been tried out thoroughly, and the cage is better in every respect.

The photograph shows 2LH as it appeared last April. Since that date numerous changes have been made. However, a description of the station, as shown may be interesting, as this was the layout with which 2LH did most of the long-distance work.

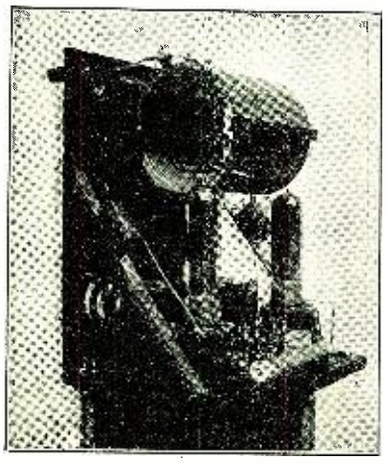
From left to right in the picture the apparatus is as follows: Tuned radio frequency amplifier for experimental purposes, small motor generator for the 5-watt C.W. shown on its right. Beneath the table may be seen the electrolytic rectifier of a special design developed at this station. This rectifier so completely changes and smooths out with the filter system the current that practically no A.C. hum may be noticed even at such a short distance as two city blocks. At a distance the carrier wave is reported much less than that of any broadcasting station using motor-generator for plate supply. The C.W. tone at two miles received with a regenerative set is a pure whistle—not resembling in the least the ordinary rectified A.C. tone with its A.C. ripple. In actual comparisons, the tone was 50 *per cent more pure* than that obtained using the motor-generator, which is the best that can be obtained for radio work. There is no vibration as with a generator and absolutely no noise. The rectifier may be run hours at a time with no heat developing.

Continuing with the description, the large navy type tuner next in line is a relic of the good old days and is retained in the station more as a souvenir than anything else, although it is still used to copy NAA. On the right of this tuner may be seen the RC. set, which was in use at the time. As this did not prove satisfactory for short-wave work, a new short-wave regenerative set has been installed. A two-stage amplifier of special construction is on the right of the RC. set. With this amplifier, WJZ, situated 40 miles distant, may be heard a block away. Choke coils and condensers entirely eliminate the distortion so common in most amplifiers. Federal transformers are used throughout. Next in line comes a wooden box on which the present 100-watt C.W. was tested. The accompanying photo of this in its present condition will show the change that has taken place. An even larger C.W. set will probably be installed in the near future, as this set has just been sold to a summer camp.

Beneath the horn may be seen the 20-watt C.W. and phone set on which 2LH has done such excellent long-distance work. Although this station has been "on the air" only occasionally, due to the conflicting activities of the operators, stations at points as far west as Wichita, Kansas, have reported the C.W. signals QSA. Several stations in Chicago have been worked with voice. This has been done on a radiation never over three amperes with four 5-watt tubes. Since the picture was taken and the installation of the 100-watt C.W. set, it has been reported from Texas and in 39 other States making a total of 40 States in all, within which 2LH's signals have been heard. The best distance on voice is to Nebraska, a distance of about 1,500 miles.

The last, but not the least important, piece of apparatus to be described is the battery-charging panel, shown at the extreme right of the picture. This consists of an old ouija board painted black (HI!) on which are mounted fuses and switches for con-

(*Continued on page* 1002)

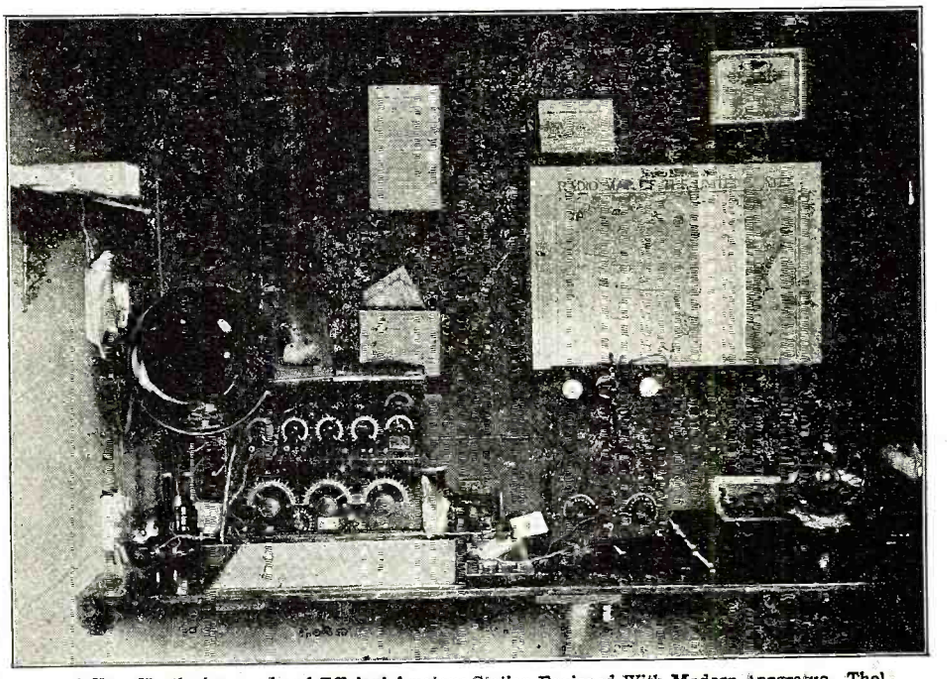


The 100 Watt C.W. Set at 2LH, Constructed by the Owners of the Station.

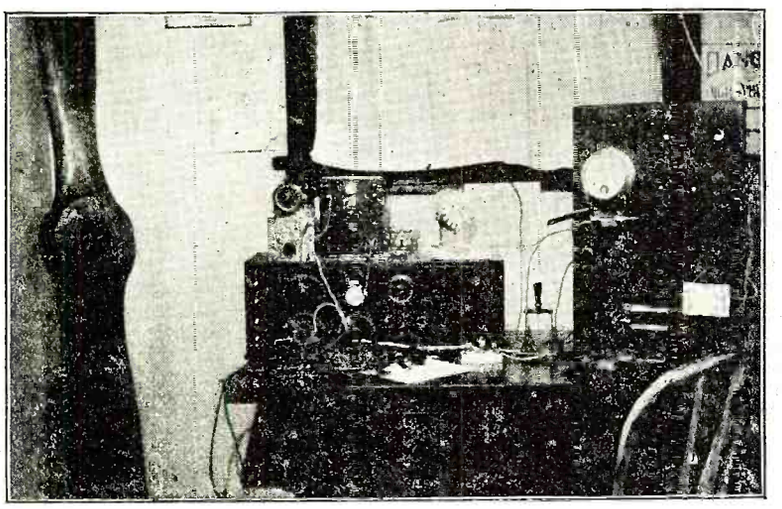
H. L. Gordon's Station

FOLLOWING is a description of my station: Inverted L aerial 60′ long and 50′ high, containing four wires of No. 21, seven-strand copper wire spaced 2′ apart. The ground is composed of a number of copper strips buried 3′ underground and also stranded wire soldered to a well nearby. The receiving outfit comprises a Zenith CRL regenerator, latest type, with three steps of amplification, Burgess "B" batteries and Radiotron receiving tubes. Also use Murdock phones with latest type radio Magnavox. The transmitter is a Benwood 15-watt C.W. and phone set, and works very efficiently. This consists of a Federal microphone, three Radiotron, improved type, five-watters and other parts listed in the Benwood bulletin. I use an Emerson motor-generator (some M-G, too, fellows) which places 500 volts D. C. on the plate and a Thordarson step-down transformer which places eight volts A. C. on the filament. The motor-generator is located under the operating table and the 6-volt storage battery and Tungar rectifier are located behind the partition.

HERBERT L. GORDON,
Antwerp, O.



A Very Neatly Arranged and Efficient Amateur Station Equipped With Modern Apparatus. The Transmitter is a 15-Watt C.W. and Phone Set.



Mr. Elton Has Obtained Remarkable DX Records With His ½-K.W. Spark Transmitter Shown in this Photograph.

M. B. Elton's Station

YOU may be a little surprised and interested when I tell you that I reached ICNE, Northampton, Mass. with only a ½-K.W. This at first seemed only a freak, but radio ICNE has heard me more than once, both in January and February.

I enclose a picture of my station and also two letters which corroborate my statements. You will notice that one owns the station, while another operates same.

My transmitter includes a ½-K.W. Thordarson transformer; oil immersed glass plate condenser, 12 stud, sawtooth rotor, driven about 3,000 R. P. M.; ammeter, kick-backs, pancake type O. T., etc. Radiotron under average conditions is about 3 4/5 amperes.

My receiver is one bulb at present with variocoupler "direct coupled." I have heard amateurs in every district in the United States but the 1st, 2nd and 3rd, and hear an average of four phones daily. These are KLP, 9ZAF, 7JZ, CWG, DD5, 6XW, Fairmont Hotel, 5JR and others. My aerial is 45′ high and 65′ long.

But this is getting off the track. I am proud of the fact that my ½-K.W. has "kicked" some 1,900 miles or more and I had to write to someone about it, so I chose RADIO NEWS. Although I like to copy a spark station, I realize the future of C.W. very much.

M. B. ELTON,
Radio, 7HM.
607 Fifth Ave., No. Gt. Falls, Mont.

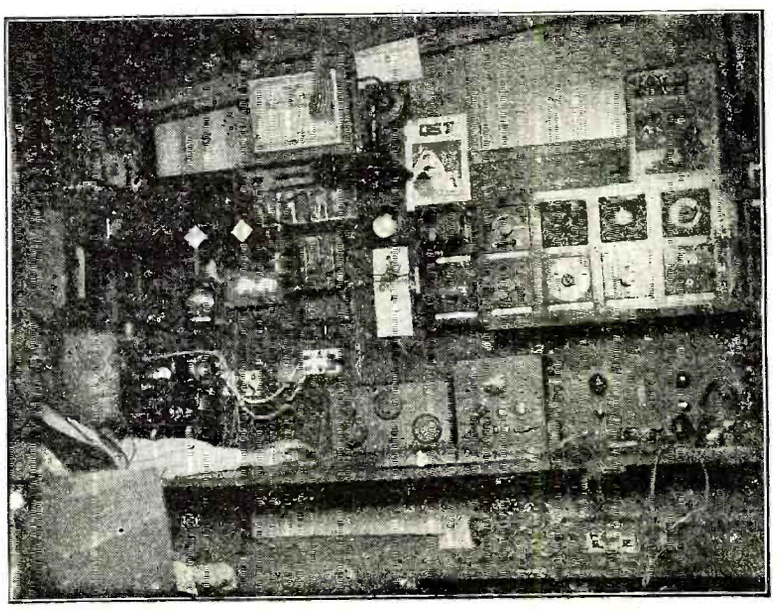
Geo. A. Clark's Station

MY RECEIVING set consists of a ten-panel de Forest Audion Ultra Audion circuit. Wave length, 150 to 25,000 meters. A complete set of de Forest honeycomb coils are available, but I only use them for reception over 600 meters.

My short wave set consists of a standard regenerative variometer set and a two-step amplifier. I use separate "A" and "B" batteries for each unit. I use a Tungar rectifier for charging the "A" batteries, so they are fully charged at all times, and a Western Electric Radiophone, using two Western Electric transmitting bulbs.

My transmitting set consists of 1-K.W Acme transformer, 1-K.W. Amrad quenched gap, Westrad O. T. oil immersed condenser. I have two sets of phones, Brandes and Murdock, 3,000 and 2,000 ohms respectively. For transmitting, I use a cage type aerial 70′ long and 60′ high at high end, and 35′ high at low end. For receiving, I use an

(*Continued on page* 1005)



Mr. Clark's is a Real Amateur Station. He Believes in Separate A and B Batteries For His Detector and Amplifier.

Dead Zones and the Vacation Set

By HARRY LUBCKE

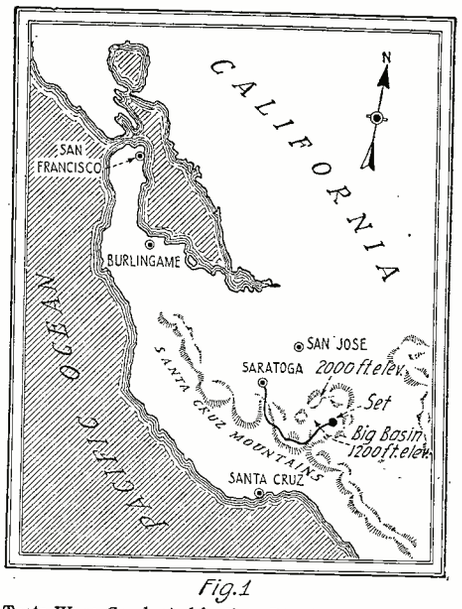


Fig. 1

Tests Were Conducted in This District to Determine the Effect of Surrounding Trees and Hills on Reception

A PORTABLE set provides an excellent means of testing the receiving properties of various locations, and one can obtain much first-hand information about the little known radio phenomena, commonly termed "pockets."

Quite an extensive test was conducted in the "Big Basin," California, lasting over a period of several days, by Mr. J. Wallace and the writer. The "Big Basin" is a nickname applied to the California Redwood Park, which is located in the midst of the Santa Cruz Mountains, about 12 miles from the Pacific Ocean. This is about 80 miles from San Francisco, air line. The elevation is about 1,200′ and a rim of mountains surrounds the camp, which is about 2,000′ high. Most of the ground is covered with towering redwoods and is quite densely wooded. The trees in the vicinity of the test were nearly 350′ high.

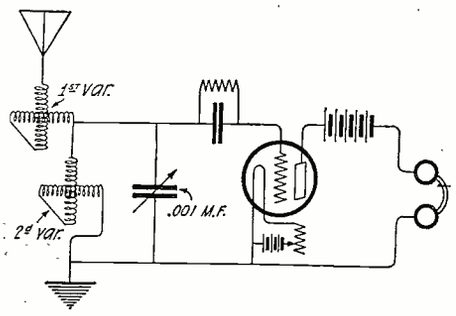
The accompanying map shows approximately the positions of the various places mentioned.

A single wire aerial was erected between two trees about 150′ apart and approximately 20′ high. The apparatus used consisted of two variometers, using a special hook-up with a range of from 100 to 400 meters, and a standard spider-web set of three coils. These were connected to the tube, "A" battery, "B" battery, etc., in the usual manner.

A large variety of detector tubes were available, namely: a radiotron, Western Electric V.T., and an electron relay. A radiotron amplifier was also used as a detector.

The set was put up in an effort to copy news and sports from San Francisco, as well as for experimental purposes. During the period of the test, which lasted from Saturday to Thursday, June 24 to 29, not one radiophone station was heard. The air was absolutely quiet and not even a crash of static was audible. The only station logged was an arc which came in so faintly that its call could not be ascertained. This was heard on Wednesday night about 5.30 o'clock.

This proved conclusively that the set was located in a "pocket" or "dead zone." The results were partly anticipated before the test was started because the Santa Cruz Mountains have a reputation for being very effective barriers to radio waves. In the town of Santa Cruz, which is located on the opposite side of the mountains from San Francisco, amateurs have repeatedly copied Los Angeles stations easier than San Francisco, although it is more than four times the distance. It is the opinion of the writer that the mountains contain a large amount of iron ore, because on the sides of the mountains in some places a reddish color can be seen, indicating the presence of iron oxide.



Hook-up of the Receiver Used in These Interesting Tests.

The apparatus was the property of Mr. J. Wallace, engineer for the Pacific Telephone and Telegraph Co. The instruments were in units, facilitating easy connection and a broad choice of hook-ups. Of all the tubes used, the Western Electric proved to be superior and it was the tube on which the only station was heard.

The ranger was skeptical about our being able to receive in that locality, as several other "radiophones," as he called them, had failed to bring in anything. A tree would have been tried as an antenna, but the ranger was against it, as it is a state park and the public is forbidden to mutilate the wild growth in any way. No doubt a 350′ big redwood tree would have made a splendid antenna, but we decided it would be better to spend our money in further experimenting than to pay it in the form of a fine for misdemeanor.

For the sake of anyone wishing to exploit the field further, the twin-variometer hook-up is shown in Fig. 2; although this type of set operates over only about 100 to 400 meters, it is very efficient, due to the absence of switches, high resistance contacts and dead-end losses.

Radio and the Boom

By JESSE MARSTEN

THE din of last spring's radio boom has subsided, but faint rumblings of next fall's predicted boom are beginning to be heard. Each day we hear of the unparalleled strides which the industry is bound to make. The picture is painted in roseate hues and no adjectives are too strong to describe what the future holds in store for radio. All of which, if true, is sweet music—certainly so to a host of bona fide radio engineers who at last see some prospects of a more obvious materialization of their hopes. But in radio, as in all big movements, the thing is not an unmixed blessing and some evil is bound to be carried in its trail.

If ever there was a dearth of radio engineers, nobody would believe it today. Overnight, as by a miracle, birth was given to a host of new radio engineers—"Radio Experts" they call themselves. Today their number is legion. Each day we are introduced to another "Radio Expert" whose new patented inventions will revolutionize the art, or who will shortly reveal new radio secrets which will "knock you dead." From a certain point of view this is, sad to relate, too true. We are indeed being initiated by these self-styled experts into secrets hitherto unknown.

In days gone by radio engineers used to spend time and energy trying to increase the efficiency of their circuits by ever so little; designing inductances, for example, so that the L over R ratio was a maximum; making condensers with minimum losses; and doing other similar foolish things. All of which was a pure waste of time according to our new prophets. What they needed was some such saving panacea as "roller bearing contacts which last a lifetime" or (static eliminators take notice) the Bluffem Lightning Arrester which "eliminates static," or the "Growling Crystal Detector, static won't bother" and a few other seventh day wonders.

In the past, engineers burdened themselves with information and nomenclature which, according to the latest dope, is useless and unnecessary. Thus they were wont to talk of variometers having a minimum and maximum inductance of so many micro or millihenries. This is all wrong. Today the radio "eggspurts" make the "best variometers having a wave-length range of 600 meters" whatever that may mean. And variable condensers? Glory be! Microfarads seem to have gone out of style. I happened to have occasion to ask a manufacturer of condensers whether he made any variable condensers having a maximum capacity of 0.0005 microfarads. The reply was that the only condensers he made were 23-plate and 43-plate condensers! I confess to having had a feeling of dizziness, for I saw myself making calculations on the basis of new formulae employing 23 plates and 43 plates as capacity factors. Receiving sets used to be designed, apart from considerations of efficiency and selectivity, to have a certain definite wave-length range. The engineers should have known better. Today the new experts design receivers to have a receiving range of so many miles.

In other words, the boom has been accompanied by an outpouring of patent frauds, misleading information, and an abysmal ignorance, so far as radio is concerned, on the part of many newcomers. The sole qualifications which they possess for radio are (1) a knowledge that the radio business is very active and (2) a keen desire to make money. Wherefore we find that anyone whose business is slow, from toothpick makers to boiler makers, is turning over his space to the making of radio apparatus. It is at once obvious that the radio output will be contaminated by inferior products turned out by people who know nothing about radio and whose only object is to be in a business which is booming, be it scientific or otherwise. Their method of designing their

(*Continued on page* 1000)

Loudspeakers and the Crystal Set

By STERLING G. SEARS

PROBABLY the most needed piece of apparatus in the radio market today, is an amplifying high quality loudspeaker. That is, one with a considerably higher efficiency of transformation from electrical to sound energy than the ordinary head receiver, and one that reproduces sound with little distortion. Tests show that the usual bi-polar type of receiver is only about one-half of one percent efficient or, in other words, it will convert a given amount of electrical energy into one-half percent of sound energy. The very best receivers of this type are quite inefficient in their ratio of transformation, and engineers have been trying for many years to improve them.

The most recent improvements in the art of receiver construction have been—the use of a moving vane in a dense magnetic field, which vane is polarized by the input current and operates a diaphragm through a connecting link; and the moving coil type which operates on the solenoid principle. Both of these types will handle several times as much electrical energy as the first mentioned type without rattling or distorting, and of course, will give correspondingly greater sound output from the larger electrical input. But even these are at best only about one percent efficient, and there is, therefore, about ninety-nine percent left for someone to take advantage of.

The outlook is, at present, hardly encouraging, but, we are not at a standstill yet, for we can accomplish the same end by indirect methods. One of the most valuable of these indirect means, is the use of the "vacuum tube" as an amplifier. This method, however, necessitates the maintenance of several other supplementary pieces of apparatus, which may make it undesirable or perhaps out of the question for some types of work. It is true that the vacuum tube can be made to give practically distortionless output, but when all the current consumed in the supplementary system is considered, the over-all efficiency is very low; notwithstanding the fact that several times as much sound energy is eventually obtained.

Mr. Sears Has Invented a New Type of Loudspeaker Which Can Be Used with a Crystal Receiver.

We have now another method of obtaining this same result, namely, by the use of a special, high-quality, supersensitive relay, which is put in operation by simply applying a constant voltage across two branches of its balanced circuit. This voltage can be supplied by a few flashlight cells since they are subject to such a small current drain—a few thousandths of an ampere—that they deteriorate very slowly and give long service. The fundamental operation of this relay system is as follows:

A small radio signal current serves to operate the balanced relay circuit, one part of which acts to maintain the input, the other part to drive the sound generating device. The phase difference or lag in the relay circuit is utilized by another coupled trap circuit to further increase the operation of the balanced relay circuit. The final result being—output sound energy from a given small input, three to six times as great as that given by any other loudspeaking device. The accuracy of balance of the relay circuit varies the quality and output intensity in an inverse relation, but very fine quality has been obtained with five times the amplification. It can, therefore, be used on any crystal set with good results, provided the head receivers respond comfortably loud on the ears. Or, it will work on any bulb set that gives such response. Of course some initial signal *must* be had as the unit *does not make its own radio broadcasting!*

The complete system can be put into a very compact form and makes a unit about as large as the types on the market. It is but one step in the simplification of the loudspeaker problem and we are all looking forward to the time when pocket receiving sets also contain a loudspeaker.

The accompanying illustration shows the experimental apparatus set up for test for efficiency versus circuit voltage.

Litzendraht vs. Solid Wire

By RALPH R. BATCHER

THE indiscriminate use of Litzendraht as a conductor in receiver coils brings up the question of whether it is true that the use of multi-strand cable (Litzendraht) always gives superior results to ordinary solid wire. For a number of years, whenever Litz coils have been used, the equipment has been judged— "That receiver must be a good one as it has Litzendraht coils." The fact that the leads to the coils may have been loose and half soldered and that the coils may have been only half tested for broken strands seemed immaterial.

A prominent radio manufacturer who has long prided himself upon the substantial way in which his equipment is assembled and the rigid tests imposed to insure perfect connections and no broken strands, has found that after the sets have been in use a year or so, retesting the coils shows that many then possessed broken strands. Examination nearly always showed the break occurred near where the ends of the wire were soldered together. The fact leads one to wonder how many coils (of Litz) in which no effort was taken to insure perfect strands, are really superior to solid wire coils.

Litzendraht even if perfect is far from being free from high frequency losses. The following paragraphs will point out where a few of these losses are. In justice, however, it must be stated that the sum of these losses will be less than the solid wire in the majority of cases, if the cable is *perfect.*

Losses due to circulating currents. Since there is a finite distance between the strands composing the cable, magnetic flux can pass between the strands. At the ends of the coil and at each tap, all the wires are joined together so that there is a closed path in which current will pass if there is the least difference in the potential of individual strands. This path is down one wire having the higher potential and back on one or more of the others. Flux threading between the strands may be but one cause of a difference of potential as referred to. The result is a circulating current which causes heating and a resulting loss of energy. A remedy is in twisting or braiding the separate strands so that this effect in one spot is balanced by an opposite effect when the positions of the wires are reversed with respect to the direction of flux. Twisting or braiding may, however, bring in other detrimental effects.

Electrostatic losses. Any difference of potential between two points on adjacent wires will cause a loss due to the capacitance of the strands. A relatively high capacitance value exists, due to the thinness of the enamel insulation and the high specific inductive capacity of enamel. The loss takes the form of absorption of energy by the dielectric. Prof. Morecroft has recently shown that such losses probably occur mostly at points where the strands cross each other at some angle, since it is at these spots where points having the greatest potential difference come closest together.

It is possible to analyze the cause of a difference of potential between two wires of a cable in another way. If all of the lines of force generated by any one wire cut every other wire, unity coupling exists between the strands. It is conceivable that some strands, due to their positions, are cut by less lines of force than others. The condition changes, moreover, in the same coil, depending upon whether it is used in series with a source of high frequency energy, or whether the energy is induced in the coil by another coil. In the latter case the flux distribution will change between the strands depending on whether the primary coil is outside or inside of the coil under consideration. Current, unhampered by outside conditions, will ordinarily have a greater intensity in the strands inside next to the tube on which cable is wound, according to Prof. Morecroft and others. If so, it is probable that this condition can be overcome if the primary coil is outside the other.

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A Multi-Range Regenerative Receiver

By KENNETH HARKNESS

RECEIVING sets with a wave-length range which permits reception from 200 to 3,000 meters or so are becoming increasingly popular. The novice of last year, who was under the impression that wireless and radio were two different arts, is beginning to explore "wireless" and listen in to the many interesting things which are happening on the longer wave-lengths.

Many of the official radiophone and radio telegraph stations transmit only on waves in the neighborhood of 2,100 meters. Some of these stations are broadcasting regular musical entertainment programs, but the majority send out official weather, crop and market reports, both by radiophone and continuous wave telegraphy.

The farmers, who have long realized the advantage of these up-to-date reports and installed receiving apparatus, are also finding particular use for long-wave reception. While the market reports are broadcasted on 360 meters, the farmers have sometimes found it very difficult to copy these broadcasts on account of interference on the lower wave-lengths. In the longer waves, however, they are able to receive the desired reports without any interference.

The time signals from the Arlington station at noon and 10 p. m. daily have become almost a necessity to the jeweler and even the ordinary individual experiences a peculiar thrill when he daily corrects his old timepiece "by wireless."

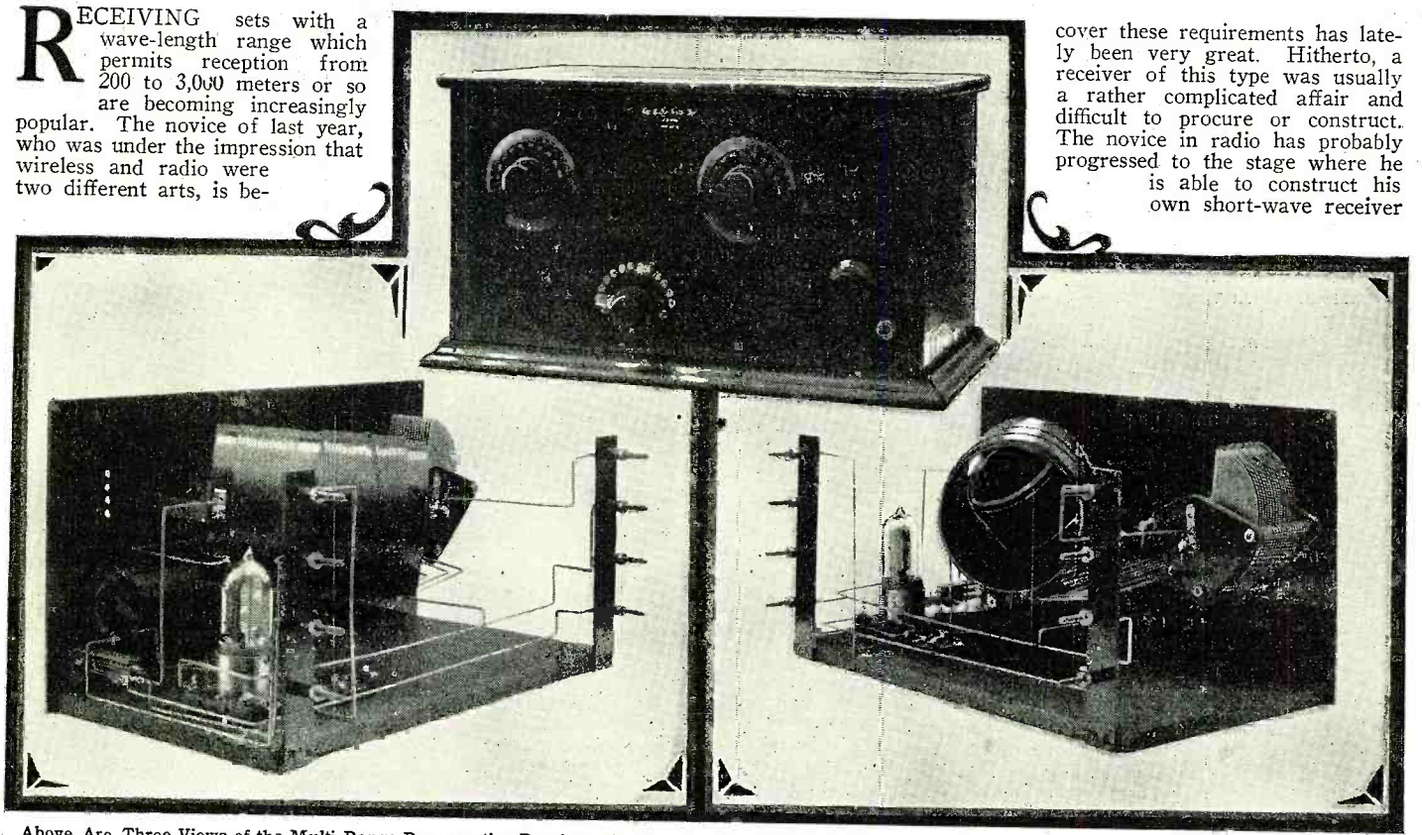
Even the real radio "ham," whose chief interest in life is usually not very far away from 200 meters, occasionally likes to hear what the other people are doing on longer waves.

But no matter in which sphere our main interest lies, most of us like to know that we are able to have a little variety if we feel like it. The jeweler may have purchased his radio receiver particularly to receive the time signal, but with "music in the air" on 360 meters, he wants to be able to receive the concerts as well.

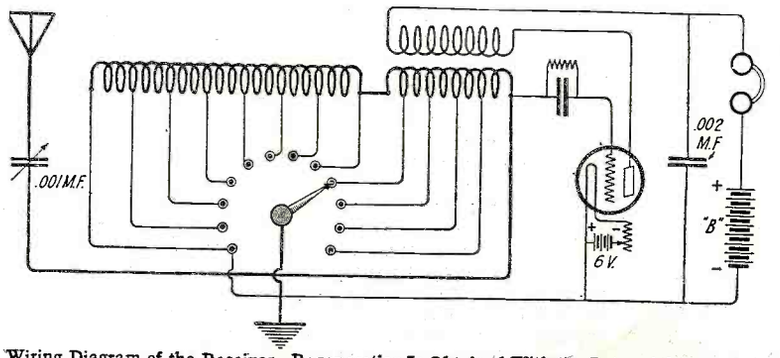
The demand for a single unit which will cover these requirements has lately been very great. Hitherto, a receiver of this type was usually a rather complicated affair and difficult to procure or construct. The novice in radio has probably progressed to the stage where he is able to construct his own short-wave receiver but has hesitated to attempt the construction of a combination long and short wave receiver in the belief that it would be too difficult.

The receiver shown in the accompanying photographs was designed by the writer to meet the demand for an easily operated and yet efficient multi-range regenerator. All wave-lengths from 200 to over 3,000 meters can be received without any loss of efficiency on the short waves. Regeneration or oscillation can easily be obtained throughout the entire range.

This is made possible by a multi-range coupler which is, of course, the heart of the instrument. The coupler is shown in a separate photograph. This new type of coil is becoming very popular on account of its simplicity and efficiency. The idea of using single layer for short waves and a bank wound loading coil for the longer waves is not a new one, but it forms a very neat and compact unit. The photograph of this multi-range coupler clearly shows the method of winding. The main inductance is wound in two sections on a bakelite tube 4" in diameter and 5¾" long. One section of the



Above Are Three Views of the Multi-Range Regenerative Receiver, the Construction of Which Is Fully Described in This Article. Wave-Length Range of 150 to 3,400 Meters Is Obtained With This Unit.



Wiring Diagram of the Receiver. Regeneration Is Obtained With the Rotor of the Coupler.

winding is made single layer for the reception of short waves. The other section is spaced ½" from the short wave portion and consists of a three-layer bank wound inductance.

The short wave section commences ½" from the end of the tube and is wound with 60 turns tapped every 10th turn. The long wave section is wound with 210 turns tapped every 30th turn. The winding terminates ½" from the end of the tube.

The rotor is wound on bakelite tube 3" in diameter and 2" long, with 46 turns of wire. The winding commences and terminates 5/16" from each end of the tube. The terminals of the rotor windings are brought out with flexible leads to two Fahnestock clips on the outside of the main inductance tube. The rotor revolves inside the short wave section of the main inductance and its shaft is set at an angle which permits a 180-degree variation of coupling.

Both the rotor and the main inductance are wound with No. 22 green double silk covered wire. The windings are treated with clear shellac to render them moisture-proof.

Believing that there are a number of amateurs who would like to make a receiver using a coil of this type, we are giving complete details. Only a few everyday tools and a little application are necessary in addition to the following parts:

1 Bakelite panel, 15½" x 8" x ⅛"
1 Wooden base, 7¾" x 15" x ½"
2 Bakelite binding post strips, 7" x 1" x ⅛"
1 Multi-Range coupler
1 Switch set, including switch lever, 14 switch points and 2 switch stops
1 Variable condenser (.001 M.F.)
1 Filament Rheostat
1 Vacuum tube socket
1 Grid condenser (.0005 M.F.)
1 Grid leak (2 megohms)
1 Phone condenser (.002 M.F.)
1 Double-circuit phone jack
8 Binding posts
2 Dials
1 Cabinet

It might be thought that a receiver of this type would be very expensive but, as a matter of fact, it can be constructed for $30. Considering the class of material that is used to make up the receiver and the results that can be obtained with it, the cost is very low.

Only the very best parts were used in its construction because, although it could possibly be built for less by using inferior material, one cannot expect to get the best results unless good parts are used.

The plan of the front panel is shown in the drawing which also indicates the sizes and locations of the various holes to be drilled. The panel should be purchased the exact size required and the edges filed smooth.

The centers of the holes can be marked on the panel either by laying them off directly on the panel itself with a T square, a triangle and a pair of dividers or the accompanying drawing, which is drawn to scale, can be enlarged to full size and pinned over the panel. The latter is the preferable method as it is usually more exact and really simpler. With a small center punch, the centers of the various holes can be punched through the positions marked on the drawing. The drawing can be removed and the centers punched out with a larger center punch. This method greatly facilitates the actual work of drilling.

The drilling can easily be accomplished by the constructor himself with an ordinary hand drill and a few drills of the sizes indicated in the drawing. If a vise is handy, the panel may be held in it between two pieces of cloth while drilling. The pieces of cloth prevent possible damage. The only further drilling work to be done is of the holes in the back binding post strips. The locations of these holes are clearly shown in the views of the back of the completed receiver. Four equidistant holes are required for the binding post screws and two countersunk holes at the bottom of each strip for screwing the strips to the wooden base.

Although the drilling is quite a simple operation, if the constructor has not the facilities for doing this work he can easily have the panel drilled in any workshop by showing the drawing of the panel here reproduced, as it is drawn to scale.

To improve the appearance of the receiver the panel should be finished. The panel of the modern type of instrument is usually satin finished and the amateur can quite easily obtain as good a finish as any commercial instrument by applying a little "elbow grease."

The panel should be secured to the work bench, either by means of small brads driven through some of the holes or by means of two thin laths of wood. All of the gloss should be rubbed off the panel with a coarse grain of sandpaper, care being taken to rub up and down in one direction. The panel may then be finished by covering it with oil and rubbing it down with a finer grade of sandpaper.

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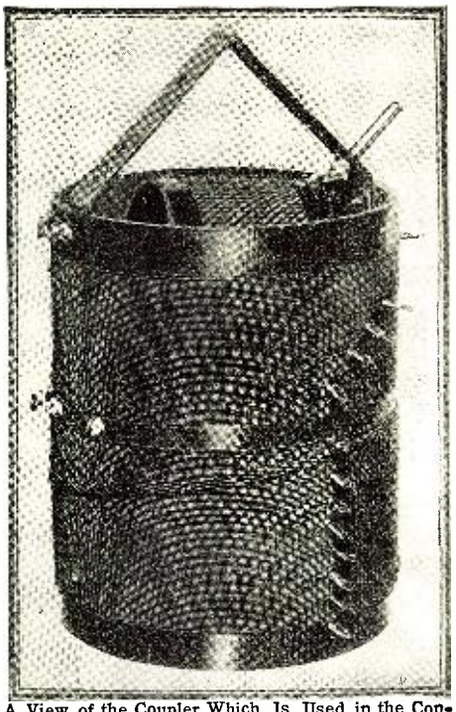
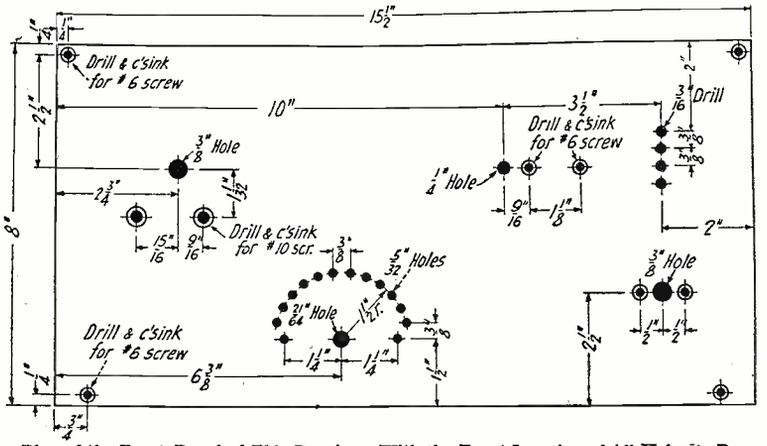


A View of the Coupler Which Is Used in the Construction of the Receiver. The Upper Section Is Wound Single Layer for Short Waves and the Lower Section is a Three Layer Bank Wound Loading Coil for Long Waves.

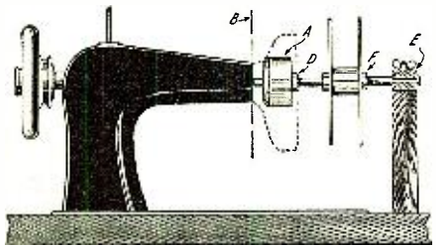


Plan of the Front Panel of This Receiver, With the Exact Location of All Holes to Be Drilled Indicated. This Plan Is Drawn to Scale.

An Efficient and Speedy Coil Winder

By D. R. CLEMONS

IN constructing wireless equipment a person frequently has a number of coils to be wound with various gauges of wire. If these are wound upon tubes, one generally does such work by hand. If fine wire is to be wound into transformer pies or secondaries, a rod mounted up to turn with a crank may serve. After a time we decided that these thousands of turns would go in faster if we possessed some power device that would turn the form at a much higher speed. Few have opportunity to own or use a lathe for this purpose, but by purchasing the remains of a Singer or other sewing machine one can develop a very efficient and fast winding machine that will handle any ordinary size of coil.



Sketch of the Coil Winder, Which Can Be Easily Constructed.

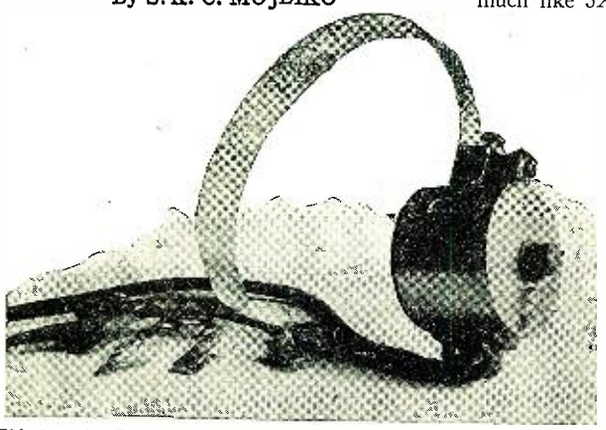
The sketch shows the manner in which the device is made. In the "head" of the machine there is a soft steel machined cam head that is rotated inside the portion shown by the dotted lines. This is shown at "A." The head is mounted directly upon the shaft, which is carried in strong bearings. All the works are first removed from the head. The part shown by the dotted lines should be detached by cutting along the line "B" with a hack-saw. This should leave the bearing exposed behind the saw cut. At the center of the cam "A," the countersunk center is bored out and tapped with any convenient thread. A threaded rod is then turned into the cam center, as shown at "D." The machine head is again mounted on the treadle top.

A wooden bracket is mounted and provided with a split metal bearing secured by removable wing-nuts at "E." The discs and core of a secondary pie form is shown clamped to the rotating spindle. It may be clamped between hexagonal or wing-nuts at "F."

Ordinary treadles of sewing machines will place the winding to the operator's left. By reversing the foot pedal and providing a short extension to the wooden rod connecting the drive wheel, the work will then be to the right. On such a device coils of any ordinary size may be easily and rapidly wound.

Awards of the $375 Pocket Radiophone Contest

Third Prize
A Portable Receiver
By S. K. C. MOJEIKO



This Portable Receiver Is Quite Novel in Design and Works Well. The Head-Band Can be Folded and the Complete Outfit Carried in the Pocket.

The portable receiver shown in the photograph was also submitted for the contest, and is an excellent example of good design and workmanship. It is essentially a portable set in every sense of the word, and it may be carried on the head if desired. The entire set is constructed around a telephone receiver, and to receive signals it is only necessary to put the head-band over the head, clip the wires to the aerial and ground and listen in.

The tuning inductance and fixed crystal detector are enclosed in a metal cap fitted over the back of the telephone receiver. It is even possible to vary the wave-length by turning the small tuning knob which protrudes from the back of the shell.

The set was tested and found to operate successfully. Mr. S. K. C. Mojeiko of Chicago, Illinois, who submitted this receiver, well deserves the reward for his skill and originality.

Fourth Prize
A Portable V.T. Set
By B. HODGSON

The vacuum tube portable set illustrated was submitted by Mr. B. Hodgson, of Revere, Mass. He finished the work of construction only two days before it was submitted, and tells his story below:

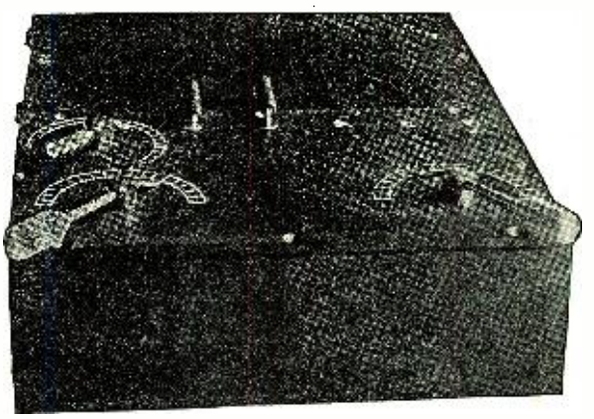
In the two days in which we have had to test the set, some truly remarkable results have been obtained. On the evening of the eleventh we copied the entire program of WBS and the Shepherd Stores of Boston as easily and with as great audibility as on any single tube set I have ever used. After the Shepherd Stores shut down, we distinctly heard WJZ and one other station which we could not identify, but which sounded very much like 3XW at Parkersburg, Pa. This may seem almost incredible work for a set of this size, but a careful examination of the circuit and the construction will show how these results were obtained. The circuit itself is identical with that of the Westinghouse Aeriola, Senior, which to my mind is the best single circuit, single tube set on the market. People living in the vicinities of Boston are copying WWJ, NOF, KDKA and even WWI, the station of Henry Ford at Dearborn, Mich., on this set. This is not freak work, but is being done very consistently. Knowing these facts about this set, it is not to be wondered at that this was the circuit I chose to use after I had decided to make a vacuum tube set.

The circuit lends itself admirably to the type of set I wanted to build as the tube will operate on a single 1½ volt battery and is the only tube on the market today which will do this. A set to be contained in a box 2"x4"x 6½" must use this tube on account of the batteries alone.

Proceeding with the actual construction, the antenna series condenser is a type 600 Micadon, cap. .00025 M.F. The antenna inductance is a variometer with exactly 270 microhenries of inductance. This value is the same as in the Senior set, and was arrived at after very careful computation.

The tube in the set is the famous WD-11 tube which operates on 1½ volts and draws .25 ampere. The grid leak and grid condenser were taken from an Aeriola Senior set which was available. The regenerative action of the set is unique in that it is secured by a combination of tickler feed-back and a tuned plate circuit. The plate variometer is of exactly the same inductance as the antenna inductance. The tickler coils wound on either side of the stator have a total inductance of about 25 microhenries.

The radio frequency by-pass condenser across the phones and "B" battery is a .001 micadon. It might be well to remark that these condensers are the smallest obtainable and are very satisfactory. The "A" battery is mounted in the box with phosphor bronze clips so that it may be slipped out and a new battery substituted. The method of mounting the tube is quite different from anything I have seen before. The tube plugs into a pair of clips in the same manner that a cartridge fuse is mounted. Tiny phosphor bronze clips soldered to flexible cores are used to slip on to the terminals of the tube. A feature of this set is the grounding of the positive side of the "A" battery to the shields. This seems to absolutely do away with all hand-capacity effects. The "B" battery is mounted in the box and some difficulty was experienced here. The outside dimension of the box, according to the rule, must be only two inches, which is too small for any standard "B" battery on the market. A No. 2156 Burgess was taken apart and rearranged so as to contain only 14 cells in two rows instead of three rows of five each. This enabled me to get the "B" battery in the box. The 14 cells gave about 20½ volts, which work very well as this tube is not critical as to "B" battery. In the box with the battery is placed 60' of stranded antenna wire, insulators, etc.



This Portable Set Uses Variometers for Tuning. In the Second Box Shown Connected to the Tuner Are the Batteries, Aerial and Insulators.

First Honorable Mention
Mr. JOHN POWELL, Jr.
1018-37th Avenue, Seattle, Washington

Second Honorable Mention
Mr. DONALD SILVER,
1319 California St., Columbus, Indiana.

Third Honorable Mention
Mr. H. P. TRAMBLEY,
2437 Polk Street, San Francisco, Cal.

Best Broadcasting Stations Will Operate on Longer Wave-Lengths

THE licensing of Class B Radiotelephone broadcasting stations by the Department of Commerce under new regulations will enable those fans who desire, to "listen in" to the best stations on a special 400 meter wave without interference from some of the lesser lights in radio broadcasting.

But what stations will be selected? As the new regulations require a minimum of 500 watts in the antenna, with dependable and nonfluctuating power, special modulation, a studio and a supervised program, using "canned" music only in an emergency or during intermission, it is not believed many of the 487 broadcasting stations can now meet the requirements. This will insure only the best and most dependable entertainment on this special wave-length, the bulk of stations continuing on 360 meters. Of course the object is just that—an effort on the part of the Department to permit "A-1" or Super broadcasting stations to send without interference from the many stations using 360 meters, so that those fans who desire can receive high-class entertainment.

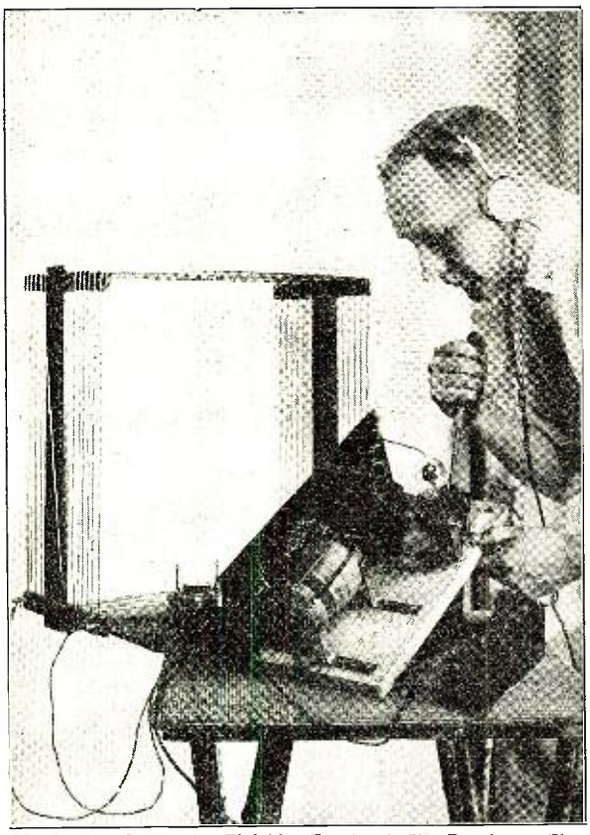
It looks as if such stations as are maintained by the Westinghouse, General Electric, American Telegraph and Telephone Company, and the Detroit newspapers would be among the first to qualify, but even they may have to make improvements and add to their equipment, while others will undoubtedly qualify; eventually as many as fifty stations may be licensed in Class B.

Upon application through the nine district

(*Continued on page* 1015)

A Super-Sensitive Receiver

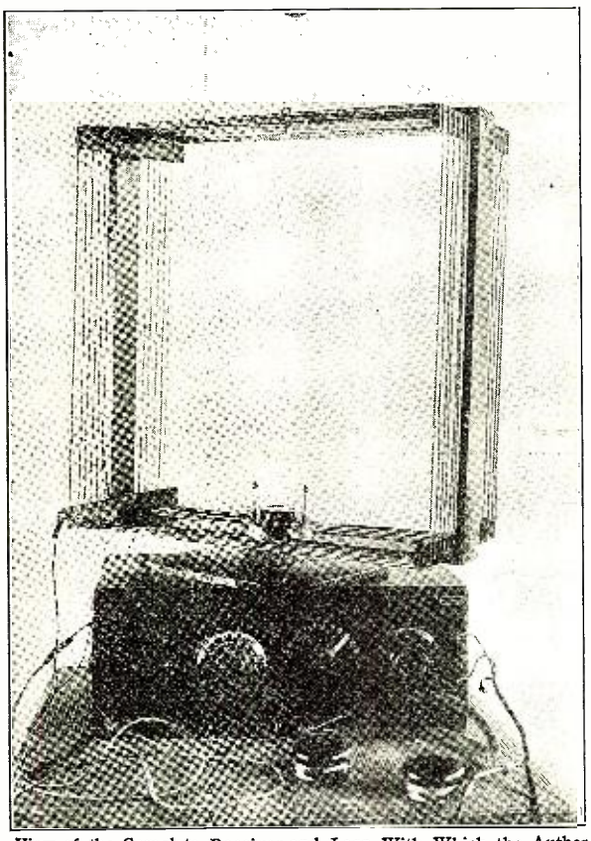
By E. M. LERCHEN



Mr. Lerchen Putting the Finishing Touches to His Receiver. The Spider-Web Coils Are Visible Near His Left Thumb.

1 43-plate variable condenser,
1 switch,
8 taps,
2 spider-web coil forms,
1 tube, 4" diameter, 7" long,
1 lb. No. 24 D.C.C. wire,
1 ball rotor,
1 detector or amplifying tube,
1 storage battery,
1 "B" battery,
1 headset,
Wire, bakelite panel, dials, screws, etc.

Wind each spider-web coil with 20 turns; the forms for these coils may be made from stiff shellacked cardboard or heavy sheet celluloid. The wire may be given a light coat of thin shellac to prevent absorption of moisture. It would be well to provide two binding posts on each coil so that they may be changed if desired. No. 24



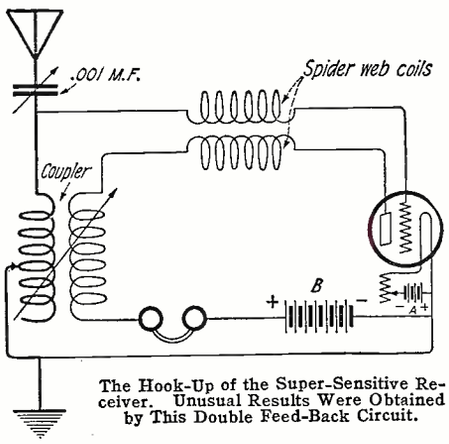
View of the Complete Receiver and Loop With Which the Author of This Article Obtained Remarkable Results.

FOR all-around amateur, broadcasting and ship reception, the receiving set described in this article will be found entirely suitable.

The circuit is so arranged that only three controls are necessary, regeneration being freely obtained over the entire range.

Distances up to 600 miles have been covered, using this receiver in conjunction with an indoor aerial 12' long. With a very small loop wound on a form 18" square, broadcasting stations ten miles distant have been heard on detector tube alone. Loop reception is made quite feasible if a good ground connection is employed in the regular manner.

This set is very selective and should appeal mostly to amateurs who have been bothered with interference. In constructing this receiver the following material will be necessary:



The Hook-Up of the Super-Sensitive Receiver. Unusual Results Were Obtained by This Double Feed-Back Circuit.

D.C.C. wire is used, as it is generally in stock at dealers and possesses most of the requisite qualities for efficient reception.

The primary of the coupler is wound with 80 turns or No. 24 wire tapped every 10 turns. Taps should be soldered. The rotor is wound with 40 turns of the same sized wire, and 20 turns are wound on each half. On both of these coils a light coat of shellac may be spread. The method of coupling the rotor to the outer form should be similar to standard practice. Pigtail flexible leads must be employed to make positive contact to the rotor. A dial and knob will be required on this shaft to control the movement. A 180° dial should be used.

The spider-web coils are separated 4" and placed parallel to each other. Square-tinned wire should be used for connections and if maximum results are desired all joints should

(*Continued on page* 922)

Hints on the Elimination of Static

By L. R. FELDER

The problem of the elimination of the static pest is one that has occupied the minds of the greatest radio engineers for many years, notably such men as R. A. Weagant and E. F. W. Alexanderson. Even with all the remarkable facilities at the disposal of these engineers, the problem has been so complex and difficult that they have at best been able only to reduce the evil effects of static. Entire elimination has not been accomplished. Furthermore, they have reduced the effect of static interference by means of tremendously long antenna and complex balancing circuits, which obviously are outside the means and scope of the layman and amateur interested in broadcasting.

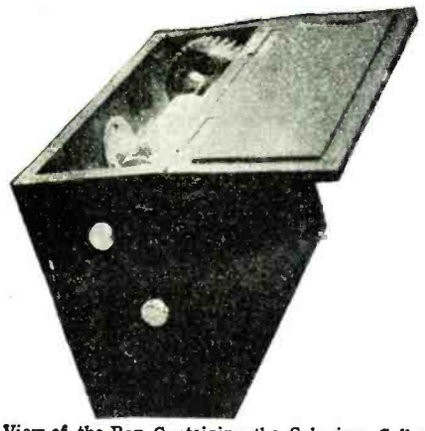
Therefore, with complete candor and honesty, the layman and amateur should be told that static cannot as yet be entirely eliminated. However, they should also be impressed with the fact that by a few simple devices within their means and ability static can be sufficiently reduced to avoid interference with the reception of broadcasting. For the information of the new radio enthusiast it should be emphasized that broadcasting is done in that band of wave-lengths where the effect of static is a minimum. Static produces its worst effect on the longer waves and is relatively mild on the short waves.

If there is anyone who should know the simple effective means for reducing static effects that person is the professional wireless operator. Talking to a few old-time ship operators on the subject brought out the interesting fact that they all advocated and agreed on one old-time remedy, namely, LOOSE COUPLING BETWEEN ANTENNA AND SECONDARY. With the appearance of all these new receivers on the market, the old reliable loose coupler seems to have faded into oblivion. This is unfortunate, since a good loose coupler will do more to reduce your static troubles than all the new fangled things now coming out. Examine most of the receivers on ship board and you will see that they are all modifications of loose couplers. One operator told me he would rather have his old loose coupled Marconi 106 tuner than any other he has seen and tried. The first and foremost precaution is, therefore, to use LOOSE COUPLING between the primary and secondary circuits. You will be agreeably surprised at the results.

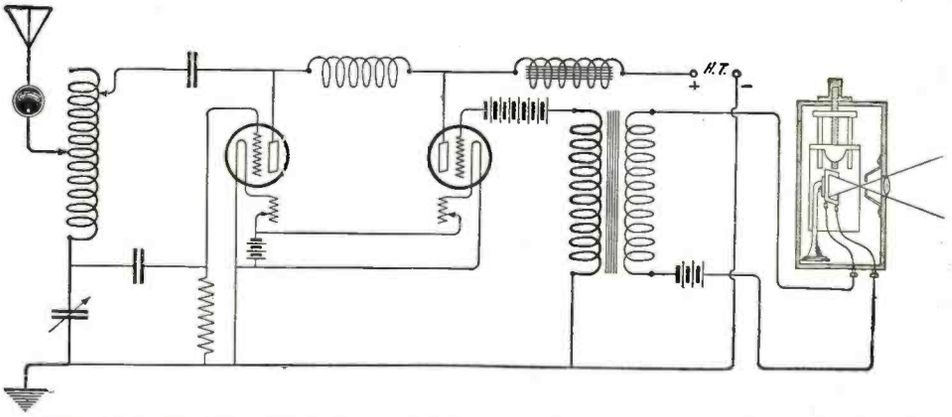
(*Continued on page* 924)

Radio Photography

By AUSTIN RIU



View of the Box Containing the Selenium Cell and Revolving Cylinder. When Closed the Box is Light Proof.



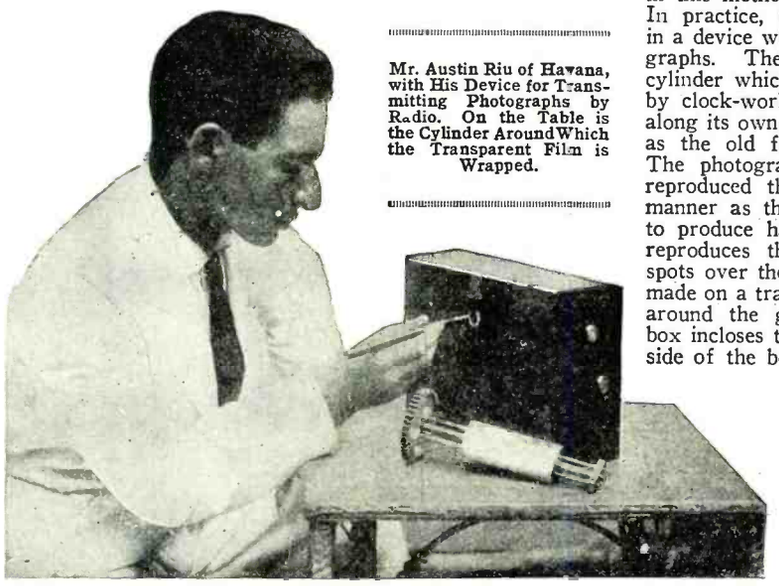
In This System the Usual Transmitting Circuit is Employed. The Radio Frequency Waves Are Modulated by Variations of the Current in the Selenium Cell Circuit.

THE problem of sending a photograph by radio is a very interesting study for the amateur. Various methods have been used and in this article will be outlined the one with which I have been experimenting, in order that others may receive the benefits of my experience in this line of work. Radio photography is one of the latest branches of radio, and if simple apparatus can be devised to transmit and receive photographs, the commercial possibilities of this new application of radio are boundless.

The apparatus which I have used in these experiments is not at all complicated, and in some respects is similar to that employed in the experiments on "Radioteleinscription" described in the October, 1921, issue of RADIO NEWS. The details given at that time of the principles of the mechanism and its regulation apply to the apparatus used in the transmission and reception of photographs. Reference should be made to this article to obtain fuller information regarding the mechanical control of the device.

There is nothing unusual about the radio transmitting or receiving apparatus. Any radiophone transmitter of suitable power may be easily adapted for the purpose of sending photographs. The diagram given on this page shows the conventional Heising modulation circuit. This transmitter is generally associated with the transmission of voice and other audible sounds by radio. This is accomplished by varying the amplitude of the radio frequency waves generated by the oscillating tube at the applied frequency of the modulating tube. This applied frequency, in the case of telephony, is the frequency of the sound waves of the human voice and is obtained by means of a microphone. The resistance of the microphone is varied by the sound waves of the voice, and, consequently, the current flow through the microphone is varied in synchronism with the modulations of the voice. This varying microphone current is applied through a transformer to the grid and filament of the modulating tube.

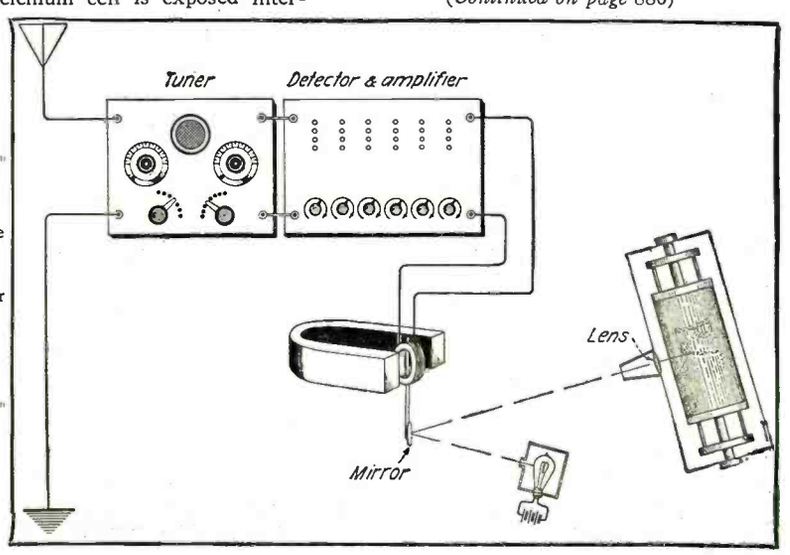
In the case of radio photography, a selenium cell takes the place of the microphone. The selenium cell is contained in a light-proof box resembling a camera, which is illustrated in the photographs. As shown in the wiring diagram, the selenium cell is connected in series with the primary of the modulation transformer and a battery, in exactly the same position which would be occupied by the microphone of a radio telephone. When the selenium cell is in complete darkness, very little current can flow in this circuit. If the cell is exposed to light, a larger amount of current will flow. It will, therefore, be understood that if the selenium cell is exposed intermittently to light, the current through the primary of the modulation transformer will vary at the same frequency. This will be repeated in the secondary of the modulation transformer and applied to the radio frequency waves, the amplitude of which will be modulated at the applied frequency.



Mr. Austin Riu of Havana, with His Device for Transmitting Photographs by Radio. On the Table is the Cylinder Around Which the Transparent Film is Wrapped.

The foregoing is the principle involved in this method of transmitting photographs. In practice, the selenium cell is contained in a device which is illustrated in the photographs. The cell is inclosed in a glass cylinder which revolves at a constant speed by clock-work; at the same time it moves along its own axis in much the same manner as the old fashioned phonograph cylinder. The photograph to be transmitted is first reproduced through a frame in the same manner as the process used by newspapers to produce half-tone effects. This process reproduces the photograph in little black spots over the entire surface. This print is made on a transparent film which is wrapped around the glass cylinder. A light-proof box incloses the entire apparatus, and at one side of the box is a small window containing a lens. The outside appearance of the apparatus, therefore, resembles a box-camera. The size and shape of the lens is such that its focal point is centered on the surface of the glass cylinder. Light shining from the outside is concentrated on one point of the photograph lying on the surface of the cylinder. This light passes through the transparent film and through the glass cylinder to the selenium cell. When the

(*Continued on page* 880)



Suggested receiving circuit for recording the photographs transmitted. Deflections of the galvanometer expose portions of the bromide paper revolving on the cylinder.

The Over-Neglected "C" Battery

By LAURENCE F. SOUTHWICK

I HAVE noticed of late many articles pertaining to amplifiers—amplifiers of all sorts, single and multiple stage, audio and radio frequency, the autodyne circuit, and so on. In very few cases have these articles, and the diagrams accompanying them, made mention of or included a "C" battery, sometimes spoken of as the "grid biasing" battery. Furthermore, on several commercial amplifiers of supposed merit provision for the "C" battery has never been made.

If you were lucky enough to own a Packard twin-six, would it ever occur to you to disconnect one engine entirely, taking off the spark-plug leads and stopping up the gas manifold simply because the six remaining cylinders would make the car go? What foolishness! Yet this procedure is very nearly approximated when an amplifier is operated with the grid at filament potential.

Much, too, has been said of the "characteristic curve" of a tube, and stress laid very properly on its rectifying action near one of the "elbows" of the curve. Too little, I think, has been noted relating to the significance of the straight portion of the amplifier curve. For convenience of reference, and also to refresh the memory, I reproduce curves which contrast the action of the tube as a detector with that of a tube used as an amplifier. (Fig. 1.) In "A" we see the variation in plate current for a grid change in difference of potential, represented in amplitude by a′ b′. We can suppose that the "period (half-cycle) there pictured is one of a group that is being impressed on the grid of the detector. This period will, let us say, be "reflected" from the curve at the elbow, and will be sent through the plate circuit with the form a″ o″ b″ and with an amplitude depending on the curve of the tube. In general, the amplitude will not greatly differ from the amplitude of the impressed wave. This illustrates the use of the tube as a detector.

For its action as an amplifier, look at drawing B. This is as a tube should act when amplifying. Note that the impressed wave is reflected truly, and not distorted, as in A. In A the distortion is what does the trick; the fact that the wave is more positive than negative, or vice versa, makes the tube a detector. In B any distortion would be heard. Have you ever turned your amplifier bulbs on too far and noticed how the signals faded a little and speech, if that was what was heard, became raspy? What you really did when you turned the filaments on too brightly, was to push a′ o′ b′ to the right of its best position. You did not wittingly increase the grid voltage, but increasing the "space current" has the same effect. You can now easily see that operating an amplifier in such a way that the grid voltage is too high (with respect to the filament) is not producing, but reducing, amplification with the bad effects of audio-wave distortion as well.

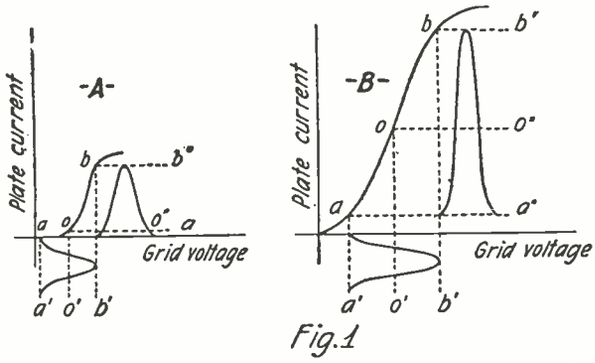


Fig. 1

Characteristic Curves of a Vacuum Tube, -A- as a Detector and -B- as an Amplifier.

Note that the curve in B is steeper than that in A. This is because a higher plate voltage (more "B" batteries) is used for amplifying than for detecting; and note, while we're at it, the reason. The elbows of curve B are of less curvature than those in curve A, which are sharp. Increasing the plate voltage makes the plate current vary more rapidly with changing grid potentials.

Before explaining the circuits which follow, I should like to make it quite clear that in A we are dealing with radio frequency waves of varying amplitude; and that what we want is just that variation in amplitude, or their *envelope*, and that this is what is amplified in B.

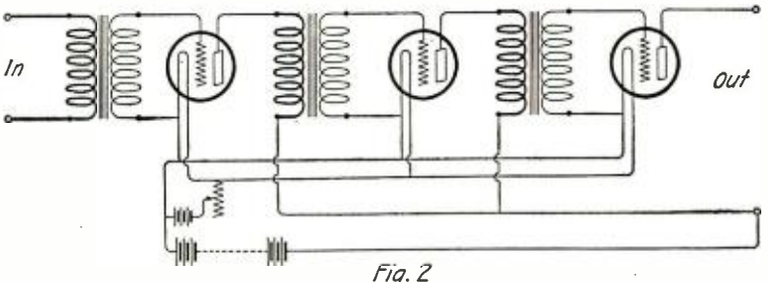


Fig. 2

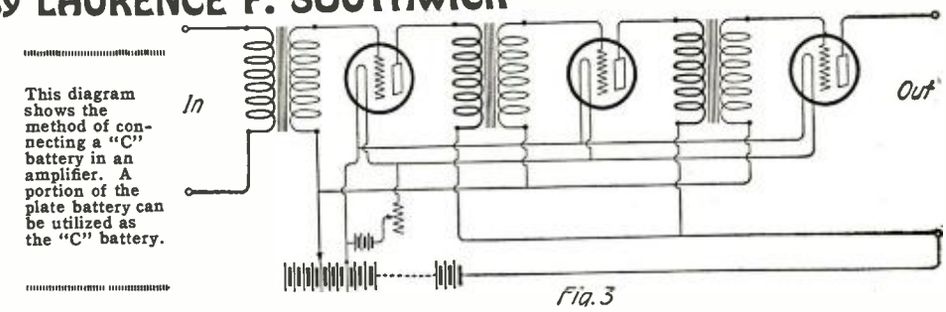
Standard Connections of a Three-Stage Amplifier Without a "C" Battery in Which the Transformer Secondaries Are Connected Directly to the Filament.

Just as in the case of the detector, where the correct portion of the characteristic curve is employed by the use of the right plate voltage and the correct capacity grid condenser, the correct portion of the amplifier curve may be used by shifting the a o b portion to the right or left until o, or the center of the oncoming waves (zero line), is in the center of the straight portion of the curve.

It is so astonishingly easy to incorporate this really most useful device in the construction of amplifiers that it seems a shame for anyone to continue to work one, no matter how cheap or poor, on half-efficiency.

The usual diagram of amplifier connections is shown in Fig. 2. Study this for a minute and satisfy yourself that, first, all the negative filament posts are strapped. Then look again and assure yourself that all the corresponding posts of the transformer secondaries are connected to the filament negative busbar, and hence together. Now take a final look at Fig. 2 and see that the other sides of the transformer secondaries all go to their respective grids, and that is all that happens to that much of the circuit.

One glance at Fig. 3 should be enough to show what has been done. Instead of connecting the bottom posts of the transformer secondaries directly to the filament negative busbar, they are all strapped to a busbar of their own, and then these two are connected together, but through a battery of which the positive pole is connected to the filament busbar and the negative to the transformer secondary busbar. Thus is overcome in one short paragraph the objection that as many "C" batteries as there are grids are needed.



This diagram shows the method of connecting a "C" battery in an amplifier. A portion of the plate battery can be utilized as the "C" battery.

Fig. 3

But the whole story has not yet been told. Look again at Fig. 3. The positive side of the "C" battery is connected to the filament negative. So is the negative side of the usual "B" battery. Why not, then, in designing apparatus, use only one "B" battery to perform all three functions of furnishing a bias to the amplifier grids, operating the detector, and then, finally, the amplifier? In most sets where a combination detector and amplifier is built they both work on one "A" and one "B" battery, and generally their terminal posts are so arranged as to permit the fewest number of connections to be made outside. When designing a set of this sort, I strongly advise putting the extra post on the panel to take care of the grid. Results will pay for the trouble. In other words, when considering amplifiers, it is well to start from the grid as the zero potential member of the tube, rather than the filament negative, as is generally done. Then, by means of suitable voltage taps, the filament negative terminal can be placed anywhere with respect to the grid, then the detector plate terminal fixed with respect to the negative filament. For the amplifier plates, you will now want all the "B" batteries you can get, within reason, since you have a way of holding the incoming signals on a portion of the curve where they belong, and as long as you increase your amplifier plate potential you both elongate and steepen curve B, Fig. 1.

I used 120 volts on the plates of a two-step amplifier, using radiotrons and about 12 volts (from four 3-volt flashlight batteries) to negatize the grids in exactly the manner shown. In addition, I made these flashlight batteries up so that a selector switch controlled the voltage, from 0 to the full 12, and tried results for a number of different plate voltages, and found three volts to be satisfactory for the 22½ "B" battery used for both detector and amplifier, six good for 45, and so on, until the higher voltages were reached. About 100 volts on the plates give as good results as can be desired. Beyond this the gain in signals is very slight.

Another feature of an amplifier constructed in this way is that the filament current can be materially reduced, the loss being compensated for by the proper value of grid battery.

One more point will complete the story. The "C" battery is just as necessary and helpful in radio frequency amplification as in audio. There, too, there must be no dis-

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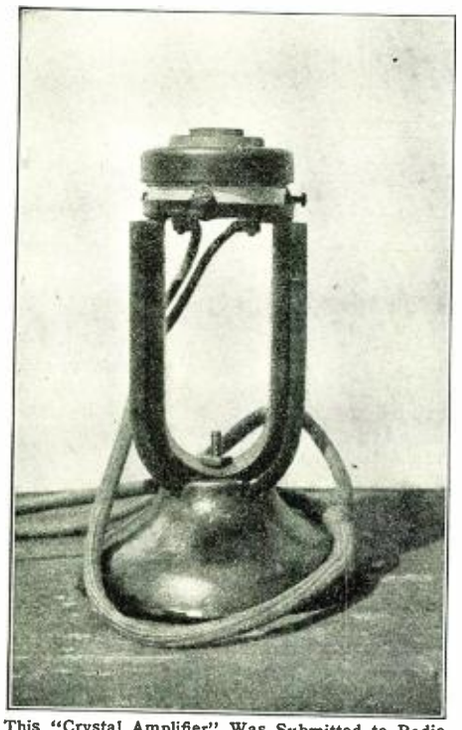
A Loud-Speaker for a Crystal Set

By HAROLD J. OSWALD

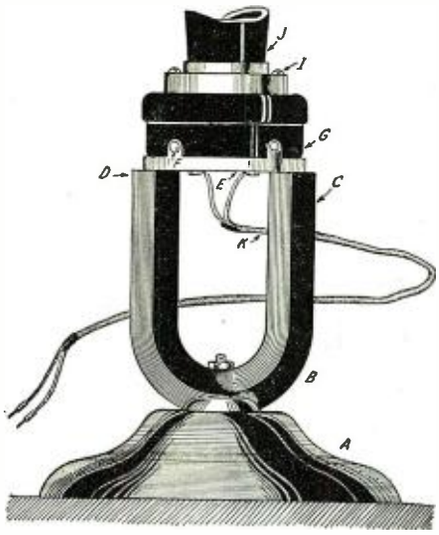


This "Crystal Amplifier" Was Submitted to Radio News in a Recent Contest. Although We Were Unable to Get Results With It, We Fulfill Our Promise to Publish the Endeavors of the Contestants.

TO date, the market has not shown the novice or the experimenter a loud-speaker that may be used successfully with a crystal receiving set. Many a new radio fan believes the ads.: "Entertain the family, no more phonograph records to buy." And they believe that by simply paying $10 or $15 and even $30 for a receiving set they just need to have the mechanic of the family fix the receiver to the phonograph horn in some way and sit and listen with delight. Then later he reads about the impossibility of amplifying the crystal rectifications. He then proceeds to sell his once prized set so he can buy a tube set and then he finds a slight difference in the price of his first set and the set of his dreams.

With the loud-speaker I have devised, which is to be used with the crystal set, it requires no batteries, no adjustment, and there are no screechings from the amplifiers because there are none. The radio fan need not worry about how he'll dig enough for those amplifying transformers, tubes, storage batteries, that Baldwin Type C and that regenerative set. I do not claim my loud-speaker makes the crystal set better or louder than all the things mentioned, but it will come up to the requirements to produce what the man who buys an "X.Y.Z.Jr." or something like that expects. He can hear the signals from WNY all over the house and WJZ all over the room. By this I do not mean that it is a rival of the old Victor phonograph with the 24" horn, but I do mean that it is loud enough to let you know it is there.

I first obtained an old "maggie" (magneto), took the magnets out and selected the strongest. This I set into a base which I drilled and inserted a 2" bolt and nut to hold the magnet upright. I took the old electric pressed glass globe holder off the chandelier and soldered this to the tops of the magnet for the Brandes Superior Receiver to fit into, which was held in place



Constructional Drawing of the Crystal Amplifier. Reinforcing the Magnetism of the Telephone Is Supposed to Produce Amplification.

by the three set screws that held the globe at one time. Then I searched the music stores until I found an old reproducer. I took the rubber coupling off and screwed it to the cap of my receiver, and procured a horn that was the size of my coupling at its small end and soldered a ring 1" wide to this so I could insert it into my coupling, then painted the whole thing black.

There is one thing that must be remembered: The north pole of the receiver must be over the north pole of the magnet and south over south. This I determined with the use of a cheap compass.

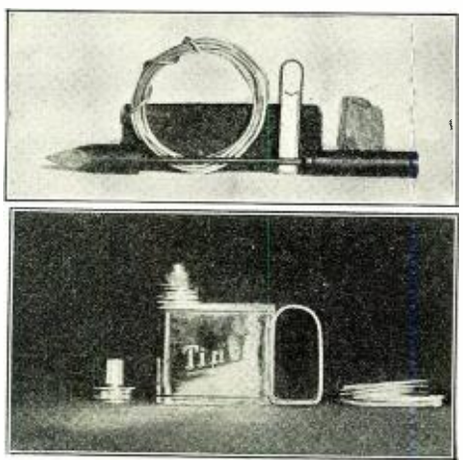
Soldering Wires of Radio Sets

By W. S. STANDIFORD

LARGE numbers of persons throughout the United States and Canada are making and installing their own sending and receiving sets; the vast majority being "new to the game," have trouble in getting firm, soldered joints that will remain united. It is of great importance to the working of receiving and broadcasting sets, that a clear path for the electrical energy (which at its best is very weak, owing to distances traveled) should be provided so that no buzzing sounds due to loose connections are heard along with the signals, there being enough trouble encountered in the radio field without adding any from this source.

Soldering wires on variometers and other parts is easy once the knack of handling a soldering iron is learned. It is better for those who have never done work of this kind to try it on some spare pieces of copper wires twisted together, which will enable them finally to do a neat job. Soldering irons, or coppers as they are termed, range in weight from a few ounces to several pounds; they can be either made or bought. The lighter ones are easier to handle, but they lose their temperature very quickly when compared with the heavier variety. The ability to retain heat as long as possible allows of a number of joints to be fastened together, thus rapid work can be done. One weighing about ¾ or one pound (shank and handle not included) will be about right for most radio work.

The one shown in the photograph weighs close to one pound, and was made by the writer from a one-inch copper bar, the shank being from a poker and wooden handle obtained from an old broom. In order to do good work in soldering, five things are essential. The point of a soldering iron has to be coated with solder or "tinned" as it is termed by men who make a living doing this work. The portions to be united together must be made very clean, either by scraping with a piece of a sharp knife blade kept for this purpose and filed, or rubbed with emery cloth—whichever method proves the handier. The parts that need soldering ought to be heated above the melting point of solder. In ordinary classes of small work, such as soldering one wire



A Complete Soldering Outfit Which Should Be in the Possession of the Amateur Desiring to Do Good Work.

to another, or sheets of metal to other sheets, the heat of a soldering iron itself must be sufficient not only to melt the solder, but also to raise the temperature of the metal to be fastened together, so that firm joints are made.

Do not let your iron become too hot, that is, red-hot; it will not take up any solder at all. Lastly, it is always essential to keep the iron well tinned at all times, so that when a person desires to use it, the device is always ready, and thus save time by not having to re-tin it. As new irons sold in a hardware store are in the rough state with no tinning upon their points, most of them also have no handle, which has to be bought separately. It is necessary after one is put on, to smooth its four-sided face with a medium coarse file so as to make the tin stick to it. To tin these sides, put the iron in a clear, red coal fire, which is not giving off any smoke. Heat it until nearly red-hot. When it has the right degree of heat, the solder will melt instantly when it is applied to the iron. At this stage if it is held about 3" away from the palm of the hand, the heat given off from the hot metal may be felt. This will serve as a guide for future heatings instead of touching solder to the tool.

Have some powdered rosin together with solder on a board; quickly brighten one face of the soldering iron with a file or a piece of sandpaper tacked on a block of wood and then rub it rapidly into the rosin and solder mixture. The surface of the copper bit will be found to have taken a

(*Continued on page* 965)

Radio Digest

DE FOREST DEMONSTRATES HIS INVENTION FOR SYNCHRONIZING SPEECH WITH MOVIES

Four American newspaper men were present at the first demonstration for laymen given in his Berlin laboratory, by Lee de Forest, of his "phonofilm."

Mr. de Forest has solved the secret of the "talking movie" with perfect synchronization. With or without accompanying pictures, he can photograph sounds, vocal or instrumental, on an ordinary moving picture film and from the same standard film reproduce the photographed sounds.

Mr. de Forest has been working on the problem for three years. After a motor tour in Bavaria he will sail for America with his perfected apparatus for practical tryouts in moving picture studios.

In the first film Mr. de Forest's assistant played a violin. You saw him wielding the bow energetically and at the same time heard the tone which, to a musically trained ear, synchronized perfectly with every movement of the violin bow. In the second film Mr. de Forest's assistant delivered a brief lecture in German on the new invention. Each word was clearly audible as articulated by the moving lips of the moving picture. In the third film Mr. de Forest described his invention in his temperamental way, his facial expression coinciding perfectly with the accompanyinig words.

This invention is not confined to "talking movies." It consists primarily of photographing sounds on a standard moving picture film and then reproducing the sounds from this film. By a simple mechanical device it is possible to photograph 10 consecutive "sound-paths" on one strip of film. A thousand feet of film can, therefore, hold 10.000 feet of photographed "sound-paths," which, by an equally simple mechanical device, can be run off continuously, making it possible to deliver a grand opera or a political oration lasting one and one-half hours—or any other variety of sounds.

The ordinary standard moving-picture film is used as well as the standard moving-picture camera and the standard moving-picture projecting machine. Mr. de Forest's basic invention is what he calls the "photion," a simple-looking glass tube with a bulbous end about two and one-half inches long. This "photion" tube is fitted inside of a standard moving-picture camera, above and somewhat to the right of the objective. The secret of the "photion" tube is that without any filaments it generates a sufficiently powerful violet light under electrical excitation to photograph sounds as transferred through a slit only two-tenths of a millimeter wide on a swiftly moving motion-picture film.

The sounds of a voice or voices, instruments or orchestra are picked up by a converter specially invented by Mr. de Forest for the purpose. It is like the microphone of a telephone, only very much finer. The ordinary microphone was too crude, Mr. de Forest explained. The converter turns the sounds into telephonic currents. From the converter these currents pass into Mr. de Forest's "audion" amplifier (intensifier), well known to wireless telegraph and telephone "fans," from which intensive electric currents pass to a high-frequency generator, whence they pass to and excite the "photion" tube fitted into the moving-picture camera. The "photion" thereupon generates the intense violet light, which is modulated or controlled by the voice, individual instruments or orchestra, and is photographed through a two-tenths of a millimeter slit on the standard moving-picture film.

The film is not only standard in size, but travels at the ordinary motion picture speed. When you look at the developed picture in a "phonofilm" you see the stereotyped film perforated on both sides, except that on the right-hand side, between the picture and the perforations, there is a track two millimeters wide, with almost microscopic hairlines, which constitute the moving picture of the sounds as turned into electric current and photographed on the motion picture film.

The positive of this "phonofilm," which may be purely a moving picture of sounds alone, or a moving picture with accompanying photographed sounds, is then put through the ordinary movie projecting apparatus equipped with a "photo-electric cell" fitted on top of the projector. The photo-electric cell converts the swiftly moving photographed sound record on the film into very weak electric currents which are passed through an audion amplifier whence they pass to something very like a gigantic telephone or wireless telegraph earpiece, whence the identical sounds emanate that were previously photographed.

The long-sought secret of synchronization is necessarily perfect, since the picture and voice or instrumental music are photographed simultaneously.

Some of the Interesting Articles Appearing in this Month's Practical Electrics

Phonograph Burglar Alarm
Electric Gun
Electrolyzing Fodder
Ocular Magnets
Electric Forge
New Developments in Electrotherapy
By Dr. Gradenwitz, Berlin Correspondent, *Practical Electrics*
Electric Hardening and Tempering Process
Experimental Arc Furnaces
Everyday Uses of Electro-Magnets
By H. W. Secor, Associate Member, American Institute of Electrical Engineers

The easily imaginable possibilities of the invention are fascinating. A presidential candidate can make himself seen and at the same time heard in every small town, village and hamlet. So can anybody else worth seeing and listening to. Film photography of sounds has a decided advantage over photographone plates in that it will be possible to run a film continuously, up to an hour and a half.

RADIO WEATHER FORECASTS IN ILLINOIS

The general supervision of the distribution of weather forecasts in Illinois by radio is under the control of the section center at Springfield. The following broadcasting program is now in operation, the hours given being in 90th meridian (Central) time:

FORECASTS MADE IN THE MORNING (ALL 485 METERS)

9.15 a. m.: WBAE (Peoria) (telephone) broadcasts weather forecasts, road conditions and market reports.

9.25 a. m.: KYW (Chicago) (telephone) broadcasts weather forecasts for Chicago and vicinity, Illinois, Indiana, Wisconsin, Upper Michigan, Lower Michigan and Lake Michigan.

10.00 a. m.: WEW (St. Louis) (telephone) broadcasts weather forecasts for Missouri and Illinois and river forecasts for the St. Louis river district.

10.00 a. m.: KYW (Chicago) (telephone) repeats the 9.25 a. m. information.

10.30 a. m.: WCAP (Decatur) (telephone) broadcasts weather forecasts for Illinois and market reports

10.45 a. m.: WAAF (Chicago) (telephone and telegraph) broadcasts weather forecasts for Chicago and vicinity, State forecasts for Illinois, Indiana, Michigan, Wisconsin, Minnesota, Iowa, North Dakota, South Dakota; general forecast, general summary of weather and crop conditions issued from Washington each Wednesday, and State summaries for Illinois, Michigan, Indiana and Wisconsin; weekly weather forecast issued on Saturdays.

11.15 a. m.: WOC (Davenport) (telephone) broadcasts local forecast for Davenport and vicinity, State forecasts for Iowa and Illinois, and river forecasts for the Mississippi between Dubuque and Muscatine.

12.00 noon: WDAC (Springfield) (telegraph) broadcasts forecasts for Illinois.

12.30 p. m.: WAAF (Chicago) (telephone and telegraph) repeats the 10.45 a. m. information.

3.00 p. m.: WBAE (Peoria) (telephone) repeats the 9.15 a. m. information.

4.15 p. m.: KYW (Chicago) (telephone) repeats 10.00 a. m. information.

FORECASTS MADE IN THE EVENING (ALL 485 METERS)

9.00 p. m.: KYW (Chicago) (telephone) broadcasts forecasts for Chicago and vicinity, Illinois, Indiana, Wisconsin, Upper Michigan, Lower Michigan and Lake Michigan.

9.15 p. m.: WDAC (Springfield) (telegraph) broadcasts forecast for Illinois.

Amateurs receiving weather forecasts are requested to advise (by mail) Weather Bureau Office, Springfield, Ill., of the quality of the service received and how distinctly the stations are heard.

OVER 500 BROADCASTERS LICENSED

Total broadcasters licensed up to September 9 numbered 502. Since the licensing of the first broadcaster in September, 1921, only 16 have withdrawn or dropped out, and although the number of licenses granted per week has been decreasing recently, there is no indication that many of the stations are contemplating a cessation of their activities.

It is natural that the licensing should decrease slowly, for today the saturation point is being approached; there are stations in all but one State, and in practically every city of importance; too many, unfortunately, in some cities, so that they frequently interfere with each other. With the new regulations, depending upon legislation, granting broader bands for broadcasting, however, it is hoped that better and far more efficient service can be rendered. The establishment of Class B stations on a 400-meter wave, for the stations which can qualify, will also improve the situation.

WGY WILL BROADCAST

Baseball fans who are also radio fans will be able to follow the World Series at home this year.

WGY, the radio broadcasting station of the General Electric Company, will give a "play-by-play" report of the World Series baseball games. Direct wires from the ball park will carry every play practically the second it happens and these will be relayed by wireless the instant received.

A "Radio Player Board" in the form of a four-column newspaper cut, by means of which the fan, with his radio receiving set at home, may follow the game, play by play,

(*Continued on page* 982)

Radio Antennae and Their Uses

By JAMES ASHTON GREIG, B. S., E. E.*

A GOOD many radio enthusiasts, who are keen for getting maximum amplification in their radio sets at home, overlook the fact that no amount of amplificatior will do them a bit of good if the signals are not being "picked up" by the antenna.

It is not strange that information regarding antennae is much scarcer and more difficult to get hold of than information about other parts of the radio set, for the radio antenna really represents a phenomenon of which we have only theories to guide us.

Long before radio was ever heard of, we knew and practiced the principles of magnetic and electrical induction. We knew that electrical currents would flow in conductors under the proper balance of pressure and resistance, and, in fact, had a very simple formula by which any of these qualities could be quickly calculated.

But we did not know, nor had we ever heard of such a thing, as electrical wave propagation through a non-conducting material. "Oscillatory discharge" was and is as much of a mystery to the electrical world as communication from the departed spirits.

The reason for this is that the behavior of an oscillatory discharge as used in radio is as much unlike commonly practiced electricity as the subject of astronomy is unlike physiology. In fact, though employing electricity for its practical performance, the operation of a radio antenna is more closely associated with the study of physics and mechanics than with the study of electricity as commonly pursued.

The function of a radio transmitting antenna is to make a big "splash" in the ether, which can be "picked up" by sensitively tuned instruments at a considerable distance from its source.

Imagine, if you will, that your antenna is a long rope, securely fastened to the top of a hundred-foot pole and that you are standing at the bottom of the pole with the loose end of the rope or antenna in your hand.

Suppose that instead of being surrounded by air you are surrounded by a jelly-like substance which we will call "the ether." The properties of this jelly-like substance include elasticity, a tendency to expand and contract as pressure is applied from an outside source.

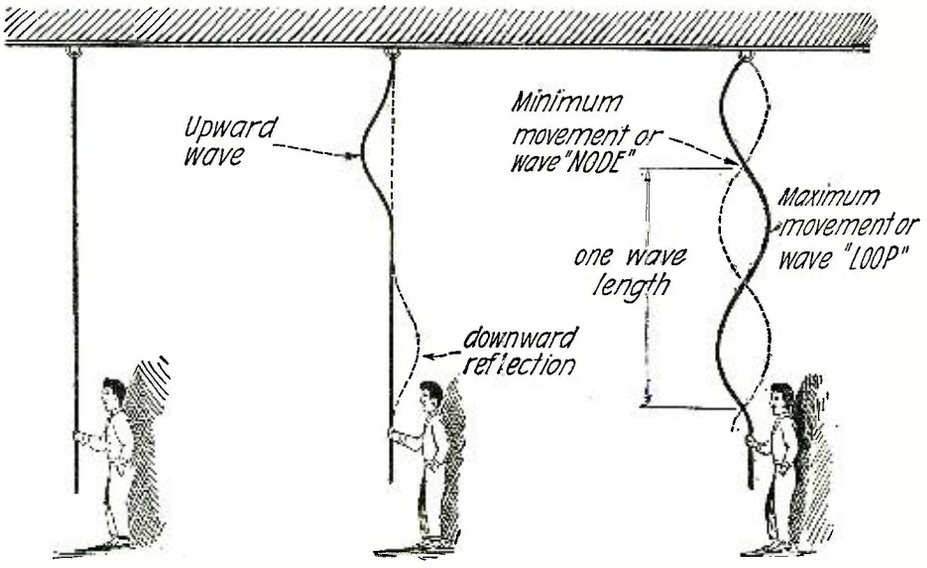
If the rope is given a quick jerk and then held taut, what happens? A movement of the rope or a "wave" of motion starts traveling upward until it reaches the top where it is reflected and starts traveling down again.

When it reaches the bottom it is again reflected upward and at the top reflected downward, and so on until the original energy supplied by the jerk of the hand is exhausted, or as we say in radio, "damped." This movement is called an "oscillatory" movement and the relative degree in which it dies out is called the "oscillation decrement."

Now let us suppose that instead of applying a single jerk to the rope we apply a succession of equally timed jerks. What will happen in this case? Instead of a single wave traveling up the rope, a succession of equally spaced waves will travel upward. As they are reflected backward they meet other waves going upward. Both being of the same "wave-length," as supplied from the same source of power, they cannot pass each other unchanged. At equally spaced intervals the direct wave coming upward and the reflected wave going downward wish to move in opposite directions at the same time and place. We have been able to accomplish some wonders in this day and age, but we have not yet succeeded in making a certain point in a rope move in two directions at the same time. In fact, as a result of these two opposite forces the rope at these equally spaced intervals does not move at all, but remains stationary. Examination will show that these places of no movement are one-half wave apart from each other all along the rope.

One-half a wave-length from these places of no movement on the rope we shall find other places where the rope's movement is a resultant of the direct and reflected waves. At such places, what are called "stationary" waves are set up, representing the maximum movement of the rope. This is illustrated by the accompanying diagram.

We can easily see what would happen to an elastic medium surrounding such a source of oscillatory movement. Waves would be created in this medium so long as the point of radiation was supplied with energy for their propagation. Refer again to the diagram and you will see that its point of support must necessarily be a node because no movement is possible. Also the point where the energy is supplied must be a loop, for if there was no movement at this point it would not be possible to jerk the rope and thus supply the power for the oscillation.



The Wave Action Which Takes Place When a Rope Is Given a Sharp Pull and a Series of Successive Jerks Well Illustrates the Actions of a Radio Wave

We are now ready to apply this illustration of oscillatory movement to radio antennæ. If we set up an oscillating current in a free conducting wire by the discharge of condensers in a nearby resonant circuit, we have produced electrically about the same result as we mechanically produced in the rope by jerking its free end.

The only difference is that the movement of the electrical vibrations in the antenna are not perceptable to the naked eye, whereas the mechanical vibrations in the rope are clearly apparent.

However, we can easily prove that such electrical vibrations *do* exist in the antenna by the effect which they produce on the surrounding elastic medium which we call the ether.

Now if we return for a moment to diagram C we can readily see that while no actual movement of the rope takes place at its point of support the maximum *tendency* to move exists there. In the radio antenna the same thing is true. The end of the antenna, which is farthest removed from the source of the electrical energy supplied, must be a current "node," because no current can flow there. Also it must be a potential "loop," because while there is no actual movement at the point of support, there is the greatest tendency to move there.

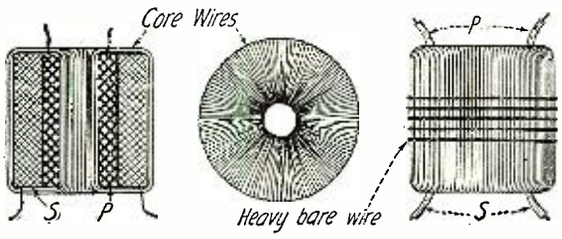
This is one of the reasons why the end of an antenna should be well insulated, for it is there that we find the greatest potentials.

Now let us look at another phase of the matter. No matter how fast you were able to jerk the end of a rope, the vibrations

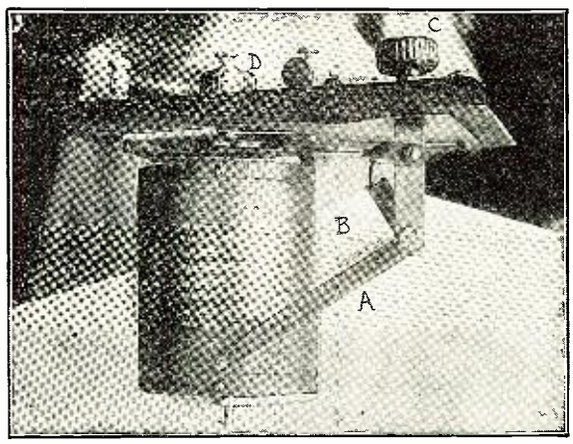
(*Continued on page* 920)

**First lieutenant of Radio Company A, 331st Field Artillery of the 89th Inf. Div., and formerly radio engineer with the Marconi Wireless Telegraph Company of America.*

Awards of the $50 Radio Wrinkle Contest



Left: The First Prize Was Awarded to Mr. Arthur Vance for His Exceedingly Useful Suggestion for Making a Transformer From a Spark Coil Secondary.
Right: An Original Tuning Arrangement Is Used in This Crystal Receiver Which Won Second Prize.



PRIZE WINNERS

FIRST PRIZE, $25

Mr. Arthur Vance,
New Orleans, La.

SECOND PRIZE, $15

Mr. F. J. Reid, 14418 St. Clair Avenue, Cleveland, Ohio

THIRD PRIZE, $10

Mr. Carl F. Propson, 68 Hudson Street, Hoboken, New Jersey

First Prize

AN AMPLIFYING TRANSFORMER FOR TWENTY-FIVE CENTS

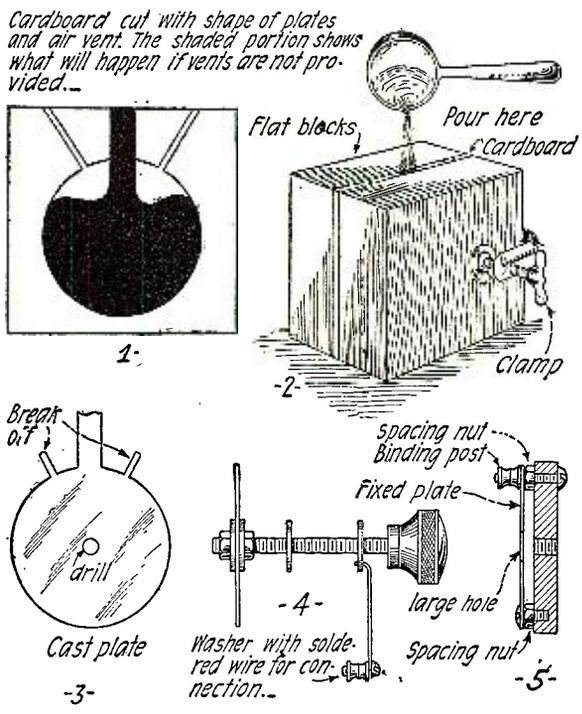
By ARTHUR VANCE

This sounds like an absurdity, no doubt, and did to me a few days ago, but it is a pleasant fact now. This transformer is distortionless, squealless and ultra-efficient. In order to build this transformer, two articles are required: an old Ford ignition coil and a patient careful disposition.

The Ford coil may be purchased at a local garage very cheaply (mine cost 25 cents). Remove the secondaries and find both leads to one of them. Decide what ratio your transformer is to be. (The ratio should be 4 to 1 or lower.) Count the layers on the coil and mark off a proportionate number of layers on the center of the coil for your primary. At this point push back the coil with a pocket-knife, exposing the winding. Lift up and break the last turn on this winding. Upon the ends now made solder larger wires and insulate with rubber tubing. Push back the primary coil and cover the entire unit with hot paraffin. The coil is now completed and ready for the iron core which consists of a bundle of iron wires. These wires are so bent around the coil that the ends meet. The same amount of wire as was contained in the original coil should be used. Around the outside of the transformer a few turns of heavy bare wire are placed to hold the core tightly and to improve appearances.

The diagrams show the necessary details clearly.

If desired this transformer may be mounted upon a panel with four terminal posts.



Full Details Are Given Above of the Method of Casting the Plates and Assembling the Condenser.

Second Prize

AN ORIGINAL TUNING DEVICE

By F. J. REID

In the photograph is shown a complete crystal receiver which employs a method of varying the inductance which is rather original. The system provides a simple, sure contact to the inductance coil which can be easily varied and provision is made for vernier adjustment of the inductance.

The photograph shows the method clearly. When the knob C is turned, the lever to which it is attached engages in a vertical slot in the brass strip attached at right angles to the arm A. In the position shown, the knob C is already turned to the right of the operator as far as possible. If C is turned to the left the end of the arm A will slide along the top of the inductance coil and at the opposite extremity of the knob C the arm will occupy the position B. Thus by a half turn of the knob C the tuning arm will vary the value of inductance in use from zero to maximum.

At any point, a vernier adjustment may be obtained by turning the knob D, which revolves the entire inductance coil, as the end of the tuning arm A will slide along the length of any wire on which it is resting.

In the model submitted for the contest the inductance is wound with enameled wire, the surface of which had been bared. In the opinion of the judges, however, this feature could be improved upon by separating each turn to prevent short-circuiting. This could be accomplished in the usual manner by winding thin cord between the turns of wire so that each turn of wire is separated by a turn of cord.

The method of tuning, however, is sufficiently new and original to merit the award of a prize. This is particularly true of the mechanical arrangement of the levers, which cause the arm A to slide along the length of the inductance coil. This arrangement is exceedingly simple, but positive, in its operation.

Third Prize

A VARIABLE CONDENSER WITH DIE CAST PLATES

By C. F. PROPSON

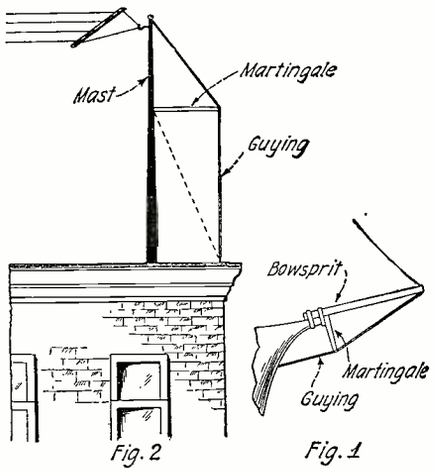
The principle of the condenser described herewith is not new, but its constructional details have been so simplified that it may be made at home with very few tools. Since its operation depends upon the distance separating the plates, it may be used in two ways; by having the plates close together the capacity is large enough for the condenser to work as the principal condenser—by separating the plates from half to quarter of an inch, the capacity is lessened to a point where the condenser may be used as a vernier, and when employed in this way, very selective results are obtainable.

The most important details of the condenser are the two plates, which were die cast at home, in the following manner. A piece of cardboard of the right thickness, and having a circle of the right dimensions cut in it, is clamped between two pieces of plain metal, or between two pieces of smooth board. The melted metal is poured in through the slot, as shown in the accompanying illustration. When the first casting is made, it will be found that the mold does not fill up perfectly, owing to imprisoned air. When the air pockets are located, the fault may be remedied by cutting thin chan-

(*Continued on page* 1007)

This Model of a Home-Made Condenser Was Submitted to the Contest and Won Third Prize.

Practical Hints for Amateur Constructors



This Is a Clever Method of Guying a Thin Iron Mast.

GUYING AERIAL MASTS

Having read Mr. Harry Lubke's article on guying aerial masts, I am contributing a plan of guying of the same nature, which would, I imagine, be more suitable for iron poles.

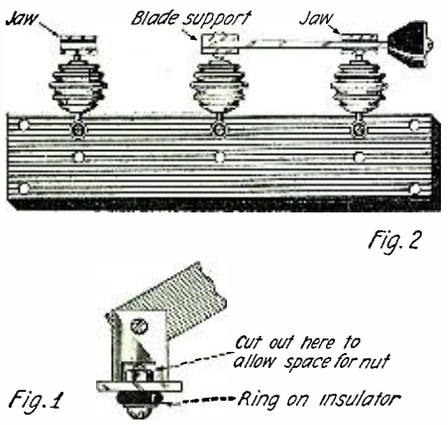
My idea deals chiefly with the use of iron pipe as a pole and was conceived while looking at a model of an old-time sailing ship. On such vessels the bowsprit was strengthened against the pull of the jibs by a "martingale" as per Fig. 1. Therefore in Fig. 2 we have a modification of Fig. 1, which I believe would be a most satisfying method of guying an iron pipe aerial as well as those of wood.

Contributed by JOHN D. GARCIA, JR.,
White Plains, N. Y.

MAKING THE AERIAL SWITCH LEAK-PROOF

The weak point of most aerial systems is the lightning switch. This is true especially in wet weather, the radiation often being halved; or in very bad cases the spark jumps directly to ground, making use of the wet switch base in so doing. Various methods of setting the switch blade and jaws on insulators to overcome this leakage have been described, but in most cases the construction has been rather complicated, and considerable time and energy have been required to make a neat job. The switch illustrated in the sketch was made in the spare hours of an off afternoon, and the little time spent was fully repaid in the comfort derived from it on wet days.

A regulation 500-volt 100-amp. S. P. D. T. knife-switch, mounted on a composition base that leaked badly at the least sign of dampness, was used. Three Electrose ball insulators were procured, care being taken to see



A Simple Method of Improving the Efficiency of a Lightning Switch.

that the iron rings were in line with each other, and fastened tightly. If they are not in line and rigidly fastened the jaws will either be mounted crooked or will wobble.

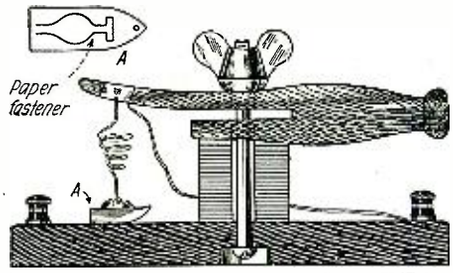
The blade and jaws were removed from the base and three ¼-inch holes were drilled one-half inch in from the edge, directly opposite the original ones, as shown in Fig. 2. These holes must be countersunk on the under side of the base so that the screw-heads will not project beyond the surface. They must be measured accurately, as otherwise the insulators will have a certain amount of play, and at the least little knock or jar they will become out of line, throwing the jaws and blade out also.

A hole must now be cut in the blade support, Fig. 1, to accommodate the nut B. This is done by drilling a ⅛-inch hole through both sides of the support, and cutting out, with a thin bladed fret-saw, to a size that will easily allow the nut to be slipped in. However, care must be taken in turning corners with the saw, or there will be a pile of broken blades lying on the bench. The insulators are fastened to the base by ⅛-inch brass bolts, nuts and washers. The jaws and blade are attached to the other end of the insulators in like manner. Looking down on the finished switch, it should resemble Fig. 2.

Of course, larger insulators may be used, resulting in a somewhat higher efficiency, but for all practical purposes and moderate powers the small Electrose ball insulator, retailing at about thirty-five cents, is as good as any. The switch may be mounted in any convenient position and place, irrespective of weather, as there is very little corrosion, and the losses, even in very wet weather, are practically nil. It is suggested that if it is desired to further protect the metal parts from corrosion they may be painted, leaving bare, of course, any parts where contact is made.

In actual use the switch has proved its worth on many a rainy night, as before the insulators were put on it was an impossibility to work any but local stations. Now no trouble at all is experienced in the worst weather.

Contributed by MARTIN WALTER, JR.,
1935 Concourse, New York City.



Here Is a Practical Crystal Detector Stand, Utilizing a Clothes-Pin as an Adjusting Arm.

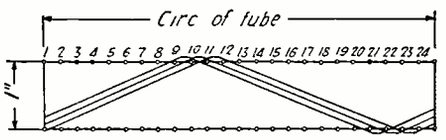
A CLOTHES-PIN DETECTOR

My endeavor to make a detector stand for my crystal receiver resulted in one similar to that shown in the sketch. Believing it to be novel and of interest to beginners I shall describe its construction.

The essential feature is the clothes-pin, an article which is found in every home. Secure a fairly smooth, dry pin and cut one leg off as indicated to allow for movement of the cat-whisker. Drill a ¼" hole in both legs to permit clearance of the adjusting screw. To the leg which has been partly cut off, glue a piece of wood ¾" square and 1" high. This small block also is bored with a ¼" hole and is so placed that the holes in the pin and the hole in the block coincide. Obtain a base of wood or other material about ½" thick and rather large; I used a base 4"x2". In the center of the base, secure an 8/32" machine screw, countersinking the bottom of the base so that the head of the screw will not protrude.

Mount the swivel and pin on this screw with a wing-nut at the top. The wing-nut provides the requisite pressure while the swivel and large hole provide movement in the other two directions. The crystal holder is made from a small strip of brass to which the head of a paper fastener is soldered. By bending the fastener as shown, any size crystal may be used. The cat-whisker and contact to the cat-whisker is soldered to a small metal strip at the point of the clothes-pin. A No. 28 wire was used. This detector stand has proved satisfactory and should be easy to make, as there are no complicated parts.

Contributed by J. HATSUKI,
Honolulu, T. H.



By This System of Winding Unit Honeycomb Coils the Appearance of the Commercial Product May Be Duplicated.

A BETTER METHOD OF WINDING HONEYCOMB COILS

Having experimented with various systems of winding honeycomb coils as described by the RADIO NEWS, I hit upon the following method which will produce a coil exactly the same as the machine wound type.

The diagram shows how this is accomplished by taking a turn around two of the pins instead of one, as is the usual practice.

Start the winding by taking a turn around one of the pins. Then lead the wire around the 11th and 12th pins on the opposite side, then back to the 23d and 24th pins on the first side, then to the 10th and 11th pins on the opposite side, then back to the 22d and 23d pins on the first side, and so on.

After the first layer is wound it will be readily seen that an exact duplicate of the machine wound coil is obtained.

Contributed by EDWARD JOHNSON.

A "SILVER" DIAL

As many amateurs wish to construct as much of their apparatus as possible I am presenting this hint so that any beginner may, with ease, make silver dials.

Secure a sheet of stiff brass, cut it to the shape desired with whatever diameter is wished, and clean it top and bottom with steel wool until it is bright. Having drilled the shaft and supporting screw holes for the knob, make a solution of sulphuric acid and rain water, using three parts of acid to one of water. Pour the acid into the water slowly, employing a porcelain bowl as container. Dip and wash the disc in this solution. Melt some tinfoil in a clean pan and, when the foil has completely melted, dip the brass disc in it, allowing it to remain for about 15 seconds. Place it in a pan of water to cool.

The finish is made by rubbing surfaces with a small piece of clean cloth until the "silver" shines up brightly. The marking may be done with a pen and good ink, or indentations may be stamped in the brass disc before silvering. This treatment may be applied to all the brass work on the set with a resulting neatness in appearance. It would be well to give each part a heavy coat of lacquer or good varnish to prevent tarnishing.

Contributed by W. C. UTZ.
Westminster, Md.

A RUBBERIZED PANEL

A great many fans who make their own sets and cannot afford to use bakelite, may be glad to know that they may use wood with all assurance that their panels will give entire satisfaction.

Break two or three old phonograph records into small pieces, place them in a tin can and add one-half pint of denatured alcohol. Allow this to stand until dissolved, a day or two. When thoroughly dissolved apply with a brush; this will give a very glossy finish when shellacked. I have had very good results by first putting on a light coat of shellac or water-proof varnish, then adding one or two light coats of the solution. One-fourth-inch wood is of correct thickness for most small receiving panels. It would be well to dry the material in a warm oven before applying the insulating mixture.

Contributed by C. E. INMAN,
Roxbury, Mass.

CHEAP AND EFFICIENT LIGHTNING SWITCH

Nowadays when every second person one meets is thinking of installing a radio set to listen to the broadcasting stations scattered throughout the United States, one of the very first questions to be solved is the installation of a ground or lightning switch to protect the home and radio apparatus.

The following described ground switch may be easily constructed from parts that are often thrown aside as useless. The switch is rugged, will stand long service and will repay the builder for the small amount of time needed to make it.

To construct the switch, obtain a double pole, single throw switch similar to that used in most residences for the power mains. The condition of the switch makes little difference. The base is not needed. The blades of the switch are joined together to lengthen the distance between the jaws. Two small pieces of copper may be placed on each side of the blades and drilled through, after which they are securely riveted; or the ends may be welded.

The handle is attached to the single blade by threading the machine screw into the place formerly used to hold the blade to the fibre end. The hinge of the switch is secured to a strip of bakelite 3½" long and ¾" wide. The size varies with the size of the switch used. A hole is drilled at each end of the strip to pass the top threaded screw of a spark plug core. The ones I used were Champion X cores. Two pieces of bakelite or other good insulating material are used to hold the jars out from the spark plug cores, as shown. If greater insulation is required, use two cores at each end and mount the jaw in the center. Three-sixteenth holes are drilled in the wood base at the proper points. After drilling these, a larger drill is used to countersink the lower end of the cores in the base which should fit snug up to the shoulder of the core. The cores are held firmly to the base by forcing the top nut over the lower tip and spreading same with a hammer after which it is passed up through the base, core and bakelite to be held firmly in place by the top lock nut.

If the switch is to be placed where it is unprotected from the weather, a water-proof housing should enclose the switch, which can be mounted with wood screws. Porcelain cleats should also be placed under the base at each end to keep it free from all dampness.

Contributed by MAURICE B. O'NEIL.

$50 in Prizes

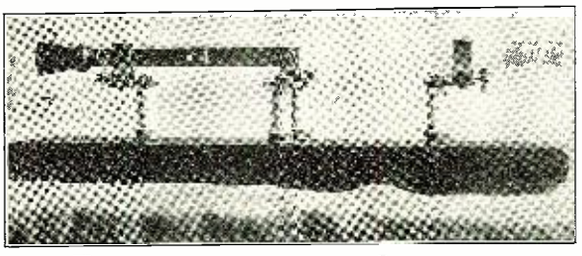
The special prize contest for radio amateurs and beginners is held each month. There are three monthly prizes as follows:

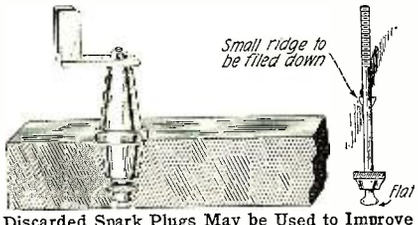
First Prize	$25.00 in gold
Second Prize	$15.00 in gold
Third Prize	$10.00 in gold
Total	$50.00 in gold

What we desire are simple ideas exclusively for the beginner and the novice, the simpler the radio idea the better the chance to win the prize.

There are lots of valuable little stunts that you amateurs run across every month, and we mean to publish these for the benefit of the entire Radio fraternity.

This prize contest is open to everyone. All prizes will be paid upon publication. If two contestants submit the same idea, both will receive the same prize. Address all manuscripts, photos and models to *Editor Radio Wrinkle Contest,* care of this publication.



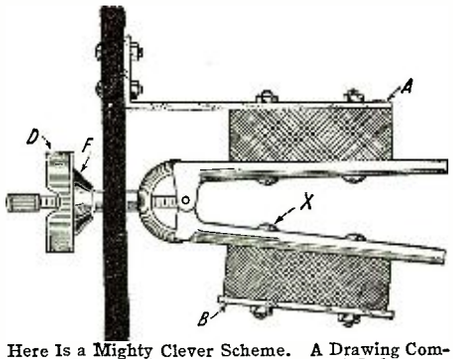


Discarded Spark Plugs May be Used to Improve the Standard Lightning Switch.

A PANEL HONEYCOMB MOUNTING

Much difficulty is generally experienced in providing a suitable holder and coupling arrangement for honeycomb or duolateral coils. The problem is still more complicated if the coils are to be mounted in the rear of the instrument panel.

I have evolved a unique coupler for this purpose, which, under actual operating conditions, works very well. It consists, essentially, of a compass with the inductance coils affixed to each arm. Coupling variation is obtained by turning the knurled adjusting knob, which moves back and forth on the threaded rod. For the benefit of readers who desire to construct a similar mounting I shall describe the construction in detail.



Here Is a Mighty Clever Scheme. A Drawing Compass Is Used to Vary the Coupling of Unit Inductance Coils.

A compass, obtainable in any stationery store, is drilled and countersunk at the four points, X, in the diagram, to pass 6/32 flat-headed machine screws. Two small stiff brass strips are cut to size and drilled for 6/32 machine screws. It would be well to nickel these strips if neat appearance is desired. Location of the holes will have to be computed after all material is at hand. The fixed coil and brass strip, A, are securely held to one arm by the two machine screws. Similarly, the upper or movable coil is attached to the other arm. It is necessary to drill a rather large hole in the panel to allow free movement of the shaft. The entire unit is then mounted as securely as possible to the rear of the instrument board. To obtain a good grip on the controlling knob it is necessary to fasten a suitable sized rubber or bakelite knob, D, to the knurled adjusting nut, E. The action is self-explanatory and an extremely smooth control is possible. Carrying out this idea of utilizing a compass as coupler, it is possible to construct variable (book type) condensers quite easily. Nor is the coupler limited to honeycomb coils; it may be used with equal success in conjunction with spider web coils and single layer inductances. With a bit of thought an efficient detector stand could be designed.

The only drawback of this coupler is that only one set of coils may be used, but by tapping the coils this disadvantage may be eliminated.

Contributed by D. BUTTERLY.

HIGH AMPERAGE "B" BATTERY

A "B" storage battery which will hold its charge any length of time, that is if it is a home made one, is a novelty and for that reason I am going to describe the construction of a battery of relatively high amperage.

The only materials required are two shingling hatchets, or a heavy hammer with a corrugated head and a corrugated or pitted plate of iron or steel or any metal harder than lead.

On the head of most shingling hatchets will be found a design very useful to battery making. It resembles a plate with small crosswise grooves cut, which, when they make an impression, the grooves, on the contrary stand out as small ridges as in Fig. 1, leaving small pits about ⅛" square.

If no shingling hatchet is procurable, cut cross-wise grooves with a file about 1/16" deep and about ⅛" apart on the head of a hammer (or on a block of metal suitable to hold in the hand) and with it strike the lead plate a heavy blow. Then cut another set of grooves exactly at right

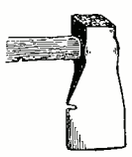


Fig. 1

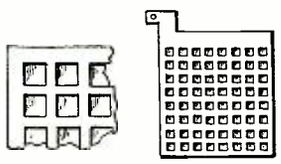
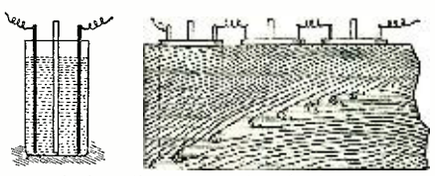


Fig. 2



Single cell and complete battery of 22½ volts

A Good Storage "B" Battery Is Described in the Accompanying Hint. This Battery Has a High Capacity.

angles to the first set of grooves, forming a criss-cross pattern.

The plates should be sheet lead about 1/16" thick and of a size convenient to the jars or test tubes used for containers.

(*Continued on page* 1006)

Monthly Laboratory Report

By LOUIS GERARD PACENT, Director

DURING the past month we have received a great number of telephone headsets and audio frequency amplifying transformers to be tested. As is well known, the requirements of radio telephony reception are different from those of telegraphy as the whole band of frequencies from 60 to 3,000 cycles must be amplified in the same proportion, while for telegraph signals these apparatus need only respond to a frequency of about 800 to 1,000 cycles. On account of this, the A. M. E. S. (Association of Manufacturers of Electrical Supplies) is now determining some standards for telephone receivers. They are also discussing ways and means for standardizing scales of dials and knobs. We are, therefore, awaiting the decision of the committee appointed by the A. M. E. S. to pass over the apparatus mentioned. There are now on the market several dials of various diameters, with scales from zero to 100° or from zero to 180°, reading from right to left or inversely, and it has been found that it was necessary to set some standards for obvious reasons. On account of this, we are awaiting the decision of the committee, and we ask the manufacturers who sent to the RADIO NEWS LABORATORIES some apparatus such as mentioned above to kindly refrain from writing and asking that the test be hurried, as we aim to do the right thing in the interest of everybody.

We have found that among the instruments submitted recently several had fiber as insulation in places where much better material should be used. For this reason alone, we are compelled to reject such apparatus, as the insulating properties of this material are very poor and do not provide a safe functioning, the fiber being affected by temperature and moisture. Some radio frequency transformers which have been submitted cannot be awarded a Certificate, as no indication of the band of frequencies they cover is given either with the transformer or stamped on the instrument itself. This makes it impossible for the dealer or purchaser to know which wave-length band will be amplified by the transformer.

We returned some audio frequency transformers which were so constructed that the insulating panel upon which were mounted the binding posts was loose and permitted the rear screw of the binding post to short-circuit on the iron core. In one variable condenser the insulation compound used for the end plates had such a low dielectric resistance that it was possible to pass a current of a few milliamperes at 110 volts between the fixed and movable plates. Among the rheostats tested was one made of hard rubber which did not stand 1.25 amperes continuously. Such a rheostat, therefore, is good only if a special receiving tube is used which operates on a current of less than .5 ampere. If the user plugged in an amplifier or some transmitting tubes for greater amplification, smoke would appear inside of the amplifier if such rheostats were used in the filament circuit. We also returned, after test, some crystal detectors which, although of a novel design, were not practical for constant use, being so constructed that the tension of the spring was not easily changed and required much fussing to be adjusted. A sensitive spot on a crystal could not be found easily and kept with the same pressure.

Among other parts for which no Certificate can be awarded are binding posts, name plates and other minor accessories, which are not in themselves radio apparatus and cannot be tested. In this same class are some meters which are parts of electrical equipment and are not radio apparatus. We feel confident that the manufacturers of these apparatus will understand the reasons why their products are not considered. It is our desire, by means of constructive criticism, to help the radio manufacturer whose products, although good, can be improved so as to be put in a higher class. The mention which is made every month of the instruments which are awarded Certificates is merely to show the radio products which are of good construction and already on the market, and it should be well understood by everyone that it is not an advertising proposition.

The RADIO NEWS LABORATORIES have been instituted with the purpose of helping the manufacturers, especially those who recently entered the field, with expert advice and helpful suggestions regarding their apparatus. The suggestions are made from a practical point of view. The apparatus submitted is used under the same conditions as they would be used by a customer in his own home. By this method and by carefully testing all the parts entering into the construction of sets we are able to point out the weak points and how they may be remedied. These tests are very costly, but we are sure that when the manufacturers realize the value of the LABORATORIES they will take advantage of it, and it will be our reward to see them put on the market some improved sets and parts with which the customers will be satisfied, thereby increasing their future business.

We have been glad to note that some manufacturers have followed suggestions that were given to them by the LABORATORIES for improvement on their products, and we feel amply rewarded to see that our work has been useful.

The tests to which the apparatus are subjected are most severe, and for several items it takes more time than for others to carry on the whole series of tests. For instance, complete receiving sets are put into service after the measurements have been made, in order to ascertain the selectivity in tuning when receiving signals, also behavior in general, and the audibility obtainable under certain conditions.

The following is a list of the apparatus which have been awarded Certificates to date, with the percentage obtained by each one according to the system described in last month's report:

Lowenstein Radiophone Corporation, Variable Condensers. Type 5001 and 5000—92%.

Fletcher Works, Variometer—71%.

Read Easy Chargometer, Ala Manufacturing Company—85%.

Sunraid Radio Company, Rheostat—90%.

National Airphone Company, Airphone Receiver—75%.

Allen-Bradley Company, Bradleystat—79%.

Klosner Improved Apparatus Company, Improved Vernier Rheostat—69%.

American Pattern Foundry Company, King Rheo-Socket—86%.

I. R. Nelson Company, Improved V.T. Socket—95%.

Chelsea Radio Company, Variable Condenser No. 1—72%.

Chelsea Radio Company, Variable Air Condenser No. 3—73%.

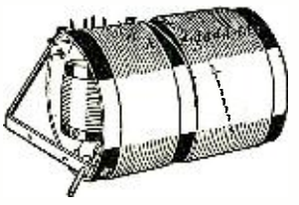
Chelsea Radio Company, Socket No. 60—85%.

To date, 78 pieces of apparatus were rejected, 27 awarded certificates, and 48 remain to be tested.

Apparatus Awarded Certificates

MULTI-RANGE COUPLER

A very neat coupler, capable of tuning to the medium wave-lengths, is the MULTI-RANGE coupler manufactured by the Radio Guild, Inc., 256 West 34th Street, New York City. The windings are of double-silk covered wire, wound on bakelite tubes, with a thin coating of shellac for protection from moisture. The taps on the coil are neatly brought out and the wire is prevented from loosening by means of special clamping pins. Taps are brought out every seven turns on the short-wave portion of the winding and at proportionate places on the long-wave winding, which is three layer bank wound. In all, there is a total of 15 taps. The tickler coil

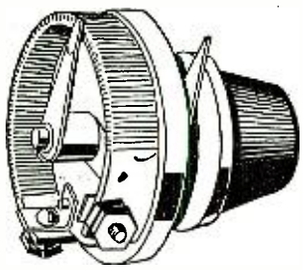


placed inside the short-wave winding, has the 180 degree coupling feature and is provided with flexible leads to the Fahnestock clips used to make connections. It is prevented from continuously rotating by means of a stopping pin on the coil mounting. Either table or panel mounting may be used. The shaft accommodates a 3-16" dial.

In the tests at the LABORATORIES, the coupler oscillated over the range of 200 to 3,400 meters. The Multi-Range coupler received a percentage rating of 76%.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 17.

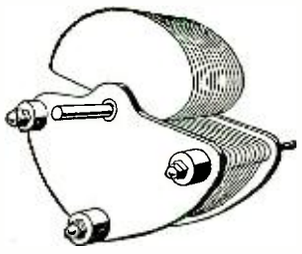
FRAMINGHAM RHEOSTAT



The Framingham rheostat submitted for test by the Ship Owners Radio Service, Inc., 60 Washington St., New York City, permits of close regulation of filament current. The base and knob are made of Thermoplax and the resistance wire is wound on a fibre supporting strip. All metal parts are nickel-plated. A desirable feature is the screw bushing for fastening on a panel, giving added rigidity. The knob is of such porportions that the heads of the mounting screws do not show. Approximate size, 2" in diameter by 2" high. Tested for four nours at 1.35 amperes. No instruction sheet furnished. Received in good packing. This rheostat received a percentage rating of 74%.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 20.

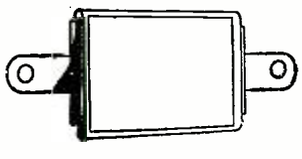
MARSHALL CONDENSER



This variable air condenser, possessing very low dielectric resistance losses, is manufactured by the New Haven Radio Co., 61 Hamilton St., New Haven, Conn. The movable aluminum plates are mounted on a brass shaft with a milled slot into which fit the stamped projections on the movable plates. This is to help prevent the plates from getting out of alignment. Connection to these geometrically cut plates is made by a strip of sheet copper which also acts as the upper bearing surface. The end plates of hard rubber insure good insulation. Stops are provided which prevent continuous rotation and provision is made for panel mounting. Shaft accommodates a $\frac{1}{4}$" bore dial. All metal parts are nickeled. The capacitance as measured on a capacity bridge was found to be 794.49 micromicrofarads (.00079449 mfd.) at maximum setting and 13.09 micromicrofarads (0.00001309 mfd.) at minimum. The phase difference angle is negligible. Instruction sheet furnished. This condenser received a percentage rating of 76%.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 21.

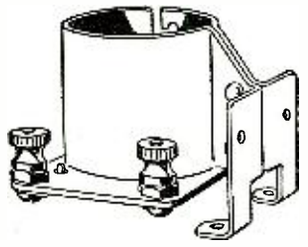
MICON CONDENSER



The Micon condenser is manufactured by Charles Freshman, Inc., 290 Hudson Street, New York City. It consists of alternate layers of brass foil and mica encased in a flat-pressed seamless brass tubing. The two end plates, one of which is in contact with the casing, are provided with projections which are used as terminal connections. In the 0.00025 mfd. submitted for test, the capacitance, as measured on a capacity bridge was 242.21 micromicrofarads (0.00024221 mfd.). The phase angle difference was negligible. No instructions furnished. Received percentage rating of 69%. Arrived in good packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 23.

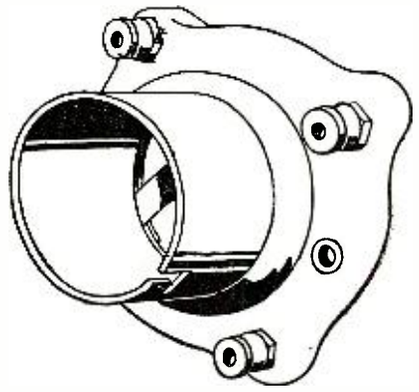
"TEAGLE" SOCKET



The Teagle socket is manufactured by the Newman-Stern Company of Cincinnati, Ohio. It is intended for either panel or table mounting and is made in such a manner that the supporting details and socket shell are made of one piece of metal. The contact springs are so fastened that lateral movement is impossible. A bakelite shelf supports the contact springs and terminal binding posts. All metal parts are nickel-plated. No instructions furnished. This socket received a percentage rating of 75%.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 19.

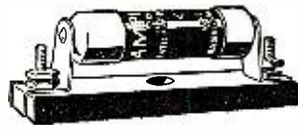
CHELSEA SOCKET No. 60



This vacuum tube socket of neat appearance and good mechanical and electrical design is manufactured by the Chelsea Radio Co., of Chelsea, Mass. Phosphor-bronze springs are used to make contact with the prongs of any standard base vacuum tube. The base is of moulded bakelite into which a highly polished nickel plated brass shell is set. Binding posts are used for making connections with the terminals which are clearly marked. Two holes are provided in the base to screw the socket down. Approximate size $1\frac{3}{4}$"x$2\frac{1}{4}$" square. No instructions furnished. Received a percentage rating of 85%.
Received in good packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 14.

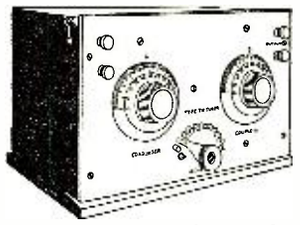
AMPERITE



Amperite is an automatic filament current adjuster which keeps the current in a vacuum tube filament practically constant for different voltages impressed. It is made by the Radiall Company of 99 Warren Street, New York City. Two type 1 style z Amperites on test in the Laboratories had a change of 0.170 ampere produced when the filament voltage was raised from 5.00 to 7.00 volts. The current at 5.00 volts was 0.965 ampere and at 7.00 volts, 1.135 amperes. A glass cartridge, held between two spring clips on a fibre base, encloses a ballast resistance wire in a partial vacuum. As the voltage increases, more current tends to flow, producing more heat in the ballast wire. It is this heat which increases the resistance of the ballast wire and limits the current flow. The carton containing the instrument contains a folder describing the operation of the device and also graphs of its performance. Amperite received a percentage rating of 73%.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT No. 18.

LAMB TW TUNER

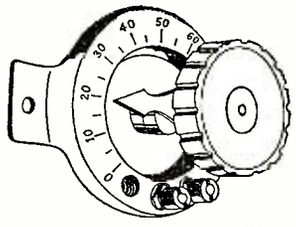


This single circuit tuner is manufactured by F. Jos. Lamb Co., 1938–1970 Franklin St., Detroit, Mich. Two dial controls are provided, one for the antenna series condenser and the other for the inductance coils, one of which rotates inside the other, variometer style. In addition 10 taps are brought out from the stator of the tuning inductance. These three controls provide sufficient selectivity in tuning. Wave-length range is 270 to 1110 meters. No instruction sheet furnished.

The workmanship is of high quality throughout, as well as the apparatus which is used. Cabinet is wax-finished in black walnut and has a hinged cover. Overall dimensions are 10"x7"x7". The TW tuner received a percentage rating of 81%. Arrived in good packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 25.

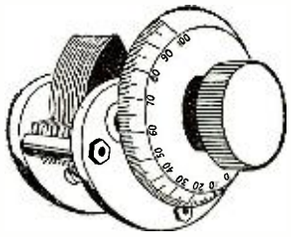
TEAGLE RHEOSTAT



This rheostat, manufactured by Newman-Stern Co., Newman-Stern Building, Cleveland, Ohio, is one of the Teagle line. The resistance element is contained in a stamped metal shell insulated therefrom by fibre. The resistance wire is wound on asbestos cord. Contact to this wire is made by means of a double-contact lever. The rheostat is primarily intended for table mounting. A knurled knob with a pointer moves over graduations stamped on the metal case. Tested for three hours at 1.35 amperes. No instruction sheet furnished. The Teagle rheostat received a percentage rating of 71%.
Received in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 26.

RADIO STORES VARIABLE CONDENSER



This well-made variable air condenser, intended for panel mounting, is manufactured by the Radio Stores Corporation, 220 West 34th Street, New York City. The stamped aluminum plates in both stator and rotor are held in place by a cast composition, insuring permanency of spacing. The bearings are of brass moulded directly into the end plates. Contact to the movable plates is made by a phosphor-bronze spring with a cup shaped hollow in which the lower end of the $\frac{1}{4}$" shaft rides. The upper end of the shaft is flattened to prevent the dial from turning. The metal dial carries a concealed counter-weight and is insulated from the shaft. Large binding posts are provided for making connections.

As measured on a capacity bridge, the capacitance of the sample tested was 499.41 micromicrofarads at maximum and 17.4 micromicrofarads at minimum settings. The phase angle difference was 8 minutes and 3 degrees, 12 minutes at maximum and minimum settings respectively. Instruction sheet furnished. Received a percentage rating of 77%. Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 22.

Correspondence from Readers

SPELL THEM

Editor, RADIO NEWS:

In RADIO NEWS for July I read G. W. Perkins' letter on Ideas for Broadcasters. In addition, I suggest that the broadcaster give examples of his call letters using words that begin with letters corresponding to those of his call. For example we will take KFI. The broadcaster might say K as in Klondike, F as in farmer, I as in India.

This method is especially adopted to call letters with an S and an F as these can hardly be distinguished.

AL. HARDEY.

Denver, Colo.

ET TU BRUTE!

EDITOR RADIO NEWS:

I wish to commend Ray Hardenbergh on his timely criticism of your magazine, in the September issue. You are making a serious mistake in taking your radical stand against the amateur, who, you will remember, gave you your bread and butter for several years. To show your appreciation for radio you persist in calling the phone hams *"amateurs,"* and the fellows that gave wireless to you, stupid *"old timers!"* Anyone can see the injustice in that. You say that your magazine covers the entire radio field, but it doesn't. It covers the phone field thoroughly, but the amateur side is sadly lacking.

If you would devote at least half of your magazine to the fellow who gets the real fun out of wireless, namely, the brass-pounding operator, I am sure that your circulation would suddenly increase.

J. M. SWIGERT, 9CLQ,
Des Moines, Iowa.

(*To set Mr. Swigert right, let us inform him that for the first two years of its existence* RADIO NEWS *was a losing proposition. It only started to make money* AFTER *the boom in radio started, last winter. Far from having made bread and butter for anyone, a small fortune was lost by* RADIO NEWS *while it was strictly an amateur periodical. Perhaps here is food for thought. On the other hand, we have never persisted in calling the phone "hams" amateurs. Quite the contrary! For the last six months we have very assiduously called them novices, which term* RADIO NEWS, *to the best of our knowledge, originated. An "old-timer," as we mentioned before, is an amateur who was in the game before the broadcast craze started. If we devoted at least half of our magazine to theoretical articles and others that are of no interest to the newcomers,* RADIO NEWS *would relapse to exactly where it was before the boom.*—EDITOR.)

"99% ALWAYS WINS"

EDITOR RADIO NEWS:

I hope that this article finds space in your magazine soon, for I believe it to be the exact sentiment of thousands of radiophone enthusiasts. It appears to me that there has been, within the past six months, as exemplified by the letters in your columns, considerable petty jealousies and argumentations between the radiophone fanatics and the straight key fanatics, as to who should be allowed the greatest amount of credit for this radio popularity all over the country.

As a rebuttal to the arguments forwarded by Mr. Warren and Mr. Hardenbergh in the September issue, I desire to place my views before the readers, in the hopes of acquiring boosts for the radiophone.

Mr. Warren makes a statement that the radiophone "is too easy." Well, in my years of experience in the radio field, which I consider sufficient to enable me to acquire a thorough knowledge of theory as well as practice, extending over six years, I would like to ask this question: take any of the well-known GOOD makes of regenerative receivers on the market today, hook one up, and tune in either on a spark transmitter or a C.W. wave, getting the code clearly and distinctly, then adjust the set to respond to the wave of a broadcasting station and try to get the words and music clearly, and you will see how much difference there is in the two classes of tuning. On the one hand, tuning to a spark station which has either a sharp decrement or broad, it doesn't make any difference, they can be found within from two points on the condenser to the full 180 degrees (some fellows are that broad); also C.W. telegraph can be located at any time within at least one point on the condenser or variometer dials, but now try to get your tubes to oscillate in resonance with the desired incoming broadcasting wave, so as to get the announcements and music clear, and see how closely one has to set the dials, to obtain persistent resonance. Anything easy about this?

Mr. Hardenbergh states: "Give them time, they will learn." But they won't learn.

List of Radio Articles Appearing in the October Issue of Science and Invention

Radio Typewriter Here.
By H. Winfield Secor

Radio and the Telharmonium.
By Robert Stewart Sutliffe

"Movie" Explains Radio.
By H. Winfield Secor

Super-Regenerative Audion Circuit.
By Robert E. Lacault

"WBAY"—Latest New York Broadcasting Station.
By A. P. Peck

Radio for the Beginner, No. 8, How to Read Radio Diagrams.
By Armstrong Perry

Radio Broadcast—List of Latest Radiophone Broadcasting Stations and Call Letters.

Radio Oracle.

I decidedly disagree with him on this statement for these reasons: first, that we are not all born as a bunch of wise-heads today, or never were, and it takes time for the human mind to perceive any condition and commit it to memory, so that this radio game is not any different. Also, that I find in my past and present experiences of installing radio receiving sets for private and public customers in this town that the average public DOES want to know the why and the wherefore, WHY you do this and WHY you do that, which all leads to thousands of questions which I am compelled to explain in as clear a language as is possible, handing them plenty of theory as well as practice, and they ARE satisfied after they actually know how and why it works.

Mr. Warren also mentions that the thrill of handling the key is considerably greater than speaking into a microphone. Yes, perhaps, if he thinks so, but I have not yet and never intend to install either a C.W. or phone transmitter; not because I haven't the cash, far from it, but because all my endeavors are centered on the most efficient receiving possible, for I consider it more interesting and harder work to continually reach out after these long distance fellows with a receiver than it is to talk or handle the key. Besides, how much more thrill can anyone want than when he is able to reproduce the concerts from Atlanta, Detroit, Wichita, Fort Worth, Kansas City, Louisville, and many others, each evening through a loud speaker with such volume that they can be very clearly heard over a distance of about a mile over the residential section of his community, so that the autos park in front of his residence throughout the entire evening, and the pedestrians line the streets on both sides, almost entirely blocking traffic, and the very next day many phone calls are received telling of the extremely satisfied results, as Mr. So and So and family "heard it nice and loud, way out at our house." If you can show me any ham or professional radio man who gets more thrill and satisfaction from handling a key or copying code than the fellow who reproduces on his set the original singing of the great opera stars, which I know will be broadcasted this coming winter, to a crowd of admiring friends and relatives, who want him to order and install sets for them right away, willing to pay him almost anything which he asks for his services, I'd like to know who he is—in other words, who gets the largest number of newly acquired friends, the key-man or the phone-man?

Please don't believe that I desire popularity, far from it, but this just goes to show you how the 99% American public feels about the two sides of the game, and the 99% always wins.

F. J. PETREQUIN,
St. Genevieve, Mo.

WE WERE WAITING FOR THIS

EDITOR RADIO NEWS:

Kindly allow me to introduce myself as one of RADIO NEWS' oldest readers. Since July, 1919, I have not missed an issue, and for that reason I wish you would take the statements I am about to offer as an honest criticism, and not as a knock.

In the editorial of the first issue you stated that the magazine was for and by the AMATEUR, and you signed off H. Gernsback—*your editor.* The issue of August, 1922, is nothing more than the average broadcast magazine, great numbers of which have recently sprung up, and you signed the editorial with a plain H. Gernsback.

The first issues of RADIO NEWS teemed over with AMATEUR, AMATEUR and AMATEUR. You crowded between your covers articles which dealt not only with receiving stations of the latest types and big commercial stations, but REAL LIVE AMATEUR SENDING articles. Just try and count the amateur articles in last August's issue.

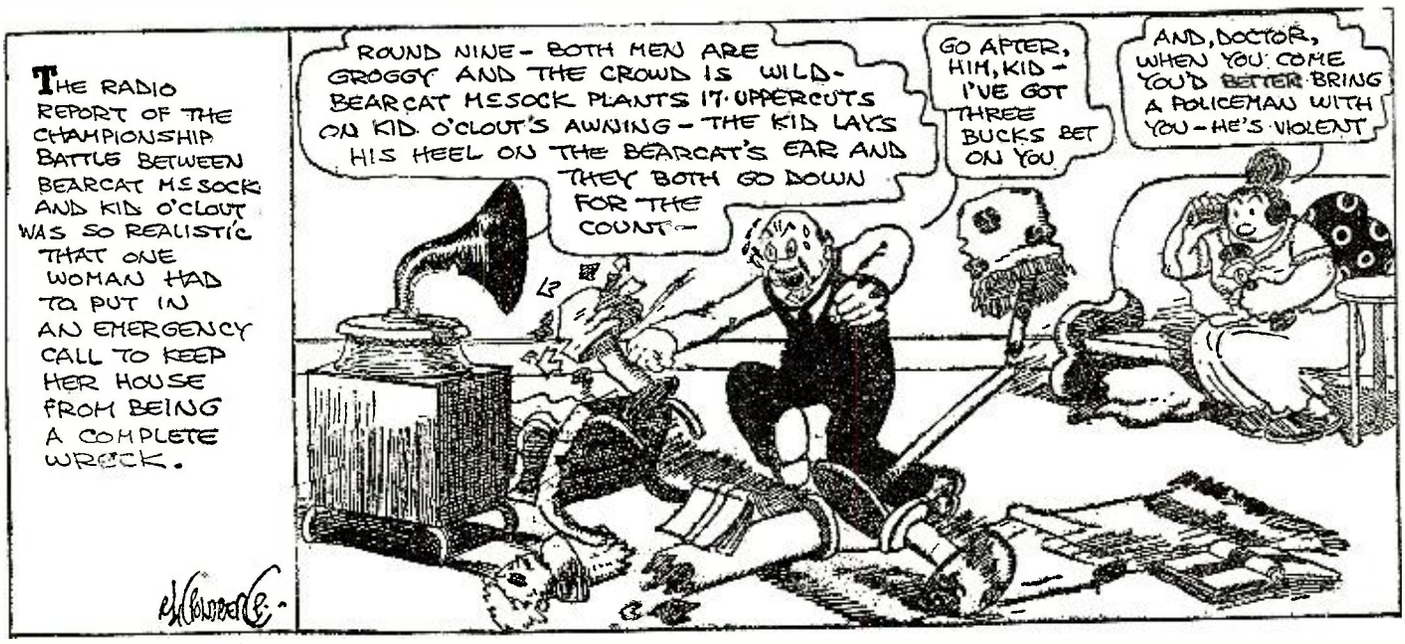
R. A. N.'s first editorial ended off thusly: "Three Cheers for American Radio AMATEURISM. Long live the radio AMATEUR."

And then alas came along the broadcast craze. The word AMATEUR, so profusely expounded in the first dozen issues, is absolutely left flat and his place is filled by the young chap who can only hear noises with his "steen" step amplifier, or the kid whose crystal set doesn't function properly. Of course, I realize it is more profitable to cater to the broadcast fiends from a financial standpoint, but don't lose sight of the fact that it was the now apparently forgotten AMATEUR who originally put the magazine on its feet.

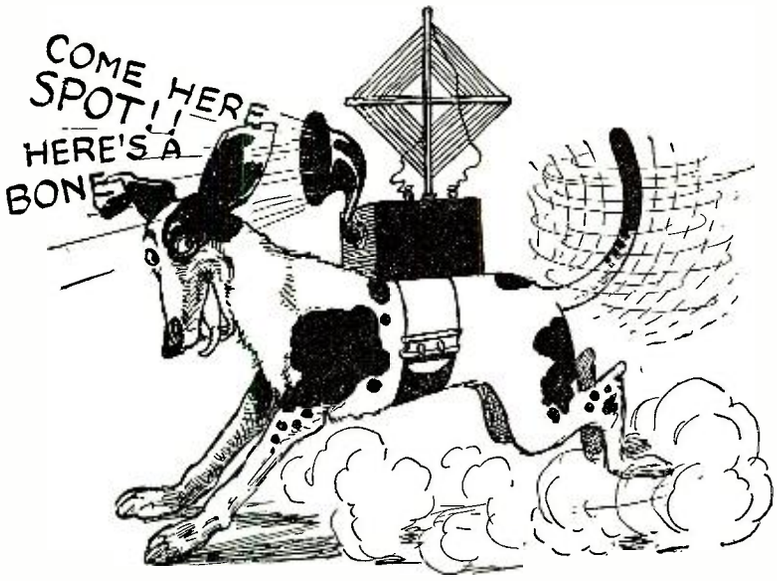
Now, then, with a great part of the load off my chest I will go ahead and say that if you canned those silly stories and the articles on scarf-pin radio sets you would have room to admit some of the amateur stuff you were so glad to start with. I can appreciate a good story as well as the next one; the stories by Ridleak were very funny,

(*Continued on page* 914)

Radio Humor



From the N. Y. Evening Mail



Thanks to this new Dog Radio Set, people who can't run will be able to make their Dog come back.

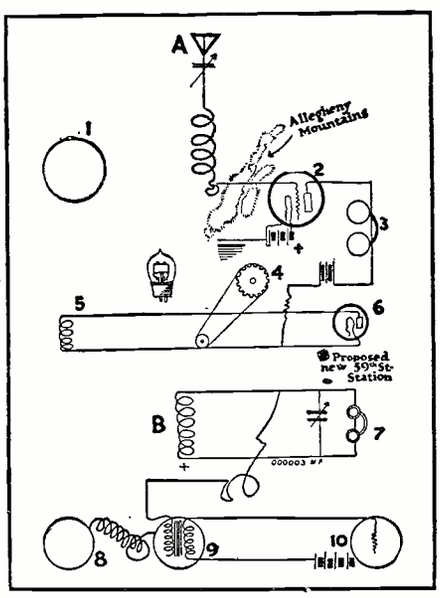
A Radio Bug

By JAMES S. HEARST

IT LOOKED almost human, in fact, it looked almost identically like a boy well along in his teens. The face was haggard and the muscles tensely drawn and there was a hopeful almost wild gleam in its eyes. Feverishly soldering and resoldering numerous wires, it seemed to be assembling a number of objects upon a shiny black panel, all the while mumbling strange words such as, "Where's that rheostat?" "I can't turn my condenser," "Honeycomb coil must be shorted," and so on. Sometimes a sound that seemed to signify joy would be emitted, and it would pause and survey its work with a look of delight. Calls to meals were ignored, requests to go on errands were treated in the same manner. Sometimes a man would come and take it by the ear and firmly lead it away, but it soon returned and continued its strange maneuvers. Suddenly it ceased operations and, in a voice suppressed by emotion, exclaimed, "Done! Gosh, I hope it works!" Wires leading to some batteries were quickly connected, and perched on the edge of a chair with two round objects adjusted over its ears, it began, with trembling fingers, to turn the knobs and dials located on the face of the instrument. Then save for the trembling, the motion of the hands ceased, and with head bent forward, it seemed to be listening eagerly. One of the dials is turned a fraction of an inch—too much; it is turned back a hair's breadth. Faint sounds of music are heard. A look of incredible wonder spreads across its face. Then with eyes glowing with joy and success, it leaps to its feet and gives out a shout such as Columbus might have uttered when he first sighted land. To the accompaniment of, "I heard sumpin'! I heard sumpin'!" it begins to prance around the room.

Its identity is solved. The transformation is complete. The chrysalis has emerged from its cocoon. It is a radio bug!

The Super Fed-Up Circuit



Coil A (out of Gelena by Insulation) is very well connected, being related on the paternal side to several admirals and James G. Blaine. On the other hand, Coil B (née Mullett) is badly hooked up, showing distinct traces of high pressure, four uncles in the Ku Klux Klan, a bridge-sharping aunt and an inherited unnatural craving for solidified alcohol.

The ? Box

Q. I am having considerable trouble with my static. What would you advise? WZY, Newark.

A. Eat more fish.

* * *

Q. I have a double-action, hammerless, safety, waterproof, non-inflammable absorbent, prophylactic crystal detector on my outfit. I can hear WWX fine, but would also like to hear FHB, TBM, RIT, FAB, LUX and FPA. What can I do about it? Anxious.

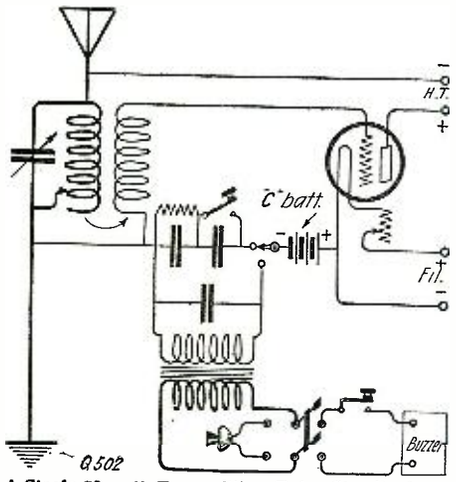
A. Paint it with iodine.

—From Life.

THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can only publish such matter as is of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you will make your letter as brief as possible.



A Single 50-watt Transmitting Tube Circuit of the Reversed Feed Back Type.

50 WATT C. W. TRANSMITTER

(502) Mr. Valentino of San Antonio, Texas, wants to know:

Q. 1. Please publish an efficient hook-up for a 50 watt C. W. transmitter.

A. 1. The desired diagram appears on these pages. The plate power may be obtained from rectified A.C. or from a direct current generator. If a transformer is used for filament heating, the connection to the rest of the circuit should be made at a center tap of the secondary winding.

EFFICIENT SHORT WAVE RECEPTION

(503) Mr. Peter Greenlay of New York, asks:

Q. 1. Do you know of a circuit for short wave reception which will prove as efficient as the standard variometer circuit?

A. 1. The two-coupler hook-up shown on these pages is quite efficient for short wave reception.

Q. 2. Kindly give all necessary data if such a receiver is practical.

A. 2. For short wave reception, L1, the primary inductance may consist of 70 turns of No. 20 D.C.C. wire tapped every 10 turns, on a form 3½" or 4" in diameter. The secondary coupling coil L1 is wound on a rotor form and consists of 25 turns of No. 20 D.C.C. untapped. L2, the secondary load is wound on a tube 3½" or 4" diameter; there are 30 turns on this inductance with taps spaced six turns apart. The ticker coil, L3 is wound on a rotor ball and is placed in inductive relation to L2. This coil may be wound with 60 turns of No. 20 D.C.C. A light coat of shellac may be applied to each coil if desired. The common filament terminal may be grounded if quiet operation is essential. To further increase the efficiency of this receiver, an "A" battery potentiometer may be utilized.

ALTERNATING CURRENT FILAMENT SUPPLY

(504) Mr. L. Webb of Philadelphia, Pa., writes:

Q. 1. Please give me an efficient hook-up for a one-tube receiver employing A.C. on the filament.

A. 1. The circuit you request appears on these pages.

Q. 2. Is it possible to secure good results with such a circuit? Are there any precautions to be observed in making same a success?

A. 2. It is possible to secure fair operation, with this circuit, although patience and perserverance will be required. This circuit will not function well with a soft detector tube. A hard tube is required for best results. The potentiometer is of about 200 ohms and is shunted across the filament terminals. Connection from the set to the filament is made at the slider. The growl and roar in the receivers is at a minimum when the slider is located near the center of the resistance. The potentiometer draws very little current from the line. Although this method does not entirely eliminate the alternator hum, it reduces same to a very low value. Many articles on this subject have appeared in RADIO NEWS but, due to the difficulty generally encountered, very few amateurs have succeeded in obtaining good results.

TUNED RADIO FREQUENCY AMPLIFICATION

(505) Mr. R. Virgil of West Virginia, asks:

Q. 1. Please publish a hook-up of an efficient one-step radio frequency amplifier together with detector and tuner. I would like to use unit inductance throughout in order to receive all wavelengths.

A. 1. The hook-up you request is shown on these pages. In place of the tuned circuit, C.L, a resistance of about 80,000 ohms may be successfully used for reception of waves over 1,000 meters. The potentiometer is quite important and should be used for the best results. A hard amplifying tube of low internal capacity should be used in the amplifier socket. All leads should be short.

SIMPLIFIED CIRCUIT FOR AUDIO FREQUENCY AMPLIFICATION

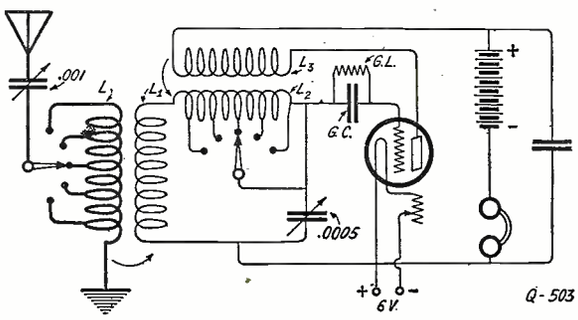
(506) Mr. S. Brown of Chicago, Illinois, writes:

Q. 1. I am desirous of constructing a short wave regenerative receiver and two stage amplifier but do not wish to use complicated jacks for cutting in the different stages. Is there a circuit of simple design which I could use for this set?

A. 1. A very simple and efficient method of connecting up an audio frequency amplifier is shown on these pages.

Q. 2. If such a circuit is available, will you kindly publish same?

A. 2. This circuit appears on these pages. It is necessary to use a hard tube in the detector socket but as hard tubes operate well as detectors, no disadvantage is incurred.



This Two-Coupler Receiver Is Extremely Efficient and Selective When Tuned Properly.

SOCKET AERIAL

(507) Mr. L. Peterson of Ripon, Cal., wishes to know:

Q. 1. Are the light plugs used in place of an aerial efficient?

A. 1. The small plugs which screw into the regular light sockets have given good results in some localities. The plug consists of a mica condenser of fixed capacity. One terminal of the condenser is connected to one side of the electric line. The other terminal is connected to the aerial post on the receiver. The condenser acts as an open circuit to direct or low frequency current but readily passes high or radio frequency current. Mica is used as the dielectric to prevent possible shortage of the house current.

Q. 2. Should a regular ground be used with this form of aerial?

A. 2. Yes. The ground connection is employed as usual.

Q. 3. Is an "A" battery potentiometer to regulate the plate voltage necessary with a C300 detector tube?

A. 3. The potentiometer is not essential but will be of some value in finding the critical operating point.

COMBINED LONG AND SHORT WAVE RECEIVER

(508) Mr. C. Hunt of Toronto, Canada, wishes to know:

Q. 1. Is there a circuit feasible for both long and short wave reception, honeycomb coils being used for long waves and a standard variometer set for short waves?

A. 1. A combined circuit for such a receiver was shown on page 354 of the August issue of RADIO NEWS.

500 MILE RECEPTION

(509) Mr. A. Scott of Charlotte, N. C., writes:

Q. 1. With what instruments should I be able to hear KDKA, which is situated about 500 miles from Charlotte?

A. 1. A good two or three stage radio frequency amplifier and detector should enable reception over this distance under favorable conditions. The circuit shown in answer to Question 505 may be employed if desired.

TUBES FOR AMPLIFICATION AT RADIO FREQUENCIES

(510) Mr. A. Gibson of Taunton, Mass., wants to know:

Q. 1. What tubes are suitable for use in radio frequency amplifying circuits?

A. 1. The tubes to use in such a circuit should possess a very low value of internal capacity. Hard tubes are generally used with the normal plate voltage.

Q. 2. Is it possible to construct a wavemeter to cover a range of 200 to 30,000 meters by utilizing unit inductance such as honeycomb or Remler-Giblin coils?

A. 2. An efficient wavemeter may be built with the unit inductances, as you mentioned. Question 479 in the October issue contained much information relative to the construction of wavemeters.

"J" TUBES

(511) Mr. R. Brunjes of West Stockbridge, Mass., writes:

Q. 1. Where and by whom is the enclosed (photo of) tube manufactured?

A. 1. The photograph is one of a "J" tube or V.T. 1. This tube is manufactured by the Western Electric Company in the United States.

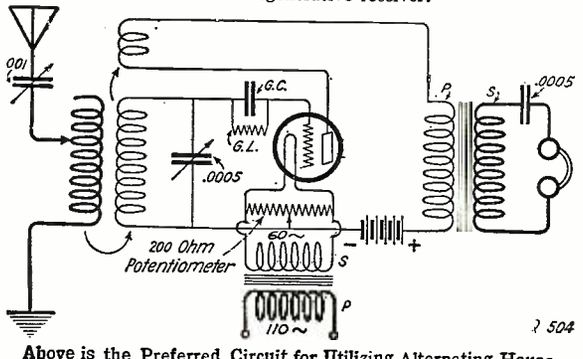
Q. 2. Does this tube function well as a detector?

A. 2. With a plate voltage of 20, this tube will perform satisfactorily as a detector. The filament of this tube is of such construction that only a red glow is obtained when the filament is properly heated.

INDUCTANCE WINDING

(512) Mr. G. Lightner of Olustee, Oklahoma, writes:

Q. 1. How many turns of No. 18 D.C.C. should I use on the primary and secondary of a coupler for a short wave regenerative receiver?



Above is the Preferred Circuit for Utilizing Alternating House Current Instead of a Storage Battery. Further Details Are Given In Answer to Q. 504.

A. 1. For 200 to 800 meter reception, use 60 turns on the primary, tapped every 15 turns or more often. The secondary is wound with 30 or 40 turns, untapped. Either a variable condenser or a variometer may be used to tune the secondary.

Q. 2. How many turns should I use for inductance coils to tune to 1500 meters?

A. 2. With a standard three circuit receiver and amateur aerial, use 200 turns in the primary, 150 in the secondary and 150 in the tickler. If the receiver does not function correctly, it will be well to reverse the tickler leads.

TURNS ON UNIT COILS

(513) Mr. G. E. Arrowsmith of St. Louis, Mo., inquires:

Q. 1. Please let me know the number of turns and size of wire to be used in winding unit coils such as the L1000, DL1500, RG150, etc

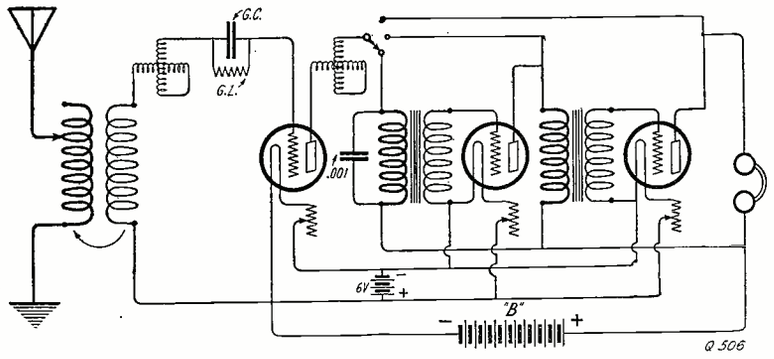
A. 1. The number after the letter denotes the number of turns in the coil. Thus a DL1000 is wound with 1000 turns. RG150 means that this coil has 150 turns. The size of wire depends upon the number of turns. For small coils, No. 24 S.C.C. is generally used. Larger coils are wound with finer wire, No. 28 S.C.C. or such. The reason for using the smaller wire is to keep the coils as smal as possible.

DOUBLE AMPLIFICATION

(514) Mr. George Yale of New York, writes:

Q. 1. Please publish a circuit consisting of one vacuum tube and a crystal detector in which the vacuum tube is employed to amplify at radio and audio frequencies.

A. 1. The circuit you desire is shown on these pages.



This is a simplified circuit for a detector and audio amplifier. Results obtained with this circuit are equal to those obtained when the more complicated jacks are used.

Q. 2. Will this circuit operate well?

A. 2. It is possible to secure efficient operation with this hookup. The vacuum tube amplifies the radio frequency impulses before they reach the tuned detector circuit. A mineral detector is shown for this purpose. After being rectified, the signals are transferred back to the grid of the vacuum tube through a suitable transformer. Although a local battery circuit is shown with the crystal detector, its use is necessary only with carborundum. Galena does not require a battery for operation. It would be well to employ carborundum in preference to other minerals as the adjustment may be made very sturdy, thereby eliminating the trouble of continually finding a "sensitive" spot. The condensers may have the following values:

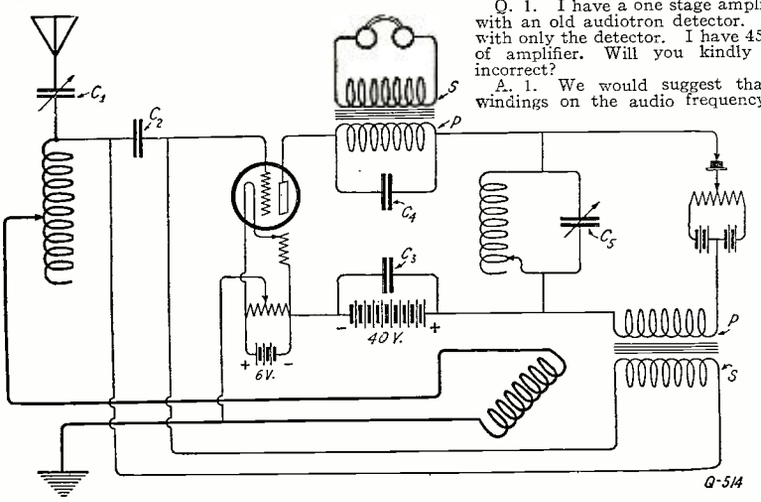
C1—.001 variable
C2—.002 fixed
C3—.002 fixed
C4—.002 fixed
C5—.001 variable

"WEAGANT 'X' CIRCUIT"

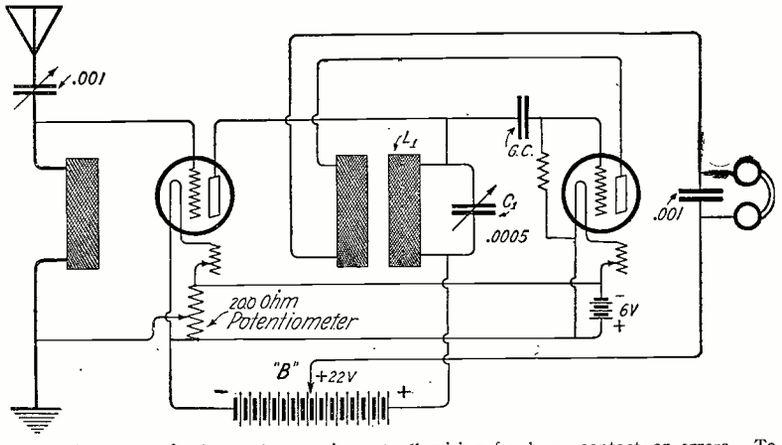
(515) Mr. W. Kratch of New Jersey, writes:

Q. 1. What is the Weagant "X" circuit?

A. 1. The Weagant circuit is a tuned plate regenerative receiver named after its originator, Roy Weagant of the Radio Corporation of America. In its simplest form, it consists of a inductance and variable condenser shunted across the phones and "B" battery. The diagram illustrates this circuit. The inductance may be coupled back to the tuning coil.



Q. 505. A one stage, tuned impedance coupled, radio frequency amplifier. By employing unit inductances, it is possible to cover the entire wavelength range of 180-20000 meters.



Q. 2. What are the advantages of using a phone transformer?

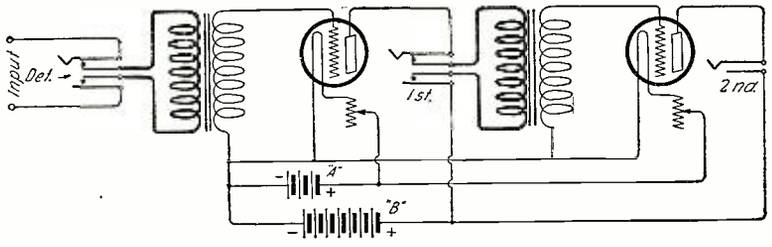
A. 2. Many advantages are to be derived from the use of a telephone transformer. If the headset is not connected correctly in the plate circuit, the battery current will decrease the permanent magnetism of the phone magnets. When a transformer is used, the current flows through the phones only when the plate current is varied. Damage to the phones is almost impossible and the crackling sounds heard with a two stage amplifier are greatly reduced Detuning due to movement of the headset is minimized. An ordinary audio frequency amplifying transformer may be employed successfully.

TWO STAGE AUDIO AMPLIFIER

(516) Mr. J. L. Bernet of Burlington, Wisconsin, wishes to know:

Q. 1. How may I connect up a two stage amplifier with jacks? This amplifier is to be used in conjunction with a CR8.

A. 1. The circuit you request is shown on these pages.



Q. 516. A standard circuit for two stages of audio frequency amplification. The "A" and "B" batteries may be used on the detector tube also.

AMPLIFICATION TROUBLE

(517) Mr. T. Serur of San Morcos, Texas, asks:

Q. 1. I have a one stage amplifier in conjunction with an old audiotron detector. Signals are louder with only the detector. I have 45 volts on the plate of amplifier. Will you kindly tell me what is incorrect?

A. 1. We would suggest that you verify the windings on the audio frequency transformer and

With one tube and a crystal detector, the circuit on the left provides amplification at radio frequency, rectification and audio amplification. Difficulty may be experienced in securing efficient operation as the operation is rather unstable.

A. 2. The method to be preferred consists in placing a metal form in front of each instrument and grounding each shield. The metal may be of aluminum, copper or tin foil. They should be of the same size as the instruments in front of which they are placed. Care must be taken that the metallic parts of each instrument do not touch the shield. By employing separate shields instead of a single large piece, hysteresis losses are reduced.

RADIO FREQUENCY SWITCHING

(519) Mr. H. Keen of Bay Point, Maine, writes:

Q. 1. In the July issue the Editor said it was impossible to use a plug to cut in one or two stages of a radio frequency amplifier. It is possible to do this by employing a plug on the aerial and ground and changing the input connections, is it not?

A. 1. Yes. It is possible to do this but due to the added capacity of the circuit very poor operation will be secured. Our October issue contained a diagram suitable for this purpose.

Q. 2. Please publish a circuit of a C.W. transmitter using two bulbs as oscillators and two modulators.

A. 2. The circuit you desire was shown in answer to question 478 of our October issue.

V. T. EFFICIENCY

(520) Mr. A. Flindt of Springfield, Ohio, writes:

Q. 1. I am now using a loose coupler and galena crystal with excellent results. I hear Detroit and Pittsburgh but rather faintly. Would I be able to hear them plainer with a V.T.?

A. 1. Yes. The substitution of a V.T. in a good regenerative circuit should increase the signal strength considerably.

Q. 2. On a loose coupler is it necessary to wind the secondary with finer wire than the primary coil?

A. 2. It is not essential to have a fine gauge wire on the secondary. The same size wire on both coils will be satisfactory.

Q. 3. Would I be able to use a number of dry cells in place of the storage battery?

A. 3. We would not advise that dry cells be used to heat the filaments. They run down too quickly and are more expensive in the long run.

SHIELDING

(518) Mr. H. Haight of Los Angeles, Cal., inquires:

Q. 1. Is there any reason why closed circuit gravity batteries may not be used for heating the filaments of a receiving set?

A. 1. The gravity batteries run down too quickly to warrant their use. Although cheaper than storage batteries, they will cost more in the end. A description of a fairly good battery appeared in the September issue of RADIO NEWS.

Q. 2. How may I shield my receiving set?

A. 2. It is possible to secure efficient operation with a two stage amplifier are greatly reduced Detuning due to movement of the headset is minimized. An ordinary audio frequency amplifying transformer may be employed successfully.

Q. 2. What sizes of honeycomb coils shall I use for 200 to 800 meter reception?

A. 2. If a double circuit is employed, six coils will be necessary; Nos. 25, 35, 75 and 100. Also two No. 50. By suitably arranging a combination of these coils, all wave-lengths between 200 and 800 meters may be received.

Q. 3. Please give circuit of a detector and one stage of amplification.

A. 3. This circuit was shown in answer to Q. 497 of the October issue of RADIO NEWS.

inspect all wiring for loose contact or errors. To obtain maximum results, from an audio frequency transformer the leads to the primary and secondary terminals should be changed about, while actually receiving, until the signal strength is greatest. It may be necessary to shunt a fixed condenser of .001 M.F. across the primary in order that the tuner may function correctly.

LIGHTNING

(521) Mr. O. Brown of San Francisco, Cal., inquires:

Q. 1. Is there any possibility of danger from the use of an outdoor antenna?

A. 1. In general, no. However, it is well to comply with the National Underwriters regulations in regard to antenna installation. A properly safeguarded aerial is a potential protector of property.

ANTENNA CONSTRUCTION

(522) Mr. B. Spruill of North Adams, Massachusetts, wishes to know:

Q. 1. What antenna is best for phone reception on 360 meters?

A. 1. A good 125 foot single wire aerial placed as high as possible will be very satisfactory for short wave reception.

Q. 2. Please publish a hookup of a two variometer receiver.

A. 2. This circuit was shown in the April-May RADIO NEWS.

LOUD TALKER CONSTRUCTION

(523) Mr. F. Strattner of Philadelphia, Pa., inquires:

Q. 1. What are the physical and electrical dimensions of the movable coil in a regular power loud talker?

A. 1. This information may be found in the October, 1920, issue of RADIO NEWS. A complete description with all details appears on page 211. This article was written by H. Winfield Secor.

LOOP RECEPTION

(524) Mr. T. Tuthell of Chicago, Illinois, wishes to know:

Q. 1. Will the enclosed circuits work with the direction finding units illustrated on page 922 and 923 of the April-May issue?

A. 1. The two circuits, consisting of a vacuum tube detector with a tuning variable condenser and a crystal detector also equipped with a tuning variable condenser, will work satisfactorily if the antenna construction is correct. The vacuum tube detector may be improved by providing a tuned plate circuit for regeneration or by having a few stages of radio frequency amplification before rectification.

LIGHTNING PROTECTION

(525) Mr. George Zimmerman of Tomah, Wisconsin, writes:

A. 1. Would No. 14 copper wire be suitable for the ground lead from a lightning arrester?

A. 1. Yes. No. 14 copper or copper-clad wire will be suitable.

Q. 2. Is a lightning arrester efficient?

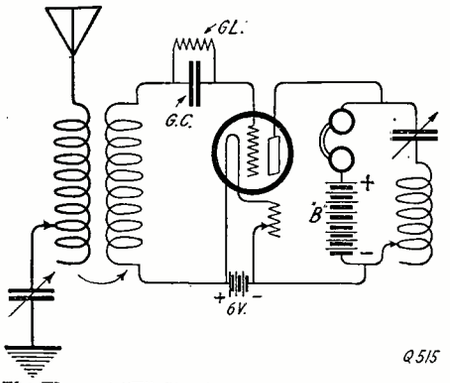
A. 2. A lightning arrester may be used on antenna installations and if approved by the Fire Underwriters will be entirely suitable.

MAGNETIC RECTIFIER

(526) Mr. G. A. Little of Gainesville, Florida, inquires:

Q. 1. Please publish details of a closed core magnetic rectifier for use in charging radio batteries. I would like the complete constructional features, size wire, number of turns, etc.

A. 1. The May, 1920, issue of RADIO NEWS contained an article by J. Stanley Brown relative to the construction of a close core magnetic rectifier. An error appears in Fig. 1 of this article. The extreme right hand lead from the secondary winding should be brought to right hand tap number 2 instead of the "off" tap. Note also the caption at the foot of this figure.



The Weagant "X" Circuit Consists of a Tuned Series Inductance and Capacity Shunted Across Phones and "B" Battery.

RECEIVER RANGE

(527) Mr. T. Bombalis of Youngstown, Ohio, writes for information:

Q. 1. What will it cost to construct a three-tube Armstrong super-regenerative receiver?

A. 1. The total cost will depend entirely on the class of material purchased and the amount of workmanship necessary. It would be quite simple to approximate the cost by referring to the advertisements in RADIO NEWS. We would suggest that you communicate with some radio dealers on this matter.

Q. 2. What is the range of a 200 to 5,000 meter regenerative receiver with one stage of audio amplification?

A. 2. We refer you to the answer to Q. 452 of our September, 1922, issue.

Q. 3. Kindly publish the constants of the three tube super-regenerative receiver.

A. 3. This and other data on the Armstrong super-regenerative receiver appeared in the August, 1922, issue, page 395, RADIO NEWS.

IONIZATION

(528) Mr. A. W. Gregory of Morristown, New Jersey, wants to know:

Q. 1. Please define ionization as applied to the action in a vacuum tube.

A. 1. W. H. Eccles in "Wireless Telegraphy and Telephony" defines ionization of a gas as meaning the production in it of particles called "ions" carrying positive and negative charges of electricity. The ions may be large aggregations of molecules or single molecules or electrons. Ionization is caused when too high a plate potential is applied to a gas content tube. This action is accompanied by a soft bluish glow. Ionization is gnerally harmful in its effect upon a soft tube.

HONEYCOMB COIL CIRCUIT

(529) Mr. N. Dow of Philadelphia, Pa., wants to know:

Q. 1. Please publish a honeycomb circuit utilizing three coils and a vacuum tube detector.

A. 1. The circuit you request appeared in our October, 1922, issue of RADIO NEWS.

Q. 2. May I use a counterpoise in the air chamber of a house, 20 feet below the aerial, as a receiving ground?

A. 2. Yes. It is possible to employ the counterpoise as you suggest and if used with a regenerative vacuum tube set, the results will be almost as good as with a ground. A crystal set operates better with a good ground connection. If the set is shielded the use of a counterpoise is not recommended, as the shielding effect is only secured with a thorough ground connection.

"C" BATTERY

(530) Mr. E. E. Moyer of Clearfield, Pa., writes:

Q. 1. Is the grid voltage from the "C" battery in the Armstrong super-regenerative receiver very critical?

A. 1. The proper value of grid voltage depends upon the tubes employed with this circuit. Taps on the C battery at every 1.5 volt will provide the required regulation.

Q. 2. What kind of inductances are used in the grid and plate circuits of that receiver?

A. 2. Unit inductances of the honeycomb, duolaterla, or Remler-Giblin type may be employed. It is possible to make up the correct sized inductance with banked windings of any of the methods outlined in previous issues of RADIO NEWS.

WGAD

(531) Mr. R. B. Giffin of Atlantic City, New Jersey, inquires:

Q. 1. Is there a broadcasting station in Porto Rico?

A. 1. We know of one station, WGAD, operated by the Spanish-American Radio School.

Corrections and Additions to the Market News Service

BOSTON, MASS. (Medford Hillside Mass.) American Radio & Research Corp. WGI	Musical program	Local	Eastern Time 10.00 a.m.	Phone.
	Weather forecast	Fed.	11.30 a.m.	"
	Boston farmers' produce market	Local	1.30 p.m.	"
	Current events and music	"	3.00 and 3.25	"
	U. S. market report	Fed.	6.00 p.m.	"
	Early sports news	Local	6.30 p.m.	"
	Entertainment and news, etc.	"	7.00 and 8.00	"
BRIDGEPORT, PA. Diamond State Fibre Company WBAG	Philadelphia fruit and vegetable report	Local	Eastern Time 12.00 noon	Phone.
	Estimated live stock receipts	Fed.	"	"
	Philadelphia meat market	Local	"	"
CHICAGO, ILL. Daily Drovers Journal WAAF	Information not available	.....	Central Time	Phone.
CINCINNATI, OHIO Cino Radio Mfg. Co. WIZ	Wholesale fruit, vegetable and weather reports	Fed.	Central Time (Daylight Savings) 12.00 noon	Phone.
	Live stock report, Chicago and St. Louis	"	3.00 p.m.	"
	Weather report	"	3.30 p.m.	"
	Entertainment, etc.	Local	7.00 p.m.	"
COLUMBUS, OHIO Ohio State Univ. WEAO	Weather, crop and market information	Fed.	Eastern Time 1.30 p.m.	Phone.
DALLAS, TEXAS Dallas News Co. WFAA	Weather report	Fed.	Central Time 12.30 p.m.	Phone.
	Baseball news	Local	2.00 p.m.	"
	Market reports	"	3.30 p.m.	"
	Market reports	Fed.	5.30 p.m.	"
	Baseball finals	Local	6.45 p.m.	"
	Music and entertainment	"	8.00 p.m.	"
HUTCHINSON, KANSAS Hutchinson Grain Radio Club Call Letters not yet issued	Grain markets, Chicago and Kansas City	Fed.	Central Time Hourly 8.30 a.m. to 12.30 p.m.	Phone. "
JACKSONVILLE, FLA.	Music and entertainment	Local	Eastern Time 3.00 to 3.15 p.m.	Phone
Florida Times Union WDAL	Music and entertainment	Local	4.00 to 4.15 p.m.	Phone.
	" " "	"	5.00 to 5.30 p.m.	"
	" " "	"	8.00 to 9.30 p.m.	"
	Crop and weather reports	Fed.	10.05 p.m.	"
KANSAS CITY, MO. Daily Drovers Telegram	Information not available	.....	Central Time	Phone.
LINDSBORG, KANSAS Central Kansas Radio Supply Co. WDAD	Music and entertainment (Market program not completed.)	Local	Central Time Twice weekly	Phone.
OMAHA, NEBR. Daily Drovers Journal Stockman WIAK	Live stock and market reports	Fed.	Central Time. 7.45, 9.10, 10.15 a.m. 12 noon, 1.50 and 3.50 p.m.	Phone.
OMAHA, NEBR. Omaha Grain Exchange WAAW	Grain and live stock reports	Fed. and Local	Central Time Hourly 8.45 to 1.30 p.m.	Phone.
	Weather report, baseball, etc.	"	5.30 p.m.	"
	Fruit and vegetable market and entertainment	"	8.00 p.m.	"
PHILADELPHIA, PA. Phila. Radiophone Co. WCAU	Fruit and vegetable reports, Philadelphia and New York fruit and vegetable shipments	Local	Eastern Time 11.00 a.m.	Phone.
	Special white potato report	"	2.30 p.m.	"
	Fruit and vegetables, live stock, meats and dairy reports	"	6.45 p.m.	"
PHILADELPHIA, PA. Strawbridge & Clothier Co. WFI	Fruit and vegetable reports, Philadelphia, New York and Newark markets	Local	Eastern Time 10.00 a.m.	Phone.
	Philadelphia fruit and vegetable report	"	2.00 p.m.	"
	Estimated live stock receipts	Fed.	"	"
	Philadelphia meat market	Local	"	"
ROSWELL, N. MEX. Roswell Public Service Co. KNJ	News, etc.	Local	Mountain Time 5 to 6 p.m.	Phone.
	K. C. live stock reports	Fed.	"	Phone & Tel.
	Weather report	"	"	" " "
	Entertainment, etc.	Local	8 to 9 p.m.	Phone.

MURDOCK RADIO

WITH less adherence to quality, we could make many more Murdock Phones.

Murdock quality has sent the demand for Murdock apparatus far beyond our expectations.

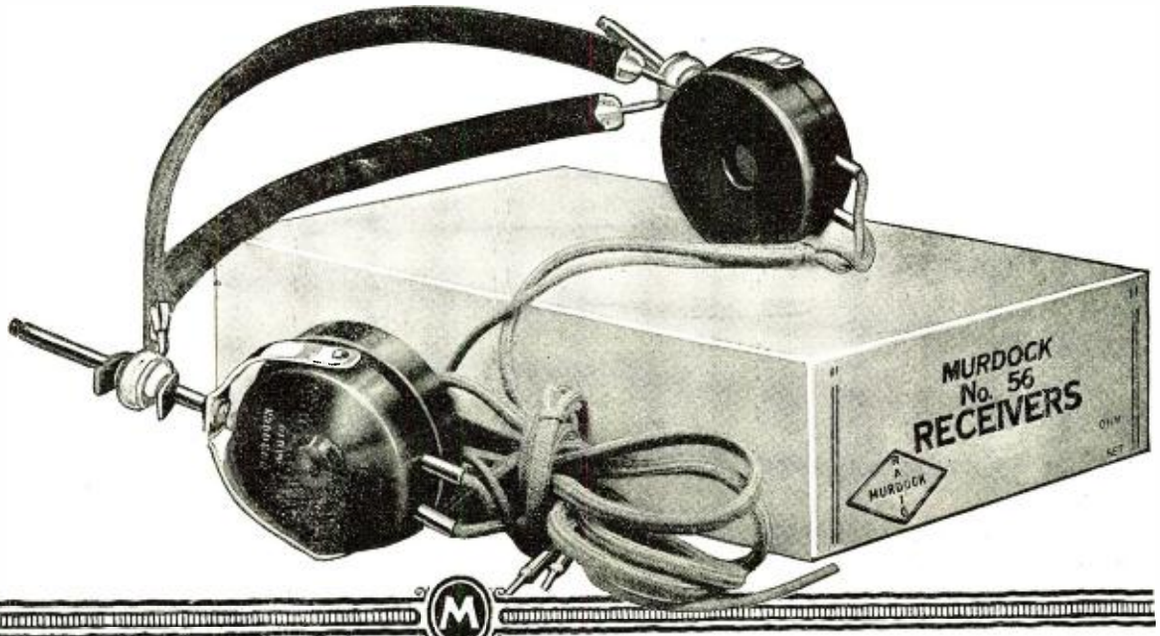
Examine Murdock apparatus at your dealer's. There are no other phones so good at so low a price. *After* you *have* bought, a 14 day trial privilege assures satisfaction with your purchase.

WM. J. MURDOCK CO.

344 Washington St., Chelsea, Mass.
1270 Broadway, New York City
509 Mission St., San Francisco, Cal.

FOR SALE BY DEALERS EVERYWHERE

No. 56-2000 ohm—$5.00
No. 56-3000 ohm—$5.50



Radio Photography

(*Continued from page 864*)

clock-work mechanism is set in motion the cylinder with the photograph revolves and gradually the focal point of light explores the entire surface of the photograph. As the point of light meets the black and transparent sections of the photograph, the black portions obstruct the light and the transparent portions allow it to pass. Consequently, the current in the selenium cell circuit varies at the frequency at which the light meets the black dots and transparent portions of the photograph.

At the receiving end there is nothing unusual about the receiving circuit, which may consist of a suitable tuner with a detector and amplifiers. In the output of the amplifier is connected an arrangement, the principle of which is shown in Fig. 2. This instrument resembles the oscillograph, which was described in the July 1921 issue of RADIO NEWS. A little coil is suspended in the field of a permanent or electro-magnet. The plate current of the receiver passes through this coil. Due to the electro-magnetic force action between the field of the magnet and the current flowing in the coil, the coil will rotate at the frequency of the variations of current in the plate circuit. To the small coil is attached a mirror and a ray of light is played on it. This ray of light will be reflected in the different positions of the coil as it vibrates. It follows, therefore, that the ray of light will follow the variations of the current in the plate circuit.

A revolving cylinder similar to that used in the transmitting circuit is covered with a piece of unexposed bromide paper and enclosed in a light proof box. On one side of the box is a small hole. The reflected ray of light may pass through this hole when it is in the correct position. If, at the transmitter, the light meets a black dot on the photograph, a very small amount of current passes through the selenium cell and the amplitude of the transmitting waves for this period is low. At the receiving end, there is a correspondingly small variation of plate current and deflection of the ray of light. Therefore, it may be said that when the light at the transmitter is focused on a dark portion of the photograph, the ray of light at the receiving station is deflected.

The receiving apparatus are arranged in such a position that this little deflection causes the ray of light to pass through the hole in the box and expose the bromide paper.

When the light at the transmitter is focused on a transparent spot, a large amount of current flows in the selenium cell circuit which causes the amplitude of the transmitted waves to be greatly increased. This, in turn causes a large variation of the plate current of the receiver and a large deflection of the ray of light. Thus, during the time that the light at the transmitter is focused on a transparent portion of the photograph, the ray of light in the receiver is deflected and does not penetrate to the bromide paper.

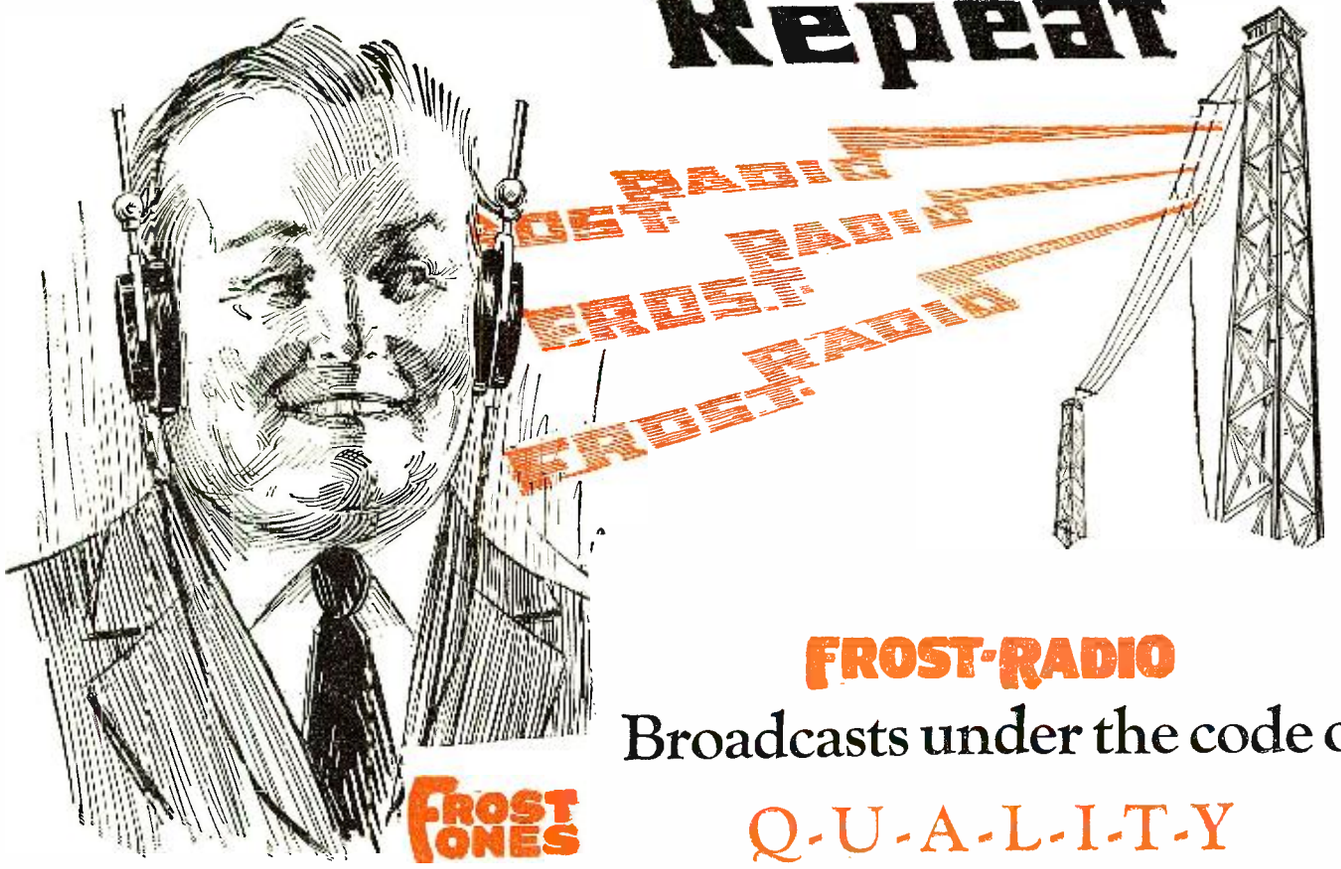
The ultimate result is that as the bromide paper revolves on the cylinder it intermittently is exposed or remains unexposed and the positions of the resulting black spots will correspond exactly to those on the photograph transmitted. When this print is reduced in size, it may be as clear as any ordinary half-tone reproduction.

A THOUGHT OF THE DAY

Some receiving sets are made to catch the purchaser instead of the music.

By A. J. DE LONG

The Calls Repeat



FROST-RADIO
Broadcasts under the code of
Q-U-A-L-I-T-Y

Cunningham Detector and Amplifying Vacuum Tubes

Nationally recognized as ideal for use with Radio Receiving Sets. Cunningham Tubes are the choice of those who want the finest results from their equipment.

Type C-300 - $5.00
Type C-301 - $6.50

A Good List to Help You Make Your Selection

Remler Radio Apparatus
Frost-Fones
Cunningham Tubes
Frost-Radio Extension Cord and Plug
Frost-Radio Improved Jacks and Plugs
Frost-Radio Receiving Transformers
Frost-Radio Protector
Frost-Radio Tuning Coil

Its range is international — known in every country — sought by buyers of Radio apparatus.

Frost-Radio is of importance to every owner of a Receiving Set. This line is backed by the combined knowledge of Radio veterans who have seen the progress of this science since its inception. Recognized everywhere as a Radio guide to satisfaction.

This past summer has been an acid test for Radio Merchandise. Frost-Radio has come through as 100% for Quality, Fair Price and Satisfactory Service.

Go to your nearest Radio Dealer. Ask for Frost-Radio apparatus. You compliment the excellence of his judgment in selecting these Radio Accessories. Their merit is unquestionable.

Like Postage Stamps Used Everywhere
FROST RADIO
154 W. LAKE ST. CHICAGO, ILL.

HERBERT H. FROST
NATIONAL FACTORY DISTRIBUTORS TO THE ELECTRICAL-RADIO JOBBER
154 W. LAKE ST. CHICAGO, ILL.

The Radio Patent Situation

(*Continued from page* 850)

of Lee and Hogan, Kintner, Austin, Beakes and Vosburgh, among others.

When the United States entered the war the commercial companies foresaw that the government would require patriotic co-operation, and large quantities of radio apparatus. The American Telephone and Telegraph Company and Western Electric Company entered the field on a large scale only by securing a patent situation under contract with the De Forest Radio Telephone and Telegraph Company in which they secured rights under the important third electrode electron tube patent and the De Forest amplifier patent, among various others. Rights were also secured under the Lowenstein invention of the negative C battery for biasing the grid of the electron tube. The General Electric Company had endeavored to construct its patent situation by securing rights under patents of the Atlantic Communication Company and the Vreeland Apparatus Company, in addition to numerous patents by its own corps of engineers, including among others, Langmuir, Alexanderson and Coolidge. The Marconi Company had continued to build its patent situation, utilizing among others the inventions of Hill and Clark on the wave changer used in spark transmitters, and Weagant for various circuits and apparatus. The Federal Telegraph Company had signed a contract with the government granting certain rights to the government under the patents controlling the manufacture and operation of arc transmitters. These patents included among others the inventions of Pederson, Poulsen, Schou, Fuller, Marx, Rodman, Watkins and Beal. The Westinghouse Electric and Manufacturing Company were becoming interested in the manufacture of radio equipment for the government. The patent situation was such that manufacturers would not accept orders for radio apparatus unless the purchaser agreed to hold the manufacturer harmless from any damages arising out of the infringement of patents. The government as a war emergency requiring radio apparatus as a vital necessity, agreed to save the producer harmless from infringement of patents and, therefore, with the co-operation of all, a large production program ensued and the government secured the much needed radio equipment for the prosecution of the war. On the signing of the Armistice, however, this condition no longer continued, and the patent monopoly heretofore existing returned with all of its legal aspect and effect. The circumstances were such that no one of the companies working in the art were in a position to sell radio apparatus without infringing some patents controlled by a competitor. The Westinghouse Electric and Manufacturing Company in gaining a foothold in the commercial radio field secured rights under the patents of the International Radio Telegraph Company and then under the inventions of Pupin and Armstrong, including the famous Armstrong regenerative circuit. They had secured certain rights under Hutin and Le Blanc multiplex line wire telephony patents, also certain rights under the patents of the Federal Telegraph Company, the Atlantic Communication Company, and inventions of certain government employees. The Radio Corporation has been formed, including the patent holdings of the General Electric Company, the Marconi Company, the American Telephone and Telegraph Company and Western Electric Company, with certain reciprocal rights designating the fields of operation for each of the several companies, and the heretofore deadlocked patent situation somewhat re-

MAKE YOUR OWN RADIO RECEIVER

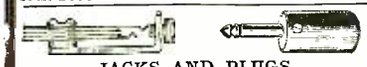
With Standard Highest Quality Parts

AND SAVE MONEY

We Pay Express or Postage in the United States East of the Rockies (Except Storage "A" Batteries)

PHONES

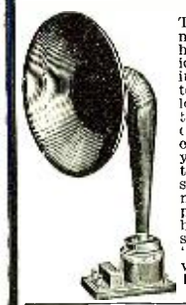
Genuine Frost and Brandes head sets complete with cords.
Frost N162—Double head sets, 2000 ohm. $4.45
Frost N163—double head sets, 3000 ohm. 5.40
Frost N164—Single head sets, 1000 ohm. 2.60
Frost N165—Single head sets. 1500 ohm. 3.10
Brandes Superior N166—Double head sets. 2000 ohm 7.20



JACKS AND PLUGS

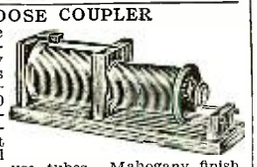
Jacks are polished nickel, nickel-silver springs, pure silver contacts. Nickel washers for mounting on any panel ⅛ to ¾ inch thick. Spread terminals make soldering easy.
N133—One spring (open circuit). Each. $0.46
N134—Two spring (closed circuit). Each. .56
N131—Four spring (two closed circuits) Each ..... .70
N135—Three spring (two open circuits, commonly called "single circuit filament control"). Each ..... .80
N136—Five spring (two open and two closed circuits commonly called "two circuit filament control"). Each ..... .95
N132—Plug, telephone type with short knurled grip ..... .75
N137—Plug (as shown), best type plug for Radio panel work, cord tips fit into plug 1.05

MAGNAVOX



The Genuine R-3 Magnavox with the 14-inch horn still remains the ideal loud speaker for use in homes, offices, amateur stations, etc. This loud speaker is made on the electro-dynamic principle, one winding being excited by current from your 6-volt storage battery. This makes it possible for this instrument to amplify as it reproduces. Your "B" battery plate voltage should be 90 to 200 volts. "Radio brings it, Magnavox tells it."
N170 — Radio Magnavox $43.50

LOOSE COUPLER



This loose coupler is preferred by many because of its wide range—200 to 3500 meters. Permits the beginner to start with a crystal set and later use tubes. Mahogany finish. All metal parts are brass, nickeled and highly buffed. Secondary has 12 point switch mounted on Bakelite coil head. Windings are green silk-covered wire.
N800—Size, 5¼x6x18 inch $6.80

CRYSTAL DETECTOR

A very high grade glass enclosed crystal detector including the crystal. All metal parts nickel plated. Adjustjustable to any point on the crystal.
N20—Enclosed crystal detector $1.40
A lower priced but nicely constructed detector. Crystal included.
N30—Detector ..... .88

GALENA CRYSTALS

Selected and tested galena. Each box contains enough for four to six crystals. Guaranteed satisfactory.
N12—Price, package 12c

SILICON CRYSTALS

Sensitive silicon crystals. Enough for four to six ordinary crystals.
N13—Price, package 12c

BINDING POSTS

Complete with screw and washer. All brass finished in polished nickel or with black composition top as listed. Order by number.

		Each	Doz.
N110	Large size, all nickeled	10c	95c
N122	Medium size, nickeled, with hole for phone tip or wire	5c	48c
N112	Medium size, black composition top	7c	75c
N120	Large size, composition top	8c	85c

SWITCH POINTS AND STOPS

Brass, polished nickel finish. Screw size, 6/32x⅝ ins. long, two nuts with each contact point and one with the stops. Stops high enough for any type of lever and point.

	Each	Doz.	Hundred
N130—Switch Point, diam., ¼ inch; height, 3/16 inch	3c	20c	$1.40
N150—Switch Stops.	3c	20c	1.40

VARIOMETERS

For efficiency, perfect inductive ratio, low capacity effect and neatness of design these variometers are unexcelled. All metal parts nickeled brass. Tight spring bronze contacts will wear indefinitely. Accurately turned rotors and stators, mahogany finish. Completely assembled and tested. Wound with two sizes of wire—No. 18 and No. 20.
N1200—Variometer, No. 20 wire. Price, $2.95
N1300—Variometer, No. 18 wire. Price, 2.95

MOULDED TYPE VARIOMETER

For those who want the round black moulded composition type, we offer the following high grade variometer. Metal parts nickel plated.
N1220—Moulded Variometer $5.95

180° VARIOCOUPLER

The primary and secondary windings of this coupler are properly proportioned and spaced. The center of the secondary is always in the center of the primary field. Unlike most couplers, it aids in tuning. Black fibre base, brown formica tube, and nickeled metal parts. Panel or table mounting.
N1100—Coupler $3.25

180° MOULDED ROTOR TYPE COUPLER

The following 180° variocoupler has heavy black tube 3/16 inch thick and moulded rotor ball. Very similar to above coupler. Metal parts nickel plated. Furnished without base, but may be mounted on table or panel.
N1120—Variocoupler $4.75

OUR GUARANTEE

Your satisfaction guaranteed. If for any reason you do not feel satisfied with your purchase, you may return it and we will refund your money. We will pay return transportation charges.

VARIABLE CONDENSERS

Very best mechanical construction, heavy hard aluminum plates. The vernier types are furnished with moulded dial and small knob for adjusting vernier. Plain types have ¼ inch shaft.
N1443—43 plates .001 Mfd. without dial. $2.90
N1423—23 plates .0005 Mfd. without dial. 2.50
N1411—11 plates .00025 Mfd. without dial 2.10
N1403—3 plates .00005 Mfd. without dial. 1.80
N1441—41 plates vernier .001 Mfd. with dial 4.95
N1442—21 plates vernier .0005 Mfd. with dial 4.25

RADIO FREQUENCY AMPLIFYING TRANSFORMER

Radio frequency transformer circuits help to eliminate static and interference, thus permitting easy, sharp tuning of long distance stations. Enclosed in metal case for shielding and can be mounted in tube socket if desired. Wiring diagrams furnished with each transformer.
N1500—Transformer. Each $4.25

INDUCTION COILS

Rigidly wound, nicely finished, low distributed capacity. All coils are equipped with standard mountings. We can supply any of these coils without mounting plugs, or straps, for 75c less than the prices shown. The wave lengths shown are range limits, based on a variable condenser of .001 Mfd. capacity.

	Number of Turns	Wave Lengths	Price, Mtd.
N1725	25	125- 250	$1.20
N1726	35	175- 450	1.22
N1727	50	240- 720	1.25
N1728	75	390- 910	1.30
N1729	100	500- 1450	1.40
N1730	150	600- 2000	1.45
N1731	200	900- 2500	1.50
N1732	250	1200- 3500	1.60
N1733	300	1500- 4500	1.70
N1734	400	2000- 5000	1.80
N1735	500	2800- 6100	2.00
N1736	600	4000-10000	2.10
N1737	750	5000-12000	2.35
N1738	1000	7900-15000	2.65
N1739	1250	9750-19500	2.95
N1740	1500	11500-26500	3.50

SWITCH LEVERS

A high grade, polished nickel-plated lever with solid moulded black composition knob. Complete with panel bushing, spring and two nuts.

	Each	Doz.
N151—1" Radius	30c	$2.40
N152—1¼" Radius	32c	2.90
N155—1½" Radius	35c	3.00

SPAGHETTI TUBING

For insulating cabinet wiring. Black finish. Three foot lengths.
N33—Per 3 ft. length 20c

DIALS


Bakelite


Composition

Genuine Bakelite Dial as pictured. Sharply engraved divisions and figures filled with a brilliant white. Three-inch diameter, with bushing for 3/16-inch or ¼-inch shaft. Set screws included.

		Each	Doz.
N500	Dial	65c	$7 00

Three-inch moulded composition dial as pictured. Has a luster that cannot be told from Bakelite. Set screws included.

		Each	Doz.
N550	Dial, 3/16-inch Shaft	40c	$4 50
N555	Dial, ¼-inch shaft	40c	4 50

AUDIO FREQUENCY AMPLIFYING TRANSFORMER

Correctly designed for minimum distributed capacity and low core losses, maximum amplification without distortion. Use 10-1 for Cunningham and Radiotron tubes; 3-1 for other makes. Fully mounted, cast aluminum feet, bakelite terminal panel.
N1510—Transformer, 10-1 ratio $3 75
N1503—Transformer, 3-1 ratio 3.70

INDUCTANCE COIL MOUNTINGS

For base or panel mounting. Connecting leads furnished, coil settings are adjustable by means of knobs. Made entirely of bakelite with nickeled brass metal parts. Coil position can be locked by knurled set screws.
N1603—Three coil mounting $4.90
N1602—Two coil mounting 3.40
N1601—Single coil mounting ..... .50

"B" BATTERIES

Standard brands, Eveready, Burgess or Franco. State choice.
N230—22½ volt Signal Corps type. Size 3½x2½x2½ inch. Price $1.08
N235—22½ volt U. S. Navy variable—5 positive taps. Size, 5x3x2½. Price $1.80
N240—22½ volt large variable—5 positive taps. Size, 6½x4x3. Price 2.25

CABINETS

These are reasonably priced but sturdily built cabinets of weathered oak. The top is removable by loosening four screws. End posts are routed to take panel 3/16-inch thick. The panels are not included. See table for panel lengths.
N212—Can be used for detector and two step. Panel space, 5½x14 ..... $2.50
N214—Can be used for 2 variometers and 1 coupler. Panel space, 5½x14 ..... 2.75
N218—Can be used for 2 variometers, 1 coupler and detector. Panel space, 5½x18 3.00
N222—Can be used for 2 variometers, 1 coupler, detector and 2 step. Panel space, 5½x22 ..... 3.25

PANELS

Genuine Formica. Panels to fit our cabinets
N262—Panel, 5½x12 inches3/16" thick .. $1.38
N264—Panel, 5½x14 inches3/16" thick .. 1.64
N268—Panel, 5½x18 inches3/16" thick .. 2.08
N272—Panel, 5½x22 inches3/16" thick .. 2.53

HOW TO ORDER

Order from this page. Please give number, description and price of the articles you order to help us avoid mistakes. Total the amount of your order and send Post Office money order, certified check or draft with your order. Be sure to give your name and street address on both letter and envelope. Do not include money for transportation. We pay it.

VACUUM TUBES

Genuine Cunningham Tubes made by the General Electric Co. Every tube guaranteed new and in original package.
N-C200—Detector $4.75
N-C201—Amplifier 6.35

VACUUM TUBE RHEOSTATS

This is a reasonably priced, smooth acting rheostat that will mount directly on back of panel. Bakelite arrow knob.
N1050—Rheostat 50c
Genuine Cutler-Hammer rheostats, we believe, are the best rheostats on the market today.

Arranged for panel mounting. The picture shows the vernier type All metal parts nickeled
N1061—Vernier type C.H. Rheostat. $1.40
N1062—C. H. Rheostat without vernier. .95

SOCKET

This is an all metal socket. Cannot break when the tube warms up. Edge is tapped for panel mounting screws. Binding posts thoroughly insulated. Nickeled brass shell, phosphor bronze contacts.
N1075—Socket 50c

VARIABLE GRID LEAK

Pencil mark type. Removable black enamcled cap.
N50—Grid Leak 22c

GRID AND PHONE CONDENSERS

Mounting holes spaced to fit screws of above Grid Leak. Mica insulation, wrapped with varnished cambric tape. Capacity, .00025 Mfd.
N55—Grid Condenser 18c
N59—Phone Condenser .001 Mfd. 25c

LIGHTNING ARRESTER OR PROTECTOR

Mounts indoors. Porcelain base, nickeled cover. Listed by the Underwriters' Laboratories under April, 1922, regulations.
N300—Protector $1.40

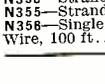
BRACH OUTDOOR ARRESTER

This is the genuine Brach No. 223 bell shaped vacuum gap outdoor arrester.
N323—Brach Arrester $2.80

ANTENNA WIRE

The following are 100 foot coils of 7 strand cable of No. 22 wire, which makes the best Aerial. Use phosphor bronze, where the span is 100 feet or more. It is stronger.
N350—Stranded Phosphor Bronze, 100 ft. $1.47
N355—Stranded Copper, 100 ft ..... .77
N358—Single No. 14 bare solid Copper Wire, 100 ft ..... .42

INSULATORS



These are very strong strain type Insulators.
N360—Moulded insulator shown above to left. Each, 15c; Doz. ... $1.68
N365—Porcelain insulator shown above to the right. Each, 9c; Doz. 95c

STORAGE "A" BATTERIES

Built of entirely new parts. With the proper care they should last several years. The De Luxe type has rubber case and cover for top as pictured, the Standard type has black wood case similar to ordinary automobile type. Guaranteed to give full rated capacity. All 6 volt batteries.

Number	Amp. Hour Rating	Shpg. Wgt.	Price
ND 60—De Luxe	60	40	$15.50
ND 80—De Luxe	80	50	17.50
ND100—De Luxe	100	62	20.50
NS 60—Standard	60	35	12.25
NS 80—Standard	80	40	14.25
NS100—Standard	100	50	16.25
NS110—Standard	110	60	18.25

The above storage batteries are the only items on which we do not pay transportation charges. We will ship by Express.

HOMCHARGER

Charge your "A" battery at home for a few cents. Attach to any 110 to 125 volt, 60 cycle, alternating current light circuit by screwing plug into lamp socket. Will also charge 6 volt auto batteries. Approved by the Insurance Underwriters.
N1900—Homcharger. Price $16.25

GREAT LAKES RADIO CO., 1124 W. JACKSON BOULEVARD, CHICAGO., ILL.

lieved. Continuous wave reception was not practical and convenient for the Radio Corporation without the infringement of the heterodyne patents and the Armstrong patent of the Westinghouse Electric and Manufacturing Company, while on the other hand the Radio Corporation's combine of patents offered serious difficulties for the commercial operations of the Westinghouse Company, and with this problem existing the great combine of patents became established, including the Westinghouse Electric and Manufacturing Company as a part of the Radio Corporation. Whether such a combine of patents is in violation of the Sherman Anti-Trust Law is the subject matter of a bill introduced in the House of Representatives.

The Wireless Specialty Apparatus Company during the war had manufactured for the Government certain constructions of mica condensers alleged by the Dubilier Condenser Company to be infringements of their patents. Suit was initiated by the Dubilier Company, but settlement arrived upon before the case progressed to an issue, wherein the Wireless Specialty Apparatus Company secured certain rights under the patents of the Dubilier Condenser Company. Professor Pickard, associated with the Wireless Specialty Apparatus Company, had been an early and creditable worker in the radio art and had secured many patents upon the crystal detector. A mutual agreement was reached between the Wireless Specialty Apparatus Company, with its operating company the Tropical Wireless Company, operating in conjunction with the United Fruit Company, and the Radio Corporation, designating the fields of operation of the several companies wherein the Specialty Company became a part of the Radio Corporation.

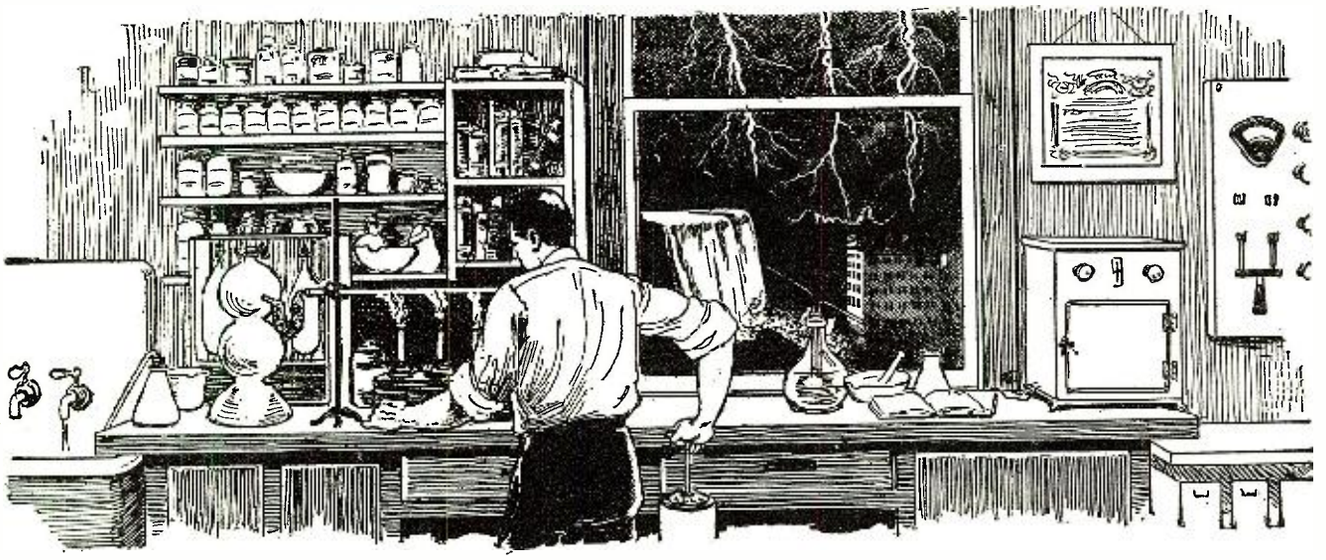
Many claims for patent infringement were filed against the government for the manufacture and purchase of radio apparatus from others than patent holders under the "save harmless" contracts, and many of these claims, although severely contested over a period of years, are still pending.

The Federal Telegraph Company by further negotiation with the government secured the return of the title to its patents covering the arc transmission system and extended certain licenses thereunder for the broader commercialization of the arc system. The government since the close of the war had also been perfecting its patent situation to a point where rights existed under the multiplex telephony patents of General Squire, the arc patents, alien owned patents seized by the Alien Property Custodian, the Rogers and Lyon underground antennae patents, the Kolster direction finder patents, the Cohen patents, the patents controlling the Hanson audio frequency system and piloting cable, and numerous inventions by employees of the War, Navy, Commerce and Post Office Departments, including certain rights under the patents of the International Radio Telegraph Company and Westinghouse Company.

PATENT SITUATION IN FOREIGN COUNTRIES

The progress of the patent situation in foreign countries during all this time may be traced in Germany through the Allgemeine Electricitäts Gesellschaft, Siemens and Halske, and the Gesellschaft für Drahtlose Telegraphie, manufacturers of "Telefunken" apparatus. The inventions of Meissner should be given much credit. The French corporation Radio France is developing a patent situation of interest. Latour of France is securing many patents in this country on high frequency alternators. In England the British Marconi Company has constructed a patent situation upon which a large settlement may result from the British Government. The Ediswan Company, known for its electron tubes, is building a patent situation in England.

When the Chemist Harnessed the Thunder-bolt!



MAN and beast react with electric speed to a warning of danger, if the alarm is immediate and personal. Self-preservation is the first law of Nature. Yet subtle perils far more disastrous than any we expect to meet lurk in the shadow of our fancied security. They are the dreaded ogres of Famine and Disease.

A few years ago the world faced a famine more terrible than any in history. Nitrates, the most essential materials for enriching the soil, were being rapidly exhausted, and universal starvation seemed inevitable. Everyone knows that plants must feed, and if the ground is not replenished with the chemicals they have consumed, vegetation will eventually die out. Nature's way of making up the deficit is too slow for our concentrated population, and farmers have resorted to artificial fertilizers for ages. Europeans, always more receptive to the teachings of Chemistry than we, raise more than twice as much grain per acre as Americans, owing to their greater use of fertilizing chemicals.

The principal substance used for this purpose is sodium nitrate, better known as Chile saltpetre, because of the large deposits of it in that country. Millions of tons of this precious chemical were being mined annually, for vast quantities are consumed in making explosives and in other industries, besides that required for agriculture. Chile kept getting richer, but her nitrate beds got continually poorer until their inevitable exhaustion became a grisly prospect. *And there was no other source of supply!*

It was here that electro-chemists stepped in and devised a way of making nitrates from the air! They stole a trick from Nature, using an artificial bolt of lightning, the electric arc, to change the nitrogen and oxygen into nitric acid. This is indeed what happens during a thunder-storm, though to a very slight extent. Other methods followed, and thanks to Chemistry the air-made nitrates can now be sold for less than the saltpetre of Chile. Better still, the supply is unlimited.

Today we are confronted with similar crises. There are impending shortages of other important raw materials. Yet so great is the general confidence in chemistry to solve such problems, little anxiety is felt. A wealth of opportunity awaits the chemist of the present, particularly in the fascinating field of Electro-chemistry. In many industries there are hundreds of chemists employed by a single company. Thousands of concerns have chemists supervising the quality of their output and of the materials they buy. In countless capacities a knowledge of Chemistry is essential.

You Can Learn Chemistry at Home Dr. T. O'Conor Sloane Will Teach You

Dr. Sloane, Educational Director of the Chemical Institute of New York, is one of this country's foremost authorities on chemistry. He was formerly Treasurer of the American Chemical Society and is a practical chemist with many well-known achievements to his credit. Not only has Dr. Sloane taught chemistry for years, but he was for a long while engaged in commercial chemistry work.

The Chemical Institute of New York was originally founded to fill a long-felt need in the Educational field. Thousands of young men and young women, realizing the wonderful opportunities for the chemist produced by the recent war and the assumption by the United States of world leadership, were keenly anxious to enter this promising field. Many of these prospective students, however, were unable to give up their regular occupations to devote the necessary time to their training. Correspondence study at home was the only solution.

Dr. Sloane will teach you Chemistry in a practical and intensely interesting way. Our home study course written by Dr. Sloane himself is thorough, logical and remarkably fascinating. It is illustrated by so many experiments that are performed right from the start that anyone, no matter how little education he may have, can thoroughly understand every lesson. Dr. Sloane teaches you in your own home with the same individual and painstaking care with which he has already taught thousands in the class room.

The Personal Help of Dr. Sloane

Dr. Sloane will personally examine and correct all of your examination papers, pointing out your mistakes and correcting them for you. He will, in addition, give you any individual help you might need in your studies. This personal training will be of inestimable value to you in your future career.

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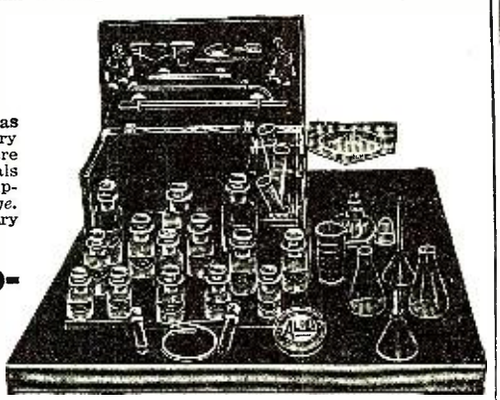
You can pay in small monthly amounts as you go along. The price of our course is very reasonable, and includes everything. There are no textbooks to buy extra, and the chemicals and apparatus used for experiments are supplied to the student *without additional charge.* Our plan places an education in chemistry within the reach of everyone.



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FAR-SIGHTED INDIVIDUALS BUILDING PATENT SITUATIONS

In this country numerous individuals have faith in the future of radio to such an extent that hundreds of thousands of dollars have been spent in research and patents, including the example, among others, the distant radio control mechanisms of John Hays Hammond, Jr.

THE PRESENT PATENT SITUATION

This brings us to the point for discussion of the patent situation existing about the time of the beginning of great public interest in radio broadcast. The enthusiasm spread throughout our country with great rapidity and small manufacturers entered the fairly enticing industry with little investigation of the patent situation. Receiving sets of various constructions were placed on the market by many manufacturers not stopping to consider the legal aspect of the patent situation. This condition has given rise within the past few months to the circularization of many warnings to manufacturers of patent infringement. Some of these warnings have listed various patents; some single patents; while other warnings have only referred to pending applications for patent filed in the Patent Office. These practices have resulted in a suit by the Freed-Eiseman Corporation against the Wireless Specialty Apparatus Company filed subsequent to a suit filed against the Freed-Eiseman Corporation under three of the Pickard crystal detector patents. Where infringement is clear and the patents unquestionably valid, the best policy for the manufacturer to follow is either to secure a license under the infringed patents or to desist from manufacture. Where great doubt exists, as so happens in a great number of these radio patents, and it is thought that the patents are not valid or not infringed, this matter of so technical a character should be left to a court for decision.

PAST LITIGATION

The problem of patents is not by any means new in the radio field. A perusal of the court records show a more or less continued activity in litigation of radio patents from an early period up to date. Justice Holmes in speaking of Common Law says:

"Wherefore then serveth the Law?
It was added because of transgressions."

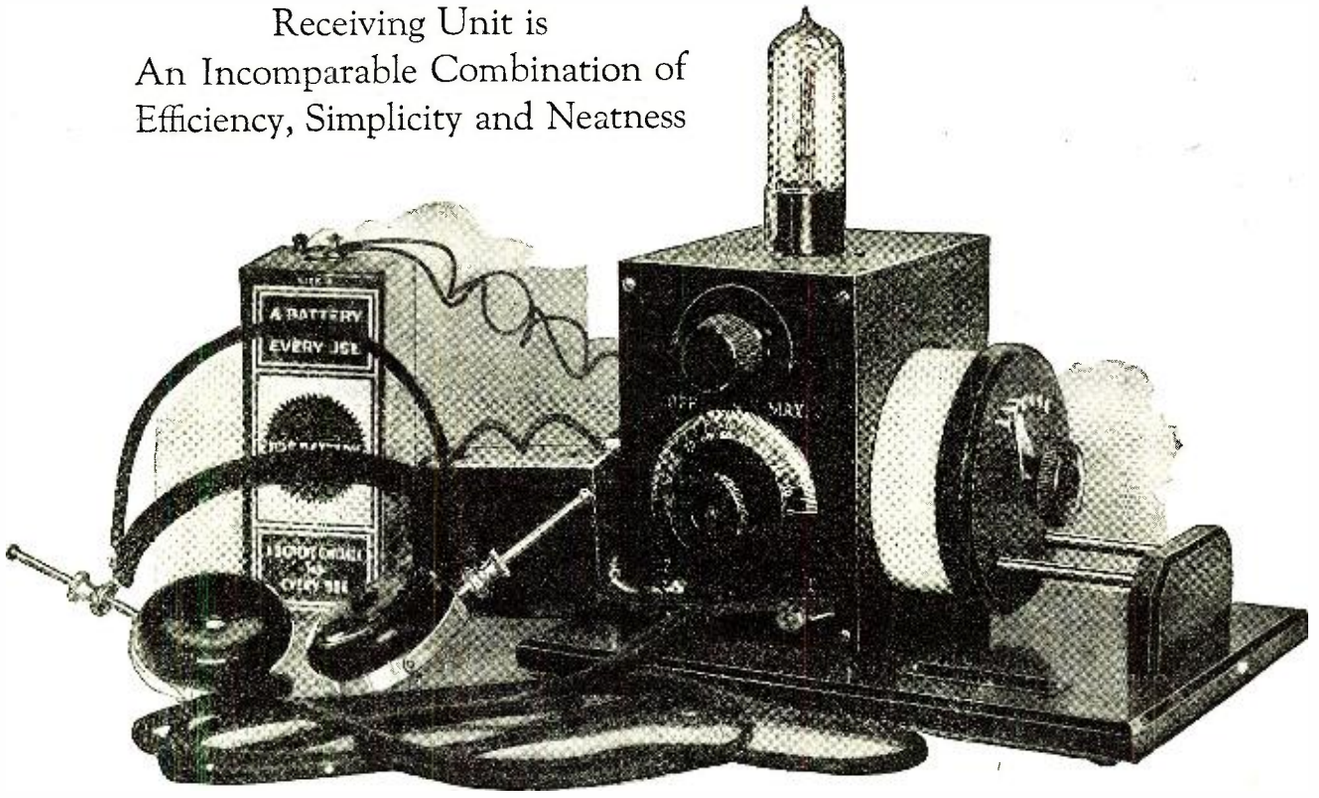
And accordingly where infringements of patents were believed to exist and the patent holders were sufficiently entrenched financially, litigation resulted.

As early as 1903 a suit was brought by a company at that time called the International Wireless Telegraph Company against Fessenden for the infringement of a very early patent to Dolbear for low frequency transmission by wireless communication. The electrolytic detector patents of Fessenden formed the basis of a suit by the International Electric Signaling Company against the United Wireless Telegraph Company and the Telefunken Wireless Telegraph Company which resulted in the favorable adjudication of the electrolytic detector patent. These patents formed the basis for a number of suits in 1904 and 1905 when they were held to be valid and infringed by a detector put out by the De Forest Wireless Telegraph Company, employing Wollaston wire in a saturated caustic potash solution. The defendant was held in contempt by the court a year later for putting out a detector having a thin strip instead of a thin wire, the construction being such that the strip made contact with the electrolyte. It was contended by Fessenden's supporters that the electrolytic detector patent covered broadly the subject of detectors. A suit was brought to test this contention in 1911 against the Wireless Specialty Apparatus

(*Continued on page* 890)

No Storage Battery Required

The BRU No. 3 Vacuum Tube
Receiving Unit is
An Incomparable Combination of
Efficiency, Simplicity and Neatness



The BRU No. 3 Vacuum Tube Receiving Unit is designed to operate on ONE DRY CELL for filament current ("A" Battery).

Binding posts are provided to "load" the primary and secondary inductances, so that the reception of almost all wave lengths is possible.

The cabinet is made of Bakelite and wood with mahogany finish. The trimmings are highly nickel-plated.

Normal wave length 150-600 meters.

Complete instructions with each set.

BRU No. 3 Receiving Unit $30.00
BRU No. 3 C " " complete... 49.00

(Including WD 11 Detector Bulb, phones "A" and "B" Batteries aerial, lead in and ground wires, ground clamp, insulators, nails and screws) Absolutely nothing else required

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TRADE MARK

BRUNO RADIO CORPORATION

152 West 14th Street
NEW YORK

Hook your radio set to this revolutionary Battery Principle!

Enjoy Uninterrupted Operation of your Set—without Battery Noise, without Constant Adjustment, without Possibility of Spilling Acid and without Continual Replacement Expense

RADIOBATS are not merely batteries with improvements. They are built on radically new and different principles that put the old automobile type "A" battery and dry cell "B" battery out of date.

Radiobats both "A" and "B" have nothing to leak. They contain the first successful semi-solid electrolyte. Every radio man who has ever spilled acid from his battery on his wife's or mother's best carpet will rejoice at this sensational and exclusive Radiobat principle. This principle plus the rugged strength of the exclusive Radiobat reinforced grid has made the use of any kind of separators unnecessary.

Radiobat "B" is a genuine 22 volt *storage* battery. It is rechargeable at home from either AC or DC. It is compact and rugged. It has nothing to break and nothing to leak.

Most important of all—Radiobat "B" is *utterly noiseless* in operation. George Gaynor Hyde, well known consulting engineer, after making an entirely independent test, reports the "total absence of any noises such as are common to

Radiobat Prices

"A" TYPE 603 60-80 A. H. . . .	$18.00
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"A" TYPE 605 100-120 A. H. . . .	24.00
"A" TYPE 606 120-140 A. H. . . .	27.00
"B" 22 VOLT With 2 volt taps . .	12.00
Chemical Rectifier for recharging Radiobat B from AC	1.00

Dealers and Jobbers: If you are not stocking Radiobats now, wire for complete details of the powerful Radiobat advertising campaign and the liberal Radiobat trade policy

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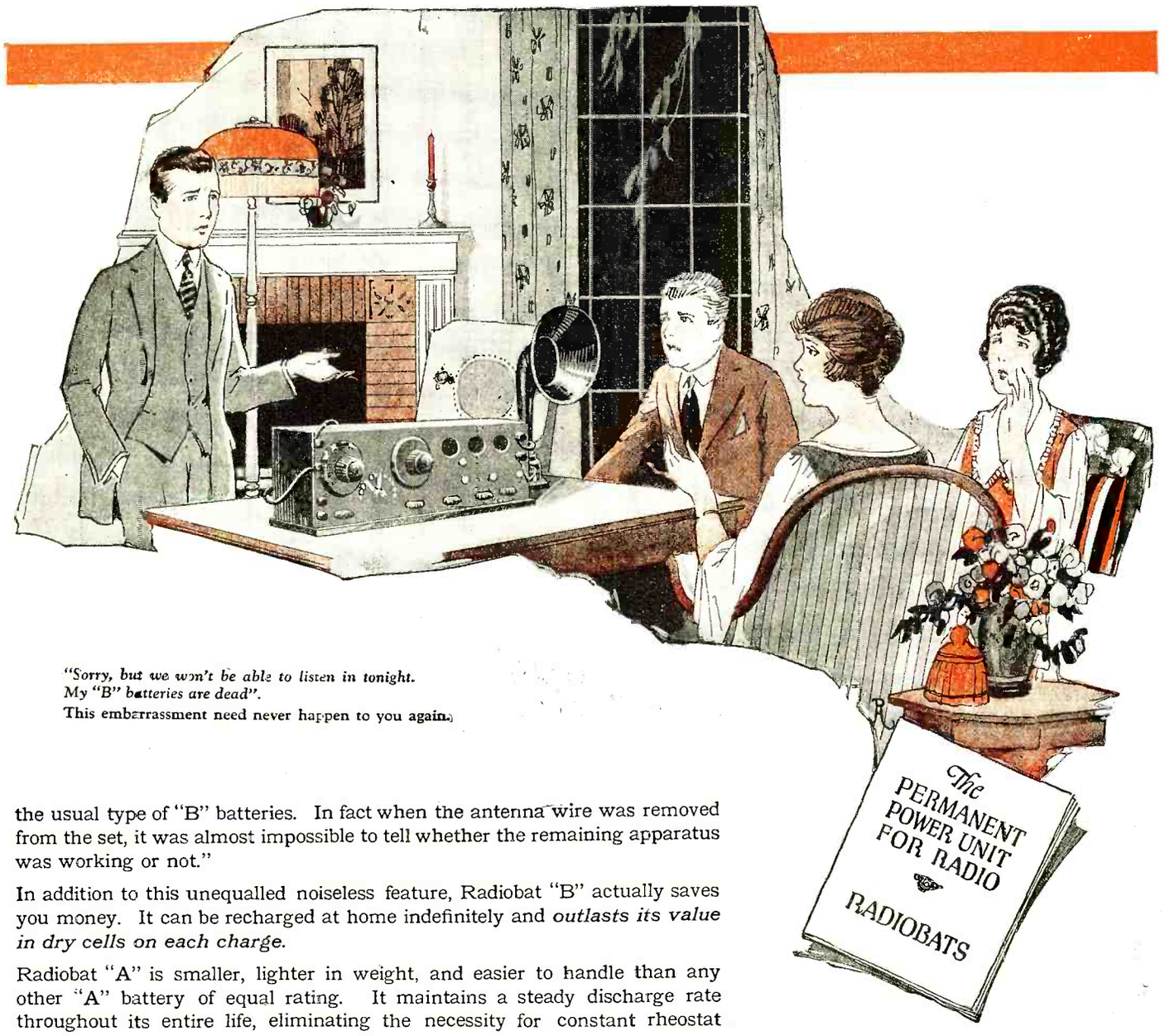
"A" and "B"



"Sorry, but we won't be able to listen in tonight.
My "B" batteries are dead".
This embarrassment need never happen to you again.

the usual type of "B" batteries. In fact when the antenna wire was removed from the set, it was almost impossible to tell whether the remaining apparatus was working or not."

In addition to this unequalled noiseless feature, Radiobat "B" actually saves you money. It can be recharged at home indefinitely and *outlasts its value in dry cells on each charge.*

Radiobat "A" is smaller, lighter in weight, and easier to handle than any other "A" battery of equal rating. It maintains a steady discharge rate throughout its entire life, eliminating the necessity for constant rheostat adjustment.

Standardize on "A" and "B" Radiobats—the permanent radio power unit. The first cost is the last. There is no replacement expense. And you will enjoy a new sense of complete pleasure and satisfaction from your radio outfit.

Multiple Storage Battery Corporation
Dept. N. · · 350 Madison Avenue, New York City

Ask your dealer for a RADIOBAT demonstration. In the meantime, send for this booklet. Your name and address on a postcard brings your copy free.

RADIOBATS

The Permanent Radio Power-UNIT

Company using crystal detectors, but a motion for preliminary injunction being denied, no further action was taken.

In a suit by the National Electric Signaling Company against the Radio Telephone Company under the Fessenden patent covering the generation and radiation of continuous waves at a transmitting station, the patent was sustained as to certain of its claims.

Suit was also brought under one of the early Fessenden radio telephone patents by the National Electric Signaling Company against the Radio Telephone Company resulting in a favorable decision for the Signaling Company. Suit was brought in 1919 by the International Radio Telegraph Company against the Western Electric Company for the infringement of the Fessenden radio telephone patents.

The early Fessenden patents on signaling by high spark frequency formed the subject matter of a suit by the National Electric Signaling Company against the Telefunken Wireless Telegraph Company in 1913 for the use of spark transmitters of high spark frequency. The patents were held valid and infringed, but later, in a suit brought against the Atlantic Communication Company, the patents were held invalid and not infringed, and although appealed, the lower court was affirmed. On these same patents suit was brought against the Marconi Wireless Telegraph Company, the National Electric Supply Company of Washington, D. C., and the Wireless Specialty Apparatus Company.

Still another of the Fessenden patents relating to a tuning circuit formed the basis of a suit against the Telefunken Wireless Telegraph Company but the patent held invalid.

An early Shoemaker patent on a tuning transformer and coupler for radio operation formed the basis of an early suit by the United Wireless Telegraph Company against the Clark Wireless Telegraph and Telephone Company and also against the Massie Wireless Telegraph Company.

The Radio Telephone Company as owner of the Stone radio telephone patents very early sought to prevent the use of radio telephony by the Collins Wireless Telephone Company.

The Seibt patent on the quenched spark gap for transmitters formed the basis of suits by the New York Patents Exploitation Co. against the Mallory Steamship Co. and the Luckenback Steamship Co. to prevent the use of quenched gaps on the ships operated by those companies.

THE HETERODYNE SUIT

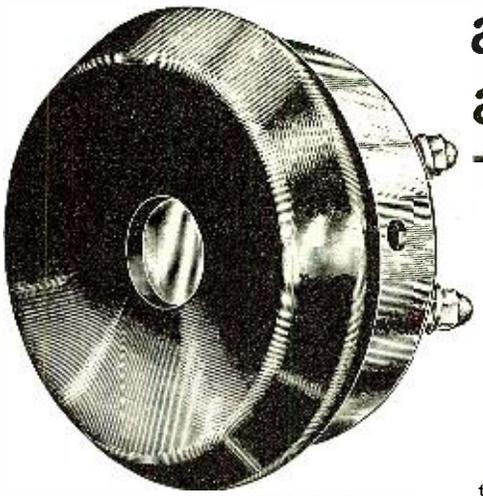
One of the most important judicial decisions in the art of radio centered about the Fessenden patents on the heterodyne. In a suit brought by Kintner against the Atlantic Communication Company the Fessenden patents were held valid and infringed. The language of the court in sustaining the invention on the heterodyne is quite remarkable, reading in part as follows:

The Federal Reporter records the inscription on more than one tombstone erected to the memory of a Fesserden patent; but, if I am right, Fessenden and his financial backers may have the comfort of knowing that the "heterodyne" is a contribution which will long be appreciated in this remarkable art, which has added so much to the welfare of mankind.

The heterodyne as patented by Fessenden is based upon applications filed as early as 1905 and the patents which issued in 1913 contain wiring diagrams as illustrated in Fig. 1. In this drawing the antenna system 2 contains a coil 8 which may be attached to a telephone diaphragm 9. Another coil 10 arranged with its field in proximity to the field of coil 8 is energized by alternator 5 at a frequency slightly different than the frequency of the incoming signals.

THE "RICO" LOUD-SPEAKER PHONE

a remarkable phone



Loud-Speaker Phone With Cord

a remark-able price

$4.50

Here is the **loud-speaker phone** for which you have been waiting! For the first time you are now able to buy a single 2,000-ohm **loud-speaker phone** that has been planned by radio **and acoustic** engineers for one purpose, and one purpose only —namely, to reproduce sounds clear and loud through a horn.

Used in any standard horn, it will amplify the weakest of sounds so that the whole family can hear your radio all over the house. Furnished complete with a five-foot (5 ft.) cord.

The RICO LOUD-SPEAKER PHONE will prove a revelation to you, if you have used regulation head receivers for loud-talkers.

We are so convinced that you will be enthusiastic about this phone that we make this

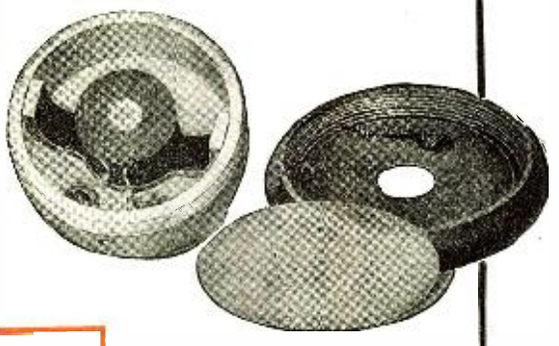
SPECIAL OFFER:

Try this LOUD-SPEAKER PHONE for five days, and simply consider the money you are sending in to us as a deposit. If, at the end of five days, you are not convinced that it is the best loud-talker phone you have ever seen or heard, return it to us and your money will be promptly refunded.

SEND NO MONEY!

Just write us and tell us that you wish one or more of these phones, and we shall rush the order to you at once. Pay your postman the price of the Phone and then test it out at our expense.

Note the new construction. The pull in the center of the diaphragm is where it should be, in the mathematical center. The result: Clear and loud tones, NO DISTORTION



RICO Tripole Head Sets are the fastest selling phones in America

COMFORT: The one thing that has been lacking in former phones. Our pure gum soft rubber headband cover solves this problem. No more ear aches from pressure, as with the old-style band.

RICO Tripole Head Sets are manufactured in types from 5 ohms to 6,000 ohms. RICO Phones will prove a revelation to you. On account of their peculiar construction they do not distort the sound, but render the tones clear and distinct. You do not get a sharp, shrill sound, nor a muffled sound as in some other receivers. The tones are always natural. This is particularly so when used in connection with two or more stages of amplification.

Mail your order at once, if the dealer can not supply you. Insist upon RICO Tripole. There is a very good reason why you should use RICO Phones, and that is they are different—not merely Phones, but

Phones built for Radio

PRICE LIST

Parcel Post—Paid Anywhere in North America

No. 25	Special Loud-Speaker Phone with cord			$4.50
No. 20	2000 ohms	Double Head	Set	6.50
No. 30	3000 ohms	Double Head	Set	7.50
No. 40	4000 ohms	Double Head	Set	9.50
No. 50	5000 ohms	Double Head	Set	12.50
No. 60	6000 ohms	Double Head	Set	15.00
No. 10	1000 ohms	Single Head	Set	4.00
No. 15	1500 ohms	Single Head	Set	$4.50
No. 75	75 ohms	Double Head	Set	6.50
No. 5	5 ohms	Double Head	Set	6.50
No. 2	1000 ohms	Receiver	only	2.50
No. 3	1500 ohms	Receiver	only	3.00
No. 05	5 ohms	Receiver	only	2.50
No. 075	75 ohms	Receiver	only	1.00

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Write for our wonderful proposition. Cash in on the fastest growing phone business in the United States.

A beat note is thus produced which may be audibly received by means of the diaphragm.

The pitch of the beat note may be altered at will so as to produce mechanical resonance with the telephone diaphragm by changing the speed of the alternator 5. Based on this disclosure Fessenden secured claims sufficiently broad to read upon our modern electron tube C. W. receiver. A great deal of controversy has existed in the art as to the difference in the Fessenden patents and the Vreeland patents on the beats receiver. Learned decisions exist on this subject. The invention of Lee and Hogan 1,141,717, relating to heterodyning in a circuit employing a rectifying detector, has also been the subject of much controversy with an invention of somewhat similar character by Vreeland.

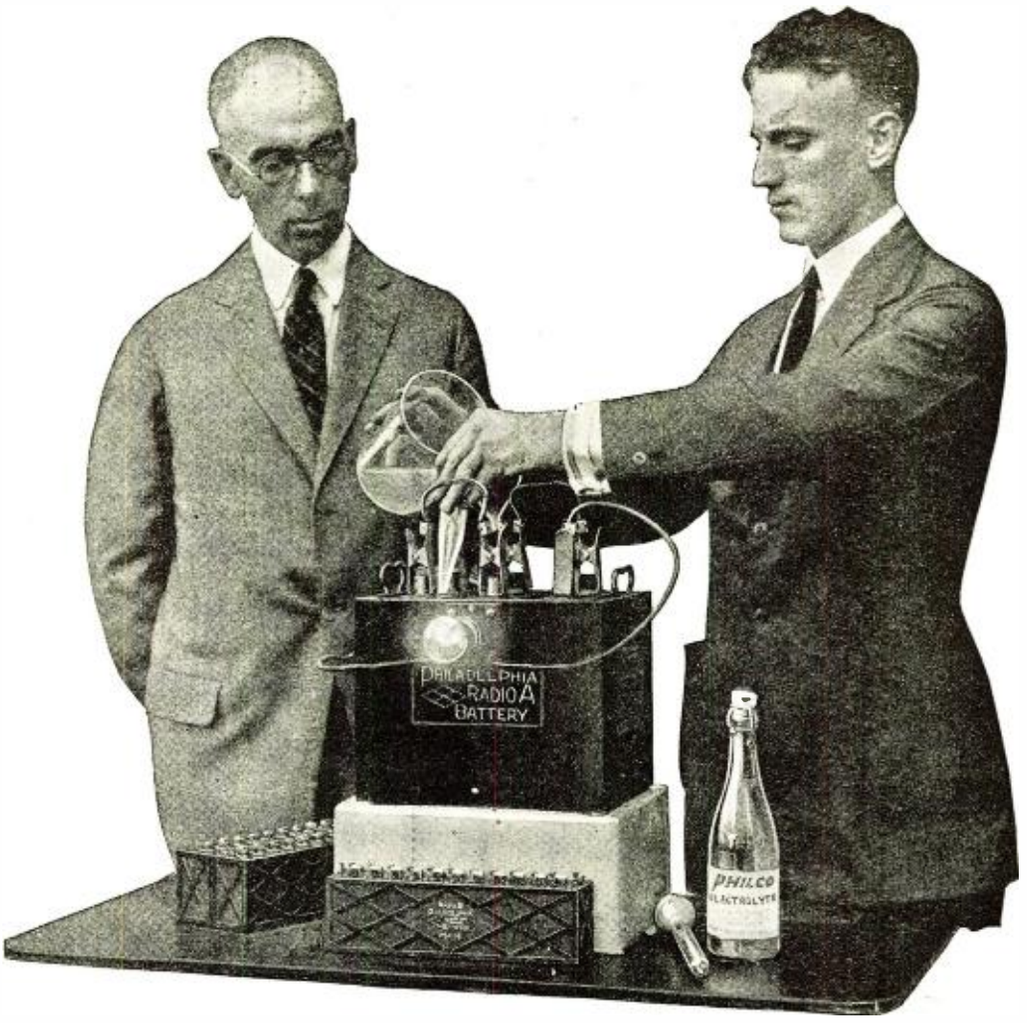
THE MARCONI COMPANY SUITS

The Marconi Company secured the title to the Dunwoody patent for the carborundum detector at an early date and brought suit against the National Electric Signaling Company to restrain them in their radio operations, whereupon the defendant filed a counterclaim against the Marconi Company for infringement of the Fessenden patents on the electrolytic detector used in some of the Marconi installations. The Marconi Company in endeavoring to enforce rights under the Dunwoody carborundum detector patent also filed suits against the United Wireless Telegraph Company and the Electro Importing Company.

Very early in the art the Marconi Company sued the De Forest Wireless Telegraph Company under Marconi patents alleged to be broad and basic upon any system of wireless communication. In a lengthy trial a number of the claims of the Marconi patents were held invalid, as too broad. In one of the patents, however, two claims were held infringed by the De Forest Company in installations employing the auto-coherer. At a later date the Marconi Company brought another suit against the American De Forest Wireless Telegraph Company under the same patents. The defendant was using a loop antenna and an electrolytic detector at the receiver, and after studying the situation the court denied the motion for preliminary injunction, being unsatisfied that the De Forest loop antenna was the equivalent of Marconi's open antenna as claimed in the patent, and that the electrolytic detector used by De Forest was the equivalent of the imperfect contact claimed in the Marconi patent and illustrated as a coherer. Nikola Tesla sued the Marconi Company on the ground of interference by Marconi patents with the subject matter of his patents.

Numerous suits were brought by the Marconi Company for the infringement of the Lodge patent relating to the loading coil employed in the antenna for securing desired wave-length of the system. The Lodge patent was sustained by the court in a suit by the Marconi Company against the National Electric Signaling Company. The plaintiff then brought suit against the Atlantic Communication Company for alleged infringement of the loading coil at the defendant's station at Sayville, Long Island. The De Forest Company was using loading coils in the radio systems installed on Standard Oil Company vessels and the Marconi Company was successful in a suit brought to prevent the continued use by De Forest of this apparatus. The Lodge patent also formed the basis for a suit by the Marconi Company against Emil J. Simon, Fritz Lowenstein, and the Kilbourne & Clark Manufacturing Company. Suit was also brought against the Wireless Specialty Apparatus Company under the Lodge coil patent and the Marconi four circuit tuning patent, whereupon the defendant filed a counterclaim under a number of the crystal detector patents and the Pickard loop patent.

This demonstration will be made at Philco service stations everywhere on October 25th—Philco Drynamic Demonstration Day. Don't miss it! Note the date!



A history-making achievement in battery engineering

Now—for the first time in history—you can equip your radio with batteries *born the day they're first used*—storage batteries that are full powered and 100 per cent new when you get them.

The new Philco Drynamic Radio Batteries—a revolutionary development in battery engineering—are CHARGED DRY at the factory. *Their life doesn't start until you pour in Philco electrolyte.*

This means that you can now get absolutely *fresh, charged* radio batteries—not partly worn out batteries that have lost charge and wasted away in the dealer's stock.

Philco Drynamic Radio "A" Batteries have all the time-tested features of the famous Philadelphia Diamond-Grid Batteries—the standard for automobiles, mine locomotives and other heavy-duty purposes.

They give a uniform flow of voltage that assures absolute freedom from "cracking," "frying" noises and eliminates need for constant adjustments. Because of their Philco Retainers they hold their charge longer than any ordinary battery, they are conservatively rated and will deliver all the electricity the name plates say they will deliver, and they are *guaranteed for two years.*

The Philco Drynamic Radio "B" Battery with its 24-volt capacity, takes the place of 15 dry cells. Its 12 cells are neatly and compactly sealed in an attractive one-piece hard rubber case—a fit companion for the finest radio outfit.

Ask your radio dealer to show you these remarkable Philco Drynamic Batteries, or go to any Philadelphia Diamond-Grid Battery Service Station.

Philadelphia Storage Battery Company, Philadelphia

RADIO DEALERS—Philco Drynamic "A" and "B" Batteries let you into the battery business on a package-goods basis, because they are shipped to you *charged but absolutely dry.* To make ready for use, just add conveniently bottled Philco electrolyte. No charging equipment. No acid sloppage. No batteries going bad in stock. Your customers are *sure* to get fresh, full powered batteries. Wire or write for details.

PHILCO
DRYNAMIC RADIO BATTERIES
with the famous shock-resisting diamond-Grid plates

Mail this coupon to-day

Sirs—I want to know more about the new Philco Drynamic-Radio Batteries.

Name.....

Street.....

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Business.....

THE MARCONI FOUR CIRCUIT TUNING PATENT

The famous Marconi four circuit tuning patent was involved in practically all of the suits referred to in connection with the Lodge patent, although the plaintiff went much further with this patent and sued, among others, the Federal Wireless Telegraph Company, the Detroit & Cleveland Navigation Company, and the American-Hawaiian Steamship Company. The patent relates to the syntonization of the coupled circuits at the transmitter and at the receiver,—the fact that two circuits are employed at each station giving the patent the general title of the "four circuit tuning patent." The drawings of the patent are shown in Fig. 2.

In the drawings, Fig. 2, the transmitter has the antenna system coupled to the oscillatory energizing circuit and each of the circuits tuned to resonance. At the receiver the antenna system is coupled to the receiving circuit and the circuits tuned to resonance with the circuits at the distant transmitter.

The expiration of the Lodge loading coil patent and the Marconi four circuit tuning patent gives the right to the public to freely use the subject matter of these patents.

THE TUBE PATENT SITUATION

Probably more publicity has been given to the Fleming valve patent than any other patent in the art. Fleming secured claims upon the employment of a two electrode valve in a radio system. The drawings of his patent are reproduced in Fig. 3. Fleming was not the first to investigate the characteristics of a two electrode valve. Edison as early as 1884 secured a patent for a two electrode valve employed as an indicator of the condition of a power line, or as a device for automatically regulating the

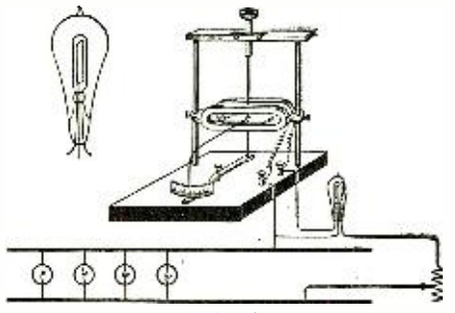


Fig. 4

A Patent Secured by Edison in 1884 Employed a Two-Electrode Valve As an Indicator. The Arrangement Was Later Applied to Radio by Fleming.

electro-motive force supplied to an electric lighting line or to other apparatus. The disclosure of this patent, as shown in Fig. 4, is quite remarkable as of that date, in that an incandescent lamp is shown having a filament and an extra plate electrode which Edison said at that time should be preferably connected to a positive source outside of the lamp whereupon a current might be made to flow across the vacuous space within the lamp between the filament and the plate.

The Marconi Company as assignee of the Fleming patent brought suit against the American De Forest Radio Telephone Company for the alleged infringement by the manufacture of De Forest "audions."

The De Forest Company filed a countersuit against the Marconi Company under a number of De Forest audion patents, among which was the grid patent shown in Fig. 5 and the amplifier patent shown in Fig. 6. The Fleming patent was sustained in two of its claims as valid and infringed by the De Forest "audion" detector. The Marconi Company submitted to a decree as to De Forest patents on the grid and the amplifier

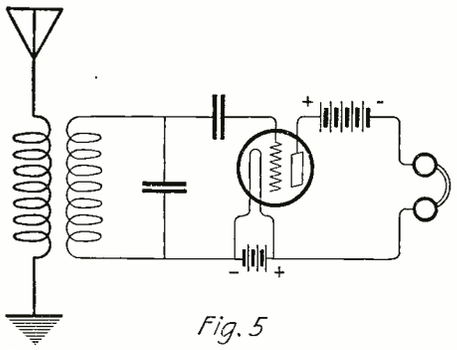


Fig. 5

The "Grid" Patent of De Forest Showed This Circuit to Indicate the Purpose of the Audion Grid.

and an accounting was ordered. A later order of the court extended the decree under the Fleming patent to cover the audion used not only as a rectifier but also as an amplifier and an oscillator. Suits were also brought by the Marconi Company under the Fleming patent against the Atlantic Communication Company and in California against the Audiotron Company, and more recently the Radio Corporation sued the Radio Audion Company under the Fleming patent. In the latter case it was urged that the Fleming patent had been sustained with unwarranted breadth and the court limited its preliminary injunction so that the Fleming patent as present reads only upon electron tubes used as detectors and not for tubes used for amplification and as generators of oscillations. It is for this reason that advertisements by the Radio Audion Company have called attention to the fact that not until the expiration of the Fleming patent can the Meyer tubes be used as rectifiers. In this suit the court ordered that the following notice be affixed or attached to the individual boxes, cartons and containers in which the same were sold or shipped:

NOTICE

This tube is not sold or purchased to be used as a detector of wireless waves.

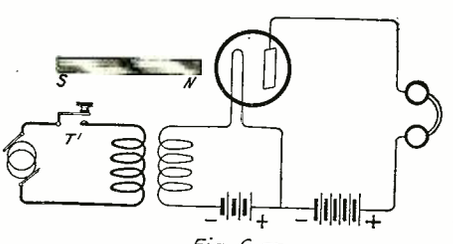


Fig. 6-a

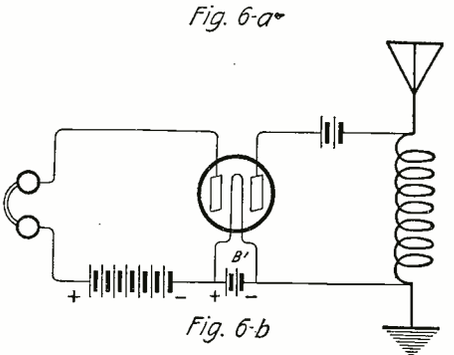


Fig. 6-b

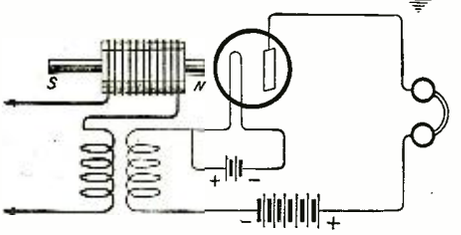


Fig. 6-c

The De Forest Audion Patents Included These Circuits Showing the Use of an Audion As an Amplifier. Figs. 6a and 6c Show Permanent and Electro-Magnets for Amplifying, While Fig. 6b Shows the Inclusion of a Third Electrode Similar to the Anode.

Quality Radio Parts at Popular Prices

From the very beginning of Radio, Gilbert Radio Apparatus has kept pace with the times. As new developments were found to have merit, we were among the first to put them on the market.

Our engineering department is constantly in touch with Radio improvements, therefore when you buy Gilbert Radio Apparatus you can be sure it is not only the best but the latest in its field.

Gilbert Radio Parts are scientifically constructed instruments

—carefully and sturdily built, and so designed that anyone can build a Radio Receiver second to none. All of the most necessary and advanced parts are included in the Gilbert Line.

Write for Catalog No. 55, just off the press.

The A. C. Gilbert Company
DEPARTMENT F
New Haven, Conn.

Any use or sale of it for such use renders the vendor or user liable to prosecution for infringement of patent. This tube is sold for use in tandem with another device acting as a detector for the purpose of amplifying either radio or audio frequency currents, or as a generator of high frequency currents, or as a generator of high frequency electrical oscillations.

The American Telephone and Telegraph Company then brought suit against the Radio Audion Company and De Forest Radio Telephone and Telegraph Company under the De Forest grid patent and the De Forest amplifier patent by reason of a controversy as to the purport of the early contract between the Western Electric Company and the De Forest Company, heretofore referred to as the basis by which the American Telephone and Telegraph Company secured certain rights under the important grid and amplifier patents.

Upon expiration of these most important patents in the next few years an interesting condition will exist. There will of course be many patents on tube structures and circuits to be considered, but clever engineers will be able to design around the patents as at present existing. Of course, the pitfalls of not knowing what may be patented or adjudicated lend difficulty to the problem. It is interesting to note the many patents on external electrode tubes taken out by individuals and companies seeking to avoid the third electrode grid patent of De Forest.

In a suit by Peter Cooper Hewitt against the American Telephone and Telegraph Company, a strenuous endeavor was made to secure damages under a number of Hewitt patents on mercury vapor tubes alleged to contain claims sufficiently broad to be read upon the use of the three electrode vacuum tubes employed on the lines of the Telephone Company. The suit was unsuccessful.

THE CRYSTAL DETECTOR PATENTS

The suit by the Wireless Specialty Apparatus Company against the Freed-Eiseman Company on three of the crystal detector patents has been previously referred to. Fig. 7 shows one of the patents involved in this litigation which is directed to the mounting of a crystal in a fusible metal carried in a cup, and also to the idea of searching of the surface of the crystal to select sensitive points thereon. Other patents in the suit relate to the cat whisker and details of the arrangement thereof with relation to a crystal.

The art will welcome a judicial decision on the subject of the crystal detector patents for it has been difficult to see just what might be new in these patents in view of the great preponderance of prior art. The majority of manufacturers have gained the impression from publicity and circularization that the Pickard patents are the first in the art to suggest the crystal detector. However, here were numerous investigations conducted to determine the rectifying properties of crystals long prior to the filing of the Pickard patents. By close study of the subject it will be found that the

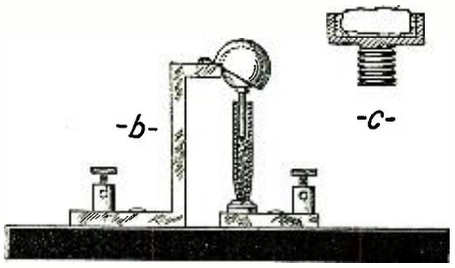


Fig. 7

The Pickard Crystal Detector Patents Held by the Wireless Specialty Co. Are Chiefly Based on Constructional Details. These Patents Are Now in Dispute.

Static Defeated and Loop Aerials Practical for All

Cotoco

TRADE MARK REG. U.S. PAT. OFF.

Buy by the name Cotoco and you buy Radio supplies that are scientifically and mechanically right. Buy by the name Cotoco and you buy abreast of the latest developments in Radio.

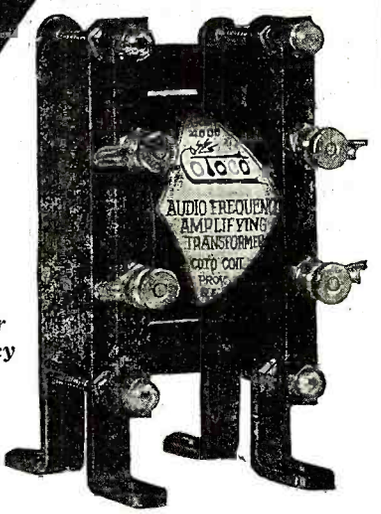
One of the nation's greatest weeklies, in an editorial article, speaks of the "growing popularity of radio frequency." The reason for this nation-wide popularity is that Radio Frequency sets alone have weathered the summer whirlpool of static. Cotoco Radio Frequency Transformer is of tapped type. Gives great selectivity and little amplification of static. The obvious advantages of Loop Aerials are fully enjoyed by those who use this method.

The name Cotoco is to be found on the best amateur and professional Radio Frequency Sets throughout the land.

Buy Always by the Name

COTOCO

Write for Free Connection Diagrams

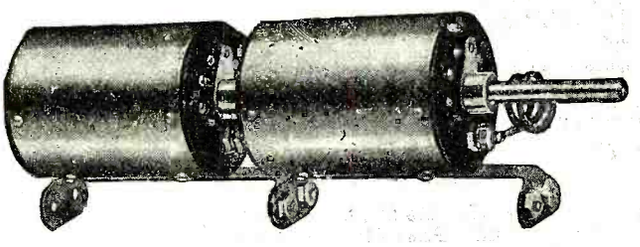


Cotoco Amplifying Transformer for Audio Frequency

Static and Distortion Yield to These Scientifically Designed Transformers

Above is our Audio Frequency Amplifying Transformer. Distortion is practically unknown to its users. Variation of audibility is at a minimum over a wide band of frequencies.

Below is the wonder working tapped type transformer for Radio Frequency that has had so much to do with the growing popularity of Radio Frequency as opposed to the regenerative principle. Many of the most efficient radio sets made this fall and winter will be built around these compact and efficient units mounted for two stages (as illustrated) or three stages of Amplification.



Cotoco Amplifying Transformer for Radio Frequency

Connection Diagrams Are Wrapped

with every Cotoco Amplifying Transformer for Radio Frequency for both two and three stages of Amplification.

If your Dealer cannot Supply you, send us his name.

Coto-Coil Co.

87 Willard Ave., Providence, R.I.

many patents are based upon details of construction, convenient and desirable forms of mountings, and a series of crystals of various kinds adapted for the rectification of energy at a radio receiver. The situation is highly creditable and behooves every manufacturer to carefully study the patents before venturing into the manufacture of crystal receivers.

THE ARMSTRONG PATENT

Much has been published concerning the Armstrong regenerative circuit patent. The drawings of this patent are reproduced in Fig. 8.

A number of licenses have been granted under the patent and suit was brought by Edwin H. Armstrong and Westinghouse Electric and Manufacturing Company, Plaintiffs, *v.* De Forest Radio Telephone and Telegraph Company, Defendant, for the alleged infringement of the regenerative circuit by the De Forest Company. A decision was rendered in favor of Armstrong sustaining the patent as based upon the reamplification of energy by the feeding back of

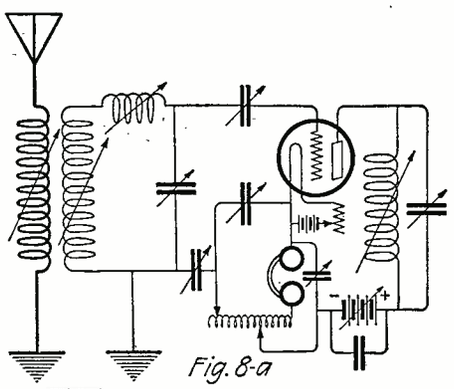


Fig. 8-a

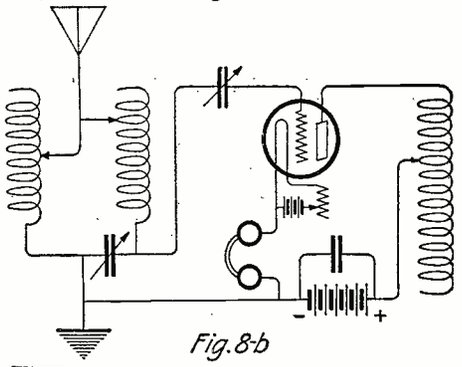


Fig. 8-b

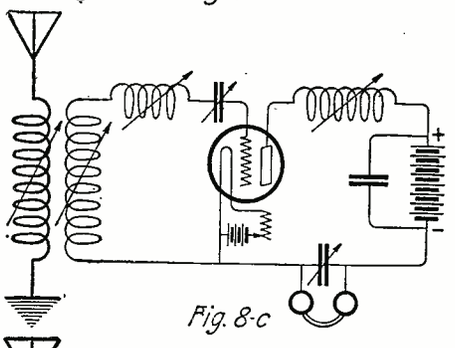


Fig. 8-c

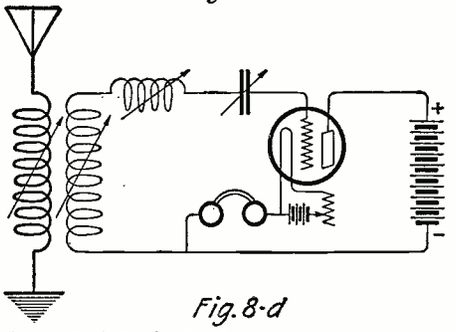
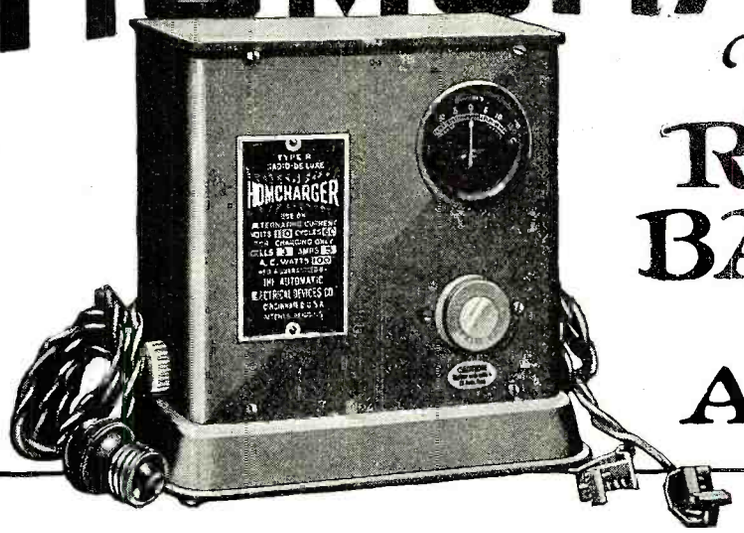


Fig. 8-d

Circuits Included in the Famous Armstrong Patent Covering the Feed-Back of Radio Frequency Energy from the Plate Circuit to the Grid Circuit.

HOMCHARGE

Your RADIO BATTERY *for* A NICKEL



THIS slogan, Mr. Dealer, has made the HOMCHARGER the most popular rectifier in the entire radio and automobile field.

Its popularity is being further increased thru dominating HOMCHARGER advertisements appearing regularly in thirty-one of the leading radio, automobile and national publications.

In addition, an entirely new and greatly augmented series of attractive sales helps are now available for your use. The

RADIO HOMCHARGER DE LUXE

is the simplest, the most efficient and most reliable battery charger on the market, and the only rectifier combining the following essential HOMCHARGER features:

1—Simplicity itself. Attach to any lamp socket and connect to battery.
2—SELF-POLARIZING. Battery may be connected either way and it will always charge.
3—Fully automatic in operation—gives taper charge—cannot overcharge or injure your battery.
4—Safe, all parts entirely enclosed, no danger from fire. APPROVED BY UNDERWRITERS EVERYWHERE.
5—Silent in operation. May be used in the home.
6—Constructed of the best material—genuine Bakelite Panel, Jewell Ammeter, Closed Core Silicon Steel Transformer. No castings used, only the finest stampings throughout.
7—Only one moving and two wearing parts. Replaceable as a unit at small cost.
8—Uses standard 15-ampere plug fuse obtainable at any electrical store.
9—CHARGES ANY "A" OR "B" BATTERY OVER NIGHT. UNQUALIFIEDLY GUARANTEED.

AN ORNAMENT FOR THE LIVING ROOM

Beauty has been combined with utility in the new RADIO HOMCHARGER DE LUXE. The body is beautifully finished in rich Antique Mahogany, the base and fittings in handsome Dull Gold. Equipped with rubber feet, it cannot mar polished surfaces. It harmonizes with the finest living room.

OVER 50,000 HOMCHARGERS

were sold by live dealers and jobbers last spring. Over 150,000 will be sold this fall and winter. Our special dealer booklet, "Homcharger Business Builders", shows how you can obtain your share of this business, and illustrates the many and various sales helps and other co-operation given HOMCHARGER dealers. Send for your copy today, or, better yet, order a case of one-half dozen or so from your jobber, and cash in on this fast-selling and profitable radio and automobile accessory. Furnished complete with attachment cord and plug, charging cable and battery clips. No extras to buy. $18.50 U. S. A., $25.00 in Canada.

RADIO FANS, AUTO OWNERS, ETC.

See the new RADIO HOMCHARGER DE LUXE at your nearest dealer. If he does not carry it, send for our free Bulletin 637 illustrating the new RADIO HOMCHARGER DE LUXE in actual colors, or your order will receive prompt attention if sent direct to the factory.

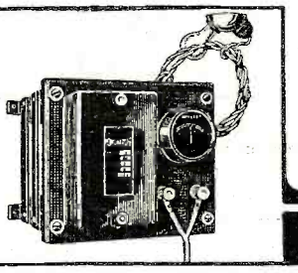
The Automatic Electrical Devices Co.

118 West Third Street **Cincinnati, Ohio**

Largest Manufacturers

of

Vibrating Rectifiers in the World



BRANCH OFFICES

New York Chicago Pittsburgh
Detroit Dallas
Philadelphia Los Angeles
Baltimore Minneapolis Kansas City
St. Louis Atlanta

TYPE "A" FOR WALL MOUNTING

OVER 50,000 IN USE

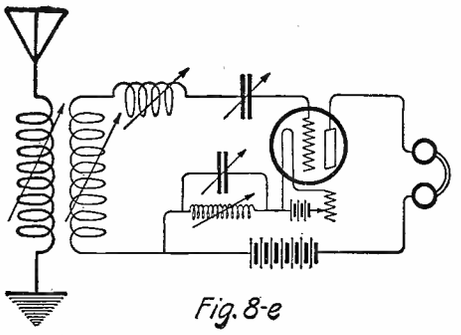


Fig. 8-e

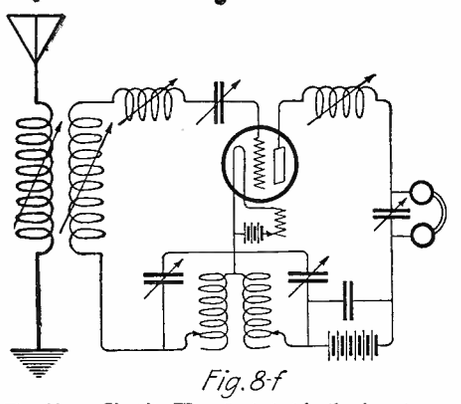


Fig. 8-f

The Above Circuits Were Included in the Armstrong Patent, Which Was Upheld in the Courts.

radio frequency energy from the plate circuit of an electron tube to the grid circuit. Among the prior uses alleged by the defendant was the work of De Forest in this country and Meissner in Germany, but the opinion awarded priority of this invention to Armstrong. An appeal was taken by the De Forest Company and the patent again sustained by the Appellate Court for the instrumentality of the feed back circuit. The language of this court is very interesting, reciting in part:

"We think this excellent contribution to the wireless art should be accorded the full scope which the court below gave it in the decree. We think the decree is not too broad, but properly described what the inventor conceived and for which protection must be accorded to him."

It may be noted that the subject matter in the Armstrong patent relates to regeneration below the point of oscillation. The language of the court, however, appears to interpret the patent as covering the audion in the condition of oscillation at a transmitter or at a receiver where energy is feeding back at radio frequency from the plate circuit to the grid circuit. This subject matter has been in controversy between De Forest, Langmuir, Meissner, and Armstrong, and only the future can determine to whom the patent on the generation of oscillations by the electron tube will ultimately be granted.

TWO THOUSAND RADIO PATENTS

Out of the two thousand patents in the art of radio, it is impossible in this article to call attention to all of the meritorious inventions. In order to have available the

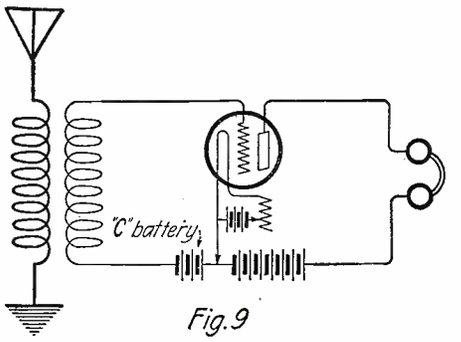


Fig. 9

Diagram of the Patent on the Use of a "C" Battery for Biasing the Grid of a Vacuum Tube.

Which Will You Judge By— Results or Unproved Claims?

Type R-A-10 Receiver Licensed Under Armstrong Patents D-A-2 Detector-Amplifier

Also Manufacturers of
PARAGON
Radio Telephone Transmitters
V. T. Control Units
Rheostats
Potentiometers
V. T. Sockets
Amplifier Transformers
Detectors
Control Dials
Amplifiers
Receivers
Switches
Variometers

Paragon Stands on its Record

In 1915 the *first* regenerative receiver, Paragon, was manufactured.

In 1916 Paragon effected the *first* transcontinental reception (not prearranged) from New York to California.

In 1917-18 Paragon receivers, due to greater sensitivity and selectivity, proved superior to all others in interception of enemy signals by the U. S. Army and Navy.

In 1921 Paragon effected the *first* transatlantic amateur reception, registering signals from 27 American amateur stations at Ardrossan, Scotland, a distance of 3500 miles.

In 1922 Paragon Products are a safe investment in a market in which it is difficult to judge values.

Paragon needs no extravagant claims; but we guarantee our customers this:—that Paragon Products are reasonable in price, sound in design and thorough in workmanship.

If your dealer does not sell Paragon Products, send for our catalogue (free) and we will see that you are promptly supplied.

ADAMS-MORGAN CO., 6 Alvin Ave., Upper Montclair, N. J.

PARAGON

Reg. U. S. Pat. Off.

RADIO PRODUCTS

subject matter of these many inventions the writer has formulated a library of radio patents. The patents are classified so that those relating to inventions of similar subject matter may be found in one place, while those of another subject are brought together in another place. Indexes are maintained as the patents are issued each week by the Patent Office which show names of the many inventors in radio who have secured patents, to whom the patents are assigned, the dates on which the patents issue, and the numerical sequence of the patents. Many inventors have not been mentioned in this article not because their inventions are not considered meritorious, but due to the limited amount of space. Before closing, however, mention might be made of the Lowenstein "C" battery patent shown in Fig. 9, wherein an extra battery is utilized in the grid circuit of an electron tube for negatively biasing the grid. The patent is now controlled by the American Telegraph and Telephone Company.

THE FUTURE INFLUENCE OF PATENTS

The comparative tranquility in litigation in radio patents in the past few years has been due largely to the efforts of the government, particularly the Navy Department, to bring about more manufacturing and less legal controversy. The manufacturing program now underway gives evidence of the relief from litigation which taxes the time of experts and counsel who otherwise might be engaged increasing the availability of radio apparatus to the public. It is hoped by careful guidance of all manufacturers that the granting of radio patents may be made the basis for building the art as a

"Carrier of news and knowledge.
Instrument of trade and industry.
Promoter of mutual acquaintance of peace and good will among men and nations."

Short Wave Directional Wireless Telegraphy

(*Continued from page* 834)

tained from reflectors of various apertures. In Fig. 1 are shown the calculated curves for apertures of 1, 2, 3 and 5 wave lengths.

The method of measurement at the receiver was the well-known "slide back" method with a rectifier; this method if calibrated against an adjustable local generator is quite reliable to a few per cent., and has given very consistent results.

Reflectors having apertures up to 3½ wave lengths were tested, and the measured polar curves agreed very well indeed with the theoretical curves. The use of two reflectors with apertures of 3½ wave lengths, one at the transmitter and one at the receiver, increased the working range about three times.

These Italian experiments showed that good directional working could be obtained with reflectors properly proportioned with respect to the wave length. The attenuation over sea for the wave length used was found to be very high, and with the apparatus available the maximum range obtained was six miles.

The experiments were continued at Carnarvon in 1917. With an improved compressed air spark transmitter, a 3-meter wave and a reflector having an aperture of two wave lengths and a height of 1.5 wave lengths, a range of over 20 miles was obtained to a receiver without a receiving reflector. The experiments at Carnarvon brought into prominence a property of wave propagation which, the author thinks, is not generally known, and the extent of which is not realized. This is the very rapid increase in the strength of the electric field with height above the ground. The rate of increase appears to be a function of the height divided by wave length, and while not very notice-

Regal Radio Products

Regal CONDENSERS PRECISION MADE

43 PLATE .001-MF $4.50
23 " .0005-MF 3.50
11 " .00025-MF 3.00
3 " VERNIER 2.50

Regal TUBE SOCKET

$0.75

Regal MULTIPLE TELEPHONE CONNECTORS

FOR PANEL MOUNTING $1.50
WITH PLUG AS SHOWN 2.50

Regal TAPERED KNOB

NEW DESIGN
HANDSOMELY FINISHED

1" DIA., 1" HEIGHT $0.40 EA
1¼" " 1" " 0.45 "

Regal VARIO-COUPLER

PERFECT ALIGNMENT AND CONTACT
$5.00

This is a "Regal" Year

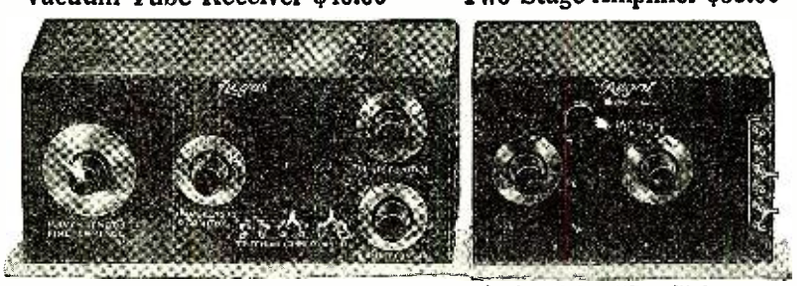
Here Are Five Big Reasons for the Enormous Sale of "Regal" Receivers

1. Designed by our own radio engineers and a scientific precision instrument simple and easy to operate. 2. Built entirely in our own factory with all "REGAL" parts. 3. Has a guaranteed wave length from 150 to 1,800 meters. 4. Backed by our thirty years' experience in the manufacture of precision instruments. 5. Priced at $40.00 instead of $100.00—reason, we build it ourselves.

(Under actual test in our testing laboratory in Bridgeport, Conn., on the evening of July 12th, we brought in a very beautiful concert from station WOH, Indianapolis; concert and base ball scores from station KDKA, Pittsburgh; Marine Band concert from station NOF, Washington, D. C.; Concert, weather and market report from station WJZ, Newark, as well as several other stations. This test was with one tube and without the use of the Regal Two-stage Amplifier.)

"Regal" Vacuum Tube Receiver $40.00

"Regal" Two-Stage Amplifier $35.00



Can be added to "Regal" Receiver to triple range and audibility

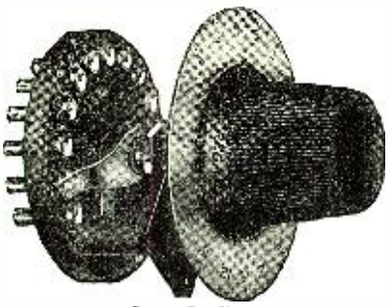
Some Excellent Features of the "Regal"

Minimum number of controls, all clearly marked, with taper knobs and etched silver dials. Unique Regal Telephone Connector, permitting use of three pairs of head phones (doing away with all jacks and plugs) Fine Regal Potentiometer Plate control—so necessary to efficient tuning of modern vacuum tube detector. New Regal Rheostat (6 Ohms—2.2 amperes) New Regal Inductance switch, doing away with all unsightly switch points and levers and insuring fine electrical connections. Regal 43-Plate Condenser. Regal Tube Socket. Mahogany piano finished cabinet with satin finish panels. Rear panel connector, for antenna, ground, batteries, etc., doing away with all crude looking wires in front of cabinet.

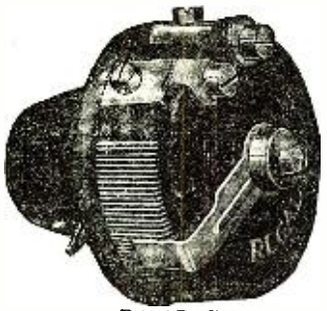
"Regal" Inductance Switch with Knob and Dial

A quality instrument that is 100 per cent efficient. 15 point switch complete in one unit. Does away with usual awkward and unsightly job of single threaded switch points bolted to panel. Requires but one hole to mount on panel. Smooth wiping contact over heads machined to same height on one piece contacts. Complete soldered assembly attached, or removed from panels by means of one threaded shaft bushing. Gives inductance regulation by dial reading. THE BIGGEST HIT IN RADIO. Complete with Knob and Dial.

Price $2.00



Patent Pending



Patent Pending

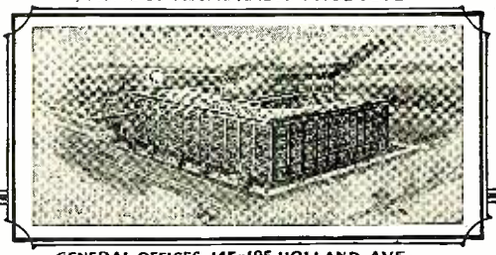
"Regal" Filament Rheostat

Your Receiving Set is worthless without a good Rheostat. The "REGAL" is mechanically perfect. Has full exposed resistance wire, giving critical adjustment so necessary to the efficient operation of a vacuum tube. Fine, smooth working control. Handsome knob, heat resistance base and highly nickel plated parts. 6 ohms resistance—2.2 amperes.

Price $1.25

HOME OF REGAL RADIO PRODUCTS

Attractive Proposition for Jobbers Dealers and Distributers



Ask for Our Handsome New Catalog No. 20

GENERAL OFFICES 145-195 HOLLAND AVE.
FACTORIES HOLLAND AVE. AND ASH STS.

Regal HEAD SETS

SUPER-SENSITIVE
BACKED BY OUR GUARANTEE

2000 OHMS $ 7.50
3000 10.00

Regal KNOB AND DIAL

3" DIA.—$1.00
4" " 1.25

Regal CRYSTAL DETECTOR

UNIVERSAL ADJUSTMENT
A DISTINCT REGAL PRODUCT

$1.25

Regal LIGHTNING SWITCH

HAS 5" BREAK
COPPER PARTS 100 AMP.

$3.00

Regal VARIOMETER

PRECISION WOUND

GUARANTEED PERFECT

$5.00

The AMERICAN SPECIALTY MFG. CO. BRIDGEPORT, CONN.

able with waves of several hundred meters, is very marked with waves of a few meters length. The order of the effect may be gathered from the following experimental results.

It has been mentioned that the range attained at Carnarvon with a 3-meter wave was over 20 miles. The transmitter was at a height of 600 feet and the receiver 300 feet, there being a clear air line between them. To the shores of Carnarvon Bay, seven miles from the transmitter, there is also a perfectly clear air line, yet the signals at sea level were much weaker than at 20 miles with the receiver 300 feet up. It was not possible to ascribe the weakness of signals to any screening or reflections from trees or other objects. Tests were made at different levels on a hill situated at this point, and it was found that signals steadily increased in strength with height. Accurate measurements were not possible with the portable receiver, but the increase of strength of the field at a height of 10 wave lengths was estimated to be 6 or 7 times. Further tests on this effect have shown that the increase of strength with height is not always uniform.

Subsequently when this reflector and transmitter used at Carnarvon were brought down to sea level it was found that the limiting range to the same receiver at sea level and over sea was four miles. When both transmitter and receiver are at a low level the range is very dependent on the nature of the intervening country, and is very restricted even over sea; when, however, both stations are many wave lengths above the intervening country its nature is of far less importance and the range is increased many times.

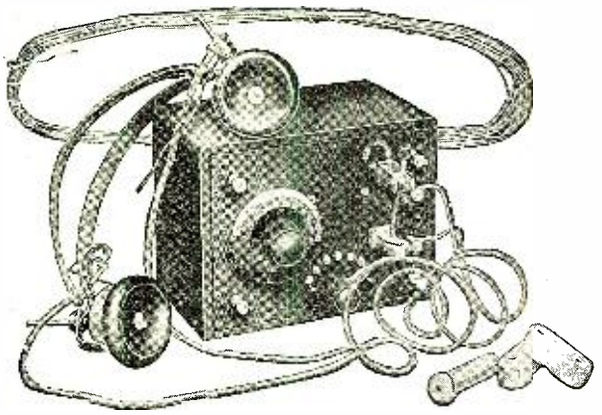
These experiments showed that very considerable ranges were possible with very short waves.

In 1919 experiments were commenced at Carnarvon with valve transmitter, with the idea of producing a directional telephone system. Mr. R. H. White and Mr. E. Green, and later Mr. A. W. Hall, assisted the author in this work. A wave of 15 meters was selected, which, while well within the capacity of the power valves available, allowed a simple reflector to be used without too large a structure. After some trials a single valve transmitter was arrived at, taking about 200 watts with a 15-meter wave and giving 1 ampere in the center of a half-wave aerial. A heterodyne receiver with supersonic beat-note was employed.

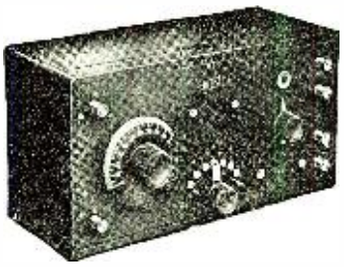
After gaining some experience and solving many small practical difficulties, very strong speech was obtained at Holyhead, 20 miles away. The strength was such that shadows produced by small hills and buildings were hardly noticeable, unless the stations were close behind them.

The next point was to test the maximum range, and particularly to find whether such waves would carry over the horizon, and whether there would then be a rapid falling off of strength. Permission was kindly given for a test to be made on the Dublin Steam Packet Company's boats running from Holyhead to Kingston, and this was done in June, 1920. During this test speech was received right into Kingston Harbor, 70 nautical miles from Carnarvon, and the point was proved that there was no rapid diminution of strength after passing the horizon line from Carnarvon.

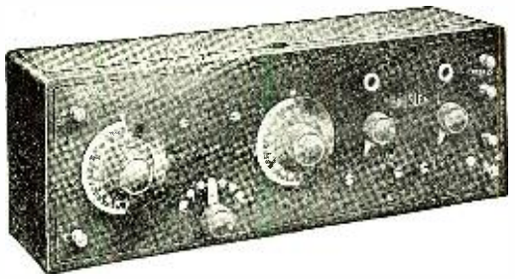
As a result of these experimen it was decided to test the range of a short wave reflector system wholly over land. A site was chosen at Hendon, and a reflector and transmitter for 15-meter waves erected with the reflector pointing towards Birmingham. Tests were commenced in February, 1921, from Hendon to a portable receiver on a motor car. Very good speech was received up to 66 miles, and fair speech in the neighborhood of Birmingham. A reflector station was then erected at Frankley, near Birmingham 97 miles from Hendon, and tests were started there in August, 1921. The following are some particulars of the Hendon and Birmingham plant:



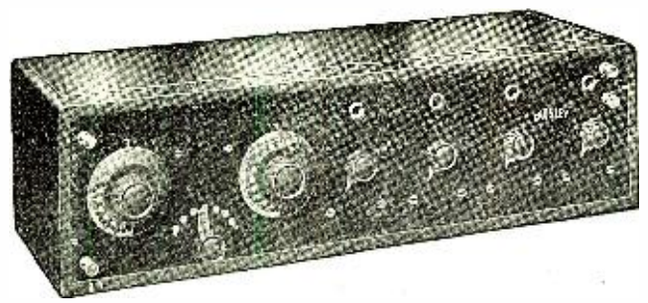
CROSLEY CRYSTAL RECEIVER MODEL 1. Complete with head phones, antenna and insulators, ready to install without additional equipment. Will receive wave lengths from 200 to 600 meters and has a range of 25 to 30 miles. Has been known to receive up to 200 miles. Price, $25.00.



CROSLEY HARKO SENIOR MODEL V. A combination tuner and Audion Detector. Will receive broadcasting stations up to one hundred miles. Under favorable conditions, a user in Denver has heard Schenectady with this model. Price, $20.00.



CROSLEY RECEIVER MODEL VI. This unit has approximately six times the range and volume of the Harko Senior. It consists of one stage of Radio Frequency Amplification and Audion Detector. It eliminates static to a large extent and distant stations are brought in clear and sharply. Price, $30.00.



CROSLEY RECEIVER MODEL X. In placing this receiver on the market, we are offering you a unit whose range, volume and selectivity are remarkable. Nothing can be compared with it at double the price. Developed in the CROSLEY laboratories, this unit combines one stage of tuned radio frequency amplification, audion detector and two stages of audio frequency amplification. It is the equivalent of CROSLEY RECEIVER MODEL VI. and CROSLEY TWO-STAGE AUDIO FREQUENCY AMPLIFIER. Price, $55.00.

CROSLEY

BETTER — COST LESS

CITIZEN RADIO IS NEW. Few people realize the Manufacturer's problem in building production to take care of the hysterical demand of last winter. While the CROSLEY MANUFACTURING COMPANY—an old established manufacturing concern—had been engaged in the production of Radio Apparatus for a year prior to the big rush, it was hard pressed to take care of the demand for its Radio Products.

IN SPITE OF THIS FACT, CROSLEY Radio Apparatus has been recognized as the standard of value at moderate cost. And with the aid of an efficient staff of engineers, certain additional refinements of detail have been effected.

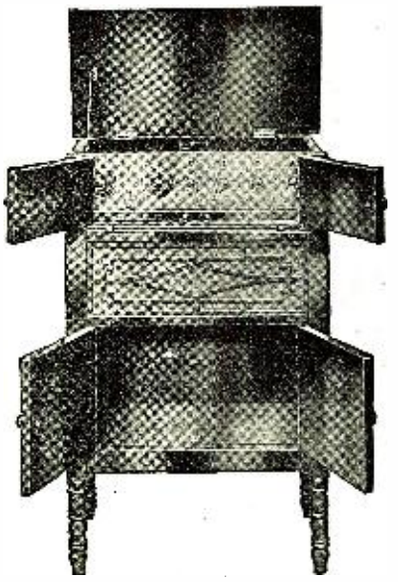
CROSLEY RADIO APPARATUS and Radio Parts, with these refinements, are better now than ever. CROSLEY values are even more marked than heretofore, and are truly representative of the manufacturer, actuated by the highest ideals and a sincere desire to give the consumer the best for his money.

Handled by Jobbers and Dealers everywhere. If your Dealer does not handle CROSLEY Instruments, write us direct.

CROSLEY MANUFACTURING COMPANY
DEPT. R. N. 2 CINCINNATI, OHIO

We also manufacture audion detector units, Tuned Radio and Audion Frequency Amplifiers to be added to this and other Receiving Apparatus.

Write for illustrated and descriptive catalog



CROSLEY RECEIVER MODEL XX. The last word in Radio Equipment design. Comprises a combination of the Crosley Receiver Model X and a highly polished mahogany finished cabinet with loudspeaker and receptacle for batteries, charger, etc. Price, $100.00.

The transmitter consists of two medium-size power valves working in parallel. The power to the valves is usually 700 watts (4,000 volts, 175mA). The aerial is rather longer than half a wave length, and has a radiation resistance of the order of 90 ohms. The efficiency, input to valves to aerial power, is between 50 and 60 per cent., and about 300 watts are actually radiated. With the reflectors up at both ends speech is strong and of very good quality. It is usually strong enough to be just audible with a ¼ to ½ ohm shunt across a 60-ohm telephone.

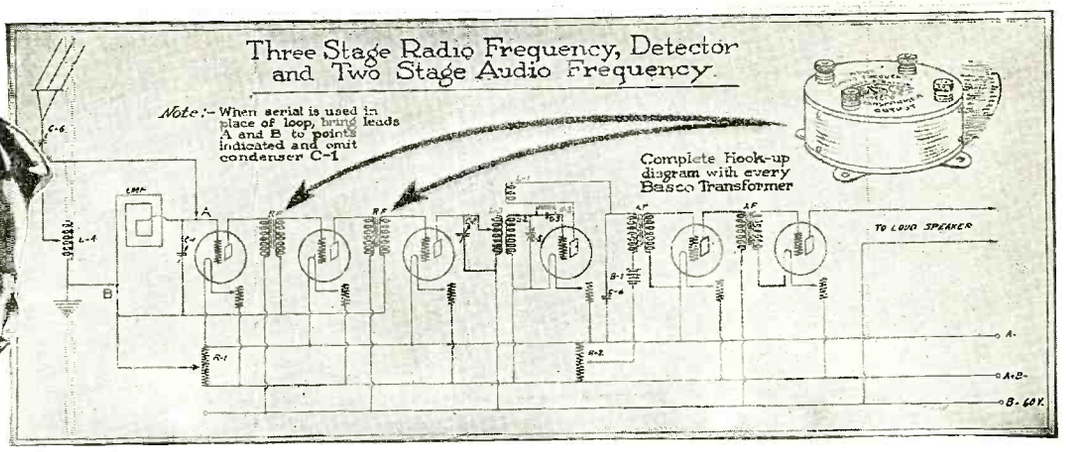
With both reflectors down the speech is usually only just audible with no shunt. Average measurements indicate that the energy received when both reflectors are up is about 200 times the energy received when not using the reflectors. Thus to get the same strength without reflectors as with them a 140-KW valve transmitter of the same efficiency would be required. Local measurements of the polar curves taken round the station show that the electric field in front of the station is increased approximately four times by the use of the reflector, and that the same order of increase is obtained during reception; the increase of energy received due to the use of the two reflectors should therefore be $4^2 \times 4^2 = 256$ times.

Fig. 2 shows a measured polar curve of the electric field of Hendon station taken locally. It is rather unsymmetrical, owing, it is thought, to the ground being on a slope, and perhaps to local reflections from trees and wires.

It has been suggested that a polar curve taken locally round the station is not the same as the polar curve at a distance, and that the directional effect is soon lost. The author does not agree with this. It has therefore been planned to measure the range of Hendon and Birmingham in different directions, but this has not yet been done. The fact that by using reflectors the energy received at these stations is increased some 200 times, is, the author considers, a proof that the directional effect does persist. It is, however, essential that the stations should be in situations free from obstacles which might cause powerful local reflections and distort the field. Experiments made with revolving reflectors, where it is comparatively easy to make measurements at any distance, also prove that the polar curve is practically constant at all ranges.

The production of waves of the order of about 12 meters and upwards is quite practicable up to several kilowatts by large power valves, and it is also practicable to operate valves in parallel. With such high frequencies very large currents pass into the grid and anode; the seals through the glass must, therefore, be large. The production of a reliable transmitting valve entailed a large amount of work, and the great dissimilarity of results from apparently similar valves was very puzzling for some time. In a new batch of valves the efficiency at 15-meter wave would vary from about 60 per cent. down to 5 per cent., and if any attempt was made to push up the power on a bad valve the glass would promptly melt at some spot. The cause of the trouble has been found to be due to losses in the deposits on the glass, owing to high-frequency currents induced. Such deposits are always produced in valves during exhaustion and vary considerably.

If a number of valves are laid successively between the plates of a small air condenser in a very high-frequency field of the order of 20,000,000 per second (without making any connections to the valves) the results are quite remarkable. Some produce no appreciable effect, while others at once put a big load on the circuit, and if 200 watts of high-frequency energy are available, the glass gets hot and will quickly melt at some spot. One of my assistants, Mr. E. Green, made a useful discovery which overcomes this difficulty and it is now therefore possible to use what are practically standard



Don't Let That Term "Radio Frequency" Scare You Out of Doubling Results

NO bugbear about it. Thousands of amateurs are accomplishing wonders with Radio Frequency. The greatest radio development of the day. A loop aerial and three stages of radio frequency hooked right to your regenerative outfit—doubles your signal strength, day or night—greatly increases your range and eliminates most of the static. Two stages are nearly as gratifying. Results will surprise you. Study the diagram shown above. And here's the ideal transformer for the job—the

Basco Super-Sensitive Receivers

Light weight — aluminum case—extra sensitive. Clean cut, rugged design. See them. 2,000 and 3,000 ohms—$6.00 & $7.50 respectively.

BASCO Radio Frequency Transformer

"The Element of Certainty"

Thoroughly proved—for any well balanced circuit. Efficient. Operates over wave band of 200 to 600 meters. Affords great selectivity. Employs non-capacity winding—**double silk covered** wire—no enamel. Maximum transfer of energy. Clean cut—neat. High grade workmanship throughout. Encased in fibre. Binding posts and base-mounting **silver plated.** No higher grade transformer can be built. Basco Radio Frequency Transformers are the first step toward a better outfit. Insist on a Basco.

JOBBERS and DEALERS, write for particulars. No better trade-building transformer built. Gets results—gets business. We have local factory representatives. Write for name of one nearest you.

$5.00

BASCO PRODUCT

Briggs & Stratton Co.
Milwaukee, Wisconsin

Ask for List of other BASCO Radio Equipment

valves, and their life appears to be about the same as for lower frequencies.

During the continuous wave tests at Carnarvon it was found that reception was quite possible on the transmitting aerial while the transmitter was operating. This has been used successfully for duplexing between Hendon and Birmingham, and eliminates all switching.

The heterodyne may be either the transmitter or an independent small heterodyne in the receiver. Both the transmission and the reception utilize the same aerial and reflector, and the transmitter is left going and can be operated while receiving.

There is no reduction in strength while the transmitter is on, but a practical trouble has appeared. Owing to the comparatively large power, strong currents are induced in all conducting structures and circuits close to the reflector and transmitter, such as the supporting towers and buildings, and every variable contact produces a noise. The elimination of all variable contacts in the neighborhood of the transmitter has proved a work of some magnitude.

Reflectors besides giving directional working and economizing power, are showing another unexpected advantage, which is probably common to all sharply directional systems. It has been noted that practically no distortion of speech occurs, such as is sometimes found with non-directional transmitters and receivers.

Although the results between Hendon and Birmingham constitute a record for telephony for the wave length—for such results were believed to be impossible two years ago—they are only a first attempt and do not represent the best that can now be done after the experience gained. Birmingham, it is interesting to note, is 10,400 wave lengths from Hendon.

It has thus been demonstrated that wave lengths of the order of 20 meters are quite capable of providing point-to-point directional commercial service over very considerable ranges. Such services will be comparatively secret as compared with the usual non-directional type of transmission.

The directional effect obtained with reflectors which are large compared with the wave length is so good that it was suggested that it would prove very useful for position finding for ships near dangerous points. Through the courtesy of Messrs. D. and C. Stevenson, consulting engineers to the Northern Lights, and the Commissioners of the Northern Lights, trials are being made with a revolving reflector erected on Inchkeith Island. Credit is due to the author's assistant, Mr. N. Wells, who has been superintending this work on the island—very often under strenuous conditions.

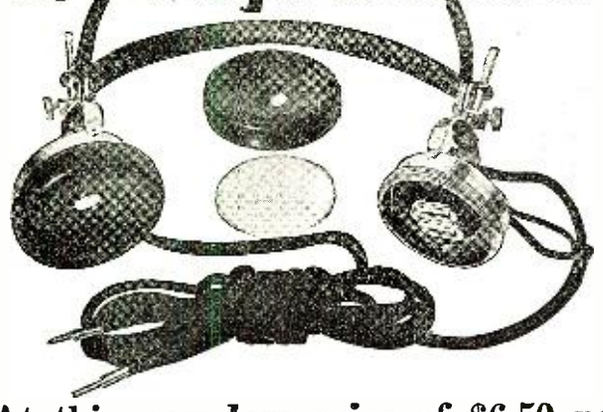
The general idea is that a transmitter and reflector revolving will act as a kind of wireless lighthouse. It is not intended at present for long ranges, but rather that revolving reflectors should be erected in position, similar to those at present occupied by fog signals, and be capable of similar ranges, so as to give the position to ships during fog when within about 10 miles of the danger point.

An experimental revolving reflector was erected on Inchkeith, and tests were made to S.S. *Pharos,* the lighthouse tender of the Northern Lights Commissioners, during the autumn of 1920. With a 4-meter wave, spark transmitter, a reflector of eight meters' aperture and a single valve receiver on the ship, a working range of seven nautical miles was obtained. The reflector made a complete revolution once every two minutes and a distinctive signal was sent every half-point of the compass. It was found that this enabled the bearing of the transmitter to be determined within ¼ point of the compass, or within 2.8 degrees. Fig. 3 shows a chart of the course of the S.S. *Pharos.*

These results were good, but it was desired to know the effect of putting the transmitter lower down at the point of the island where ships would pass quite near. A new and

"RED-HEADS"

A Triumph in Radio Receiver Design



3000 Ohms, Complete with Cord and Military Headband

NOW $6.50

At this new low price of $6.50 per pair, Red-Heads are unquestionably the biggest value on the market today in moderately-priced, high-grade receivers.

Just Note These Specifications

Each "Red-Head" receiver is wound to 1500 ohms (3000 ohms per pair) with highest quality electrolytic copper on accurately ground pole pieces attached to the best magnet steel procurable for the purpose. Machine-finished aluminum backs with strain posts and nickeled binding posts. Ear caps of scientific design, moulded from our special red-brown composition, comfortably fitting the ear. High quality, fully adjustable military-type head-band with seamless tape binding. Green mercerized cord. Careful workmanship and distinctive appearance. *Fully guaranteed.*

They've Been Popular for Seven Years

It was back in 1915 that "Red-Heads" made their bow in the radio field. Almost immediately they "caught on." Experimenters and young engineers, probing the mysteries of wireless and demonstrating its practical possibilities, liked "Red-Heads" from the start; liked their accurate mechanical construction; liked especially their high degree of permanent sensitiveness.

Year after year "Red-Heads" have been improved, refined; and with the increased volume annually produced, manufacturing economies have been instituted.

Today we offer "Red-Heads" at $6.50 per pair, and we do not hesitate to say that at this price they represent America's best value in radio headsets. Obtainable at your dealer's or sent direct to you prepaid on receipt of price.

The Teagle Line Makes Wonderful Strides

Six engineers of the Newman-Stern organization, profiting by wide knowledge and long experience in the radio game, devised seven pieces of radio apparatus that are today winning fulsome praise from thousands of experimenters.

These items, manufactured in the Teagle division of the Newman-Stern Co., include the Teagle Filament Rheostat, the Teagle Vacuum Tube Socket, the Teagle Stopping Condenser, the Teagle Grid Condenser, the Teagle Crystal Detector, the Teagle Universal Adaptafone and the Teagle Receiving set—all of them "better radio instruments."

Teagle MADE IN U.S.A.

It will pay you to send for our special circular on Teagle radio specialties. In this announcement we have only space to describe the Teagle Grid Leak, an extremely efficient little item that is fast winning distinction in the radio field.

Do You Regularly Use "NAA" Arlington Tested Minerals?

If you are one of the tens of thousands of satisfied converts to Arlington Tested Crystals, you will need no reminder from us to continue to employ these extraordinarily efficient detector minerals. They certainly do the work. They are sorted and tested and everyone of them means *better receiving service.*

For your own protection look for the signature of J. S. Newman, the originator, on every container. It will insure guaranteed sensitiveness.

NAA Galena, Silicon or Goldite, price per crystal, postpaid, $0.25. Mounted, set in woods, metal, in brass cup, price per crystal, postpaid, $0.40.

You will find "NAA" Arlington Tested Minerals at your dealer's. If he cannot supply you, we will mail them to you direct on receipt of price.

A Newman-Stern Radio Catalogue Can Be Had for the Asking

A very interesting and helpful catalogue this is, too. Chock full of instruments and apparatus of standard make and proven worth; all fully described, and all priced for the careful and economical buyer. A postal from you will bring the catalogue promptly.

A Word of Caution

It will take shrewdness and common sense above the average to make wise selections of radio apparatus this fall and winter.

The market is just simply glutted with radio goods. Hundreds of makers have come into the field—many of them expecting to make a quick clean-up.

Strange names and unfamiliar brands are beckoning for attention and patronage.

The instruments that are offered, right and left and everywhere, are bright and glossy and good *looking.* But how shall you know which are the efficient, which are the safe, instruments to buy?

It's truly a hard market for the beginner; naturally not so hard for the experienced experimenter.

Why is it not so hard for the experienced experimenter?

Because he knows the tried and tested makes; he knows the reliable and old-established radio houses.

He knows that mere gloss in appearance, or high sounding superlative in descriptive matter, or incomprehensibly low prices, in the long run *mean nothing.*

He is not going to be side-tracked from the path of safety which leads to the brands of radio apparatus that have made their mark by reason of solid merit.

Take radio telephone head-sets for example—you can get them today at almost any old price.

But what you want is not merely low price; you want *service, efficiency.*

How can you be certain of securing these indispensable qualities?

Your best guarantee of satisfaction consists in *sticking to the goods with reputation.*

No. T-104 Teagle Moisture-Proof Variable Grid Leak

The advantages of a variable grid leak are too well known to require comment. No two tubes seem to possess the same characteristics and consequently no fixed leak can fully satisfy the requirements. On the other hand an open pencil mark changes its resistance with every change in the vapor density of the atmosphere and none of the enclosed variable grid leaks have hitherto been made to avoid this condition.

The Teagle Grid Leak is designed to fill the need for a *good* variable grid resistance. The brass bound insulating disc is threaded to the shoulder and a turned brass cover is provided, threaded accurately to make a moisture-tight joint. The cover is knurled for readily screwing on and off. Diameter 1⅛ inch. The contact screws are spaced to fit the Teagle Grid Condenser.

No. T-104 Grid Leak.....$0.60

No. T-103 Mica Grid Condenser, to fit Grid Leak.... .40

Sent to you direct prepaid on receipt of price, if you cannot secure it at your dealer's.

Newman-Stern Building

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Pioneers in Radio Field

Cleveland, Ohio

larger reflector was designed, and erection has just been completed.

Fig. 4 shows polar curves taken with reflector.

This latter figure gives measured polar curves taken recently with the new reflector and illustrates very well how the beam sharpens up with large ratio of reflector aperture to wave length. The curves were measured at a distance of four miles.

The best method of giving the direction to a ship by means of such a revolving beam requires consideration. The method being adopted is, the author thinks, the most practical one. When listening in a receiver to a moderately sharp revolving beam the signals are heard only for a very short time. Taking the case of such a beam shown in Fig. 4 as produced by the 4.28-meter wave: supposing it makes a complete revolution in one minute, then at four miles with the receiver at maximum sensitiveness signals will be heard for seven seconds every minute. Near the limit of range signals will be heard for only about four seconds. The exact time of maximum signals is not easy to determine by ear, but the times of starting and vanishing are easy to determine, as the rate of rise and fall of the signals is extremely rapid. The time half-way between these two times gives with great exactness the moment when the beam is pointing to the ship.

It would be quite possible to arrange to send a general broadcast signal when the beam passes through true north; then by arranging for the beam to revolve at a perfectly uniform rate, the bearing on the ship could easily be determined by means of a stop-watch. This method is probably the most accurate, but has some disadvantages. It entails accurate timing mechanism at the transmitter; the use of two waves; and three, or perhaps four receivers on the ship, as well as the use of a stop-watch.

For the short wave two receivers are required, one at each end of the bridge, or one fore and one aft. This is necessary to avoid screening by the ship itself. If the broadcast wave for giving the time when the beam passes true north is another short wave, then two more receivers would be required.

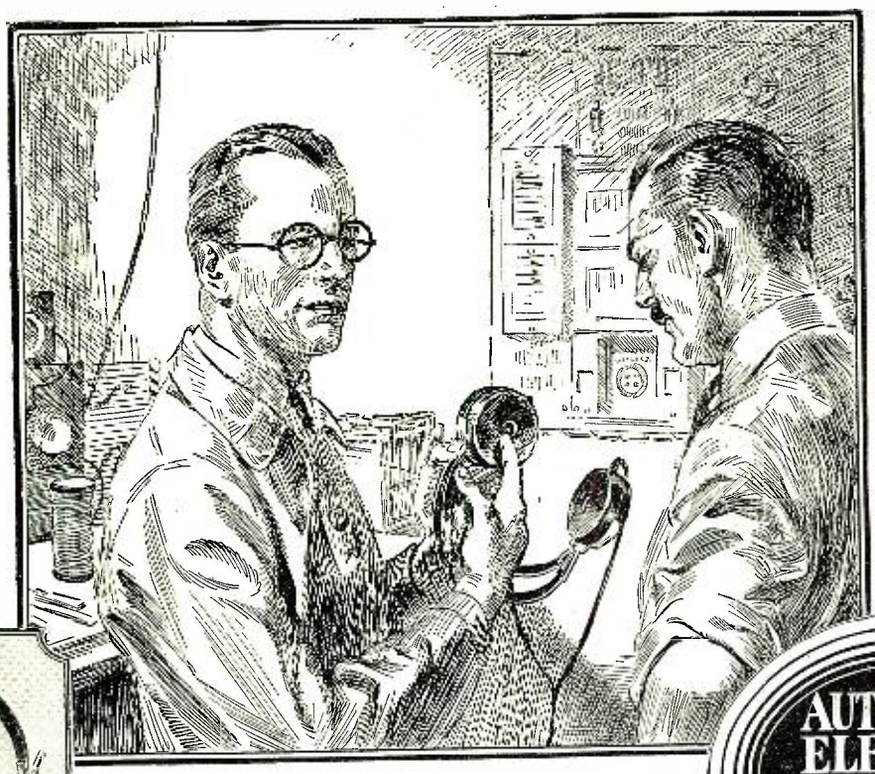
The method provisionally adopted avoids accurate timing mechanism at the transmitter and the use of a broadcast wave, also the use of additional receivers and a stop-watch. On the base of the revolving reflector contact-segments are arranged so that a definite signal is transmitted every half or quarter-point of the compass. A distinctive letter is sent every two points and short signs mark the intermediate points and half-points. When listening-in at the receiver a few short signs are heard and one or two letters. The letters and signs used are shown on the card (Fig. 5). If the letters *t* (—) *i* (— —) *o* (— — —) *i* (— —) *t* (—) *i* (— —) are heard:

By reference to the card shown in Fig. 5. the half-way position is between South and S. ½ West and the bearing to the transmitter will be S. ¼ W.

The apparatus proposed is of a very reliable nature. The spark transmitters are very robust and last for years without attention. The receivers are simple valve rectifiers with fixed adjustments except for a "backing off" potentiometer for dealing with powerful signals at close range. The attenuation of these waves over sea is so strong that a little experience enables distance to be judged by strength of signals, and this can be measured by means of the potentiometer. The only qualification necessary for a person determining the bearing is the ability to read a few Morse signs.

In conclusion, it is thought that enough has been done to show that short-wave directional wireless telegraphy is likely to be very useful in the future, and the results just described should lead the way to more extended researches.

The names of some of those who have been directly associated with these experi-



AUTOMATIC ELECTRIC
LONG RANGE
RADIO
HEAD SETS

"A Little Knowledge Is a Dangerous Thing"

AND that's the truth which applies to the business of making Radio equipment. It is something to think about when you buy Head Sets.

There are two kinds of manufacturers of Radio head sets—those who know little or nothing of telephone design—and concentrate their efforts in quick production regardless of quality. And then there are those who know the business through years of experience and who place *scientific design* and *quality* above everything else. So this is a plea for the good of the industry — and for your protection.

Specifically — these Automatic Electric Head Sets have been developed by telephone engineers who've devoted more than thirty years of effort to the designing of better telephone apparatus. The time spent in the perfecting of this improved receiver is shown by the remarkable results which are produced under all conditions.

This is the high grade plug that comes attached, when desired, to *Automatic Electric Head Sets*. It will take care of any kind of cord terminals, will fit any kind of jack and will accommodate two head sets. With this plug attached to our head set you can be sure the head set is properly "poled."

It has many distinctive features which prove its superior effectiveness. The powerful single pole electro-magnet and complete soft iron magnetic path—assure perfect clearness of both weak and loud signals. No distortion or foreign noises — whether used with crystal, V. T. detectors or multi-stage amplifiers.

If your dealer handles Radio equipment of the finest quality he is familiar with the Automatic Electric Head Sets. Ask him.

If your dealer cannot supply you, we will send you a complete Head Set, postpaid, for $10.00 — with plug attached $11.50.

Automatic Electric Company

ENGINEERS, DESIGNERS & MANUFACTURERS OF THE AUTOMATIC TELEPHONE IN USE THE WORLD OVER

HOME OFFICE AND FACTORY: CHICAGO, U. S. A.

ments have already been mentioned, and the author has to acknowledge the large amount of help and assistance derived from the advice and researches of many others.—*Abstract from our contemporary, Wireless World.*

Correspondence From Readers

(*Continued from page* 874)

but that Hill Billy junk appeared to be nothing but a cheap imitation. If this valuable space was filled with articles on radio frequency and C.W. transmission from an AMATEUR standpoint the entire AMATEUR WORLD would think a great deal more of your once fine magazine. These are not only my thoughts, but all real AMATEURS think along these same channels.

Do you know, Mr. Gernsback, that there are two general classes of broadcast fiends? 1. The rich bird who buys his stuff outright and wonders why he can't get long distance telephony, especially in summer by simply turning a knob. 2. The fellow who builds his set according to directions and if it doesn't come up to his expectations tortures his paper with fool questions such as, "Why can't I get the music from Hokem with my $3.75 set?" or again, "How far can I tune in music with the set described June 12?"

I don't say all broadcast enthusiasts do those things. By all means share our magazine with them, and a few of them may even become AMATEURS, *BUT* for goodness sake don't let them have the entire paper, as per the last few issues.

Remember your 1919 editorial, in which you said:

> "Now, my friends, it is up to *you* how great and big RADIO AMATEUR NEWS shall be. Its future is in *your* hands. We're off. . . . Three cheers for American Radio AMATEURISM—Long live the Radio AMATEUR. . . . H. Gernsback—Your Editor."

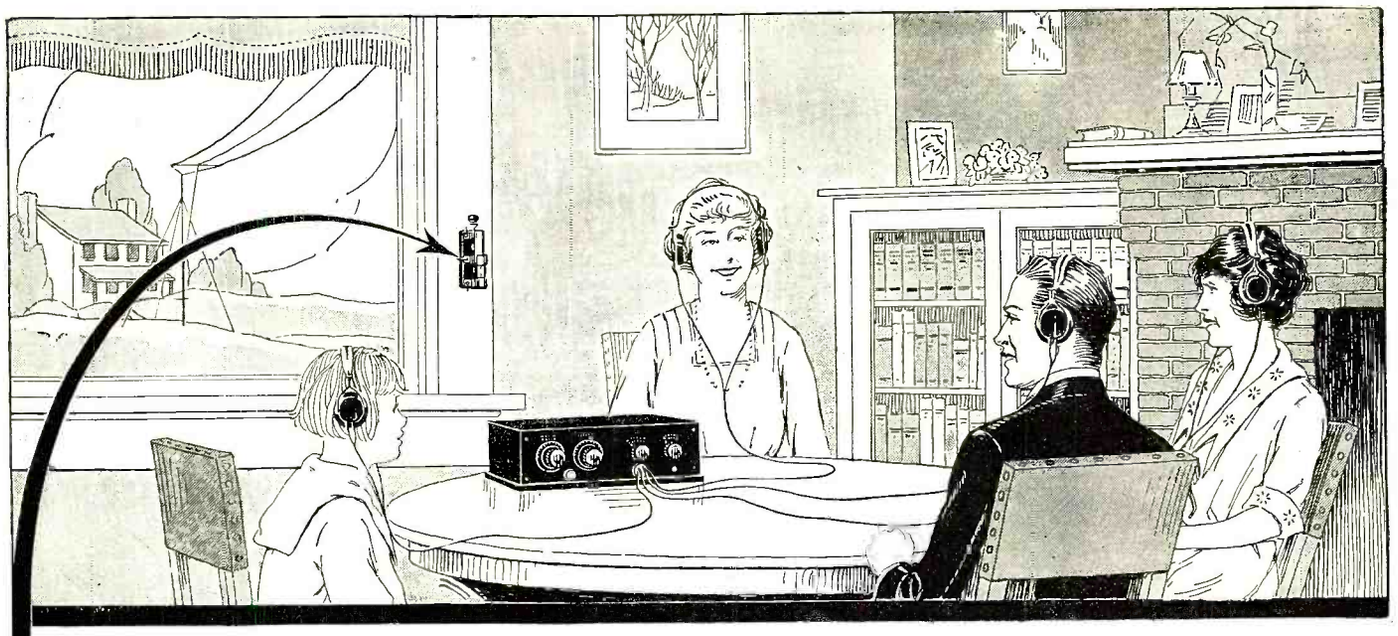
Therefore, for the sake of old times, OUR EDITOR, bring RADIO NEWS back to its old, esteemed position with the AMATEUR.

LEONARD S. COHN,
3659 N. 21st St., Philadelphia, Pa.
Radio 3AQA.

(We were truly glad to receive Mr. Cohn's letter. We have received similar ones from other readers, but none that was so aptly put as this one. We are, therefore, publishing it as a fair sample of the others.

The fly in the ointment in this case, as in so many other similar ones, is that no constructive criticism is given, and that is where the rub lies. There are several arguments to set our friends at rest, in connection with this, the foremost being that "if you are in Rome do as the Romans do."

Why has RADIO NEWS *grown to such tremendous proportions compared to other radio periodicals which remain just where they were before? Simply because* RADIO NEWS *is catering to the majority, not to the minority. On the other hand, we feel quite strongly that* RADIO NEWS is today the *Amateur's periodical just as much as it was in* 1919, *when the Editor's editorial was written. The great trouble is not with the Editor or with a sinister policy in this case, but with the amateurs themselves. They set up all sorts of howls, month after month, and bombard us with letters that* RADIO NEWS *is being turned into a broadcast magazine, but these selfsame complainants* NEVER TAKE IT INTO THEIR HEADS TO SIT DOWN AND WRITE THE SORT OF ARTICLES THAT THEY WOULD LIKE US TO PRINT.



Radio Lightning Arrester Switch

This Lightning Protector Combines All the Merits of a Radio Ground Switch and a Vacuum Tube Lightning Arrester

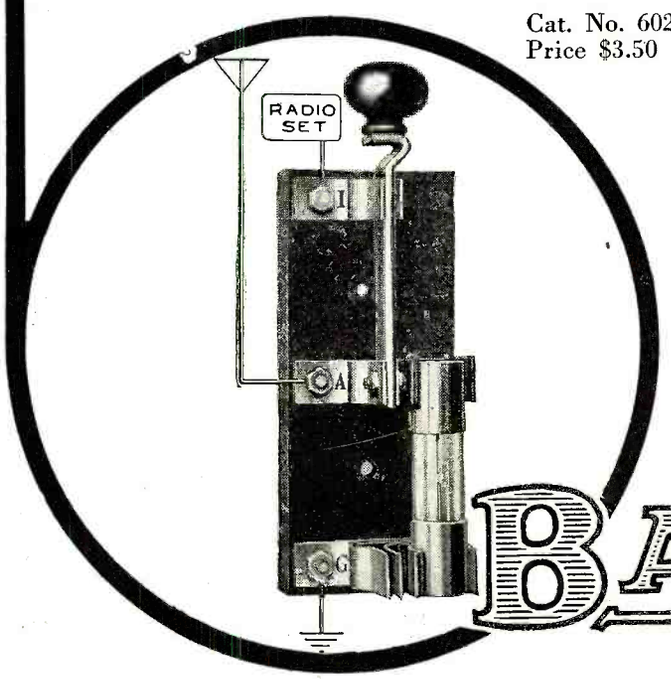
(Patents Pending)

It gives continuous Vacuum Tube Arrester protection with a positive ground when desired.

By mounting both on one base we have produced a compact protective device combining the two best known means of lightning protection and at small additional cost over either one.

Approved and Listed by the Underwriters' Laboratories. The new Regulations of the National Board of Fire Underwriters permits its installation either outside or inside similar to a telephone fuse. This illustration shows its adaptability to indoor use.

Send for Bulletin No. 30, telling of the merits and disadvantages of both types, and how by combining the two on one base we have solved the lightning protection problem.



Cat. No. 602
Price $3.50

To Radio Distributors and Dealers

Trade Discounts to Radio Distributors and Dealers who have established standing or can prove their status.

Local distribution is through Dealers where available.

Ask for our new Window Display Card designed to boost sales and featuring our Four-Phone Plug.

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BARKELEW

Our editorial office, of course, in the very nature of things, can write only so many articles. The bulk now, as always, is furnished by contributors. What, then, happened for the past months, and is still happening, is this: We write to the old-time amateurs, who used to be our good contributors, that we wish certain articles on certain subjects. Eight out of ten times these gentlemen have gone into the radio business and are now making so much money that merely writing articles is of no interest whatsoever to them. The remainder say that they have nothing to write about.

We have never as yet refused to print a good technical article that has come to us. As a matter of fact, we admit we are hard up for them right along, and if we were not combing the whole world for them, the foreign press included, we would not have as many as we have now. Some of the other magazines are republishing old articles in a new dress, but we have never felt that we should stoop to this level. It is not good practice to take a three-year-old article, revamp it and dish it up as new. We try to print original matter exclusively; but we must always depend upon the amateurs themselves to furnish us with ideas and articles, and this is exactly what they do not do.

If all you fellows who are criticizing the policy of RADIO NEWS *would only spend the time, wasted in criticism, in turning out an article of the kind you want to read, all this sort of thing would automatically stop.* RADIO NEWS *pays especially high rates for original articles with photographs, and makes it fairly interesting for contributors, but so far the amateurs have fallen down miserably in sending in enough contributions.*

We hope that our friends will measure up to the situation and take the hint.—EDITOR.

THE NOVICE SPEAKS

Editor, RADIO NEWS:

If the criticisms of that group of radio fans who tell the whole pop-eyed world that they are brass pounders gets much hotter, I can see where along about December there will be a section of RADIO NEWS published on asbestos paper. Provided of course that you have not failed by that time because of giving the public first-hand information both technical and non-technical on that greatest of all hobbies—radio.

Your able statement in answer to one such criticism as regards the future of radio communication and your magazine's policy was by no means the most uninteresting part of your September issue. It did a lot of us novices good to know that you believe in us and in that form of radio communication, which means so much to us now.

I believe your magazine is the most helpful on the newsstands today, because you have succeeded in producing a magazine which is not too far above the heads of the new-comer in radio nor is it so completely given over to the new-comer as to insult the intelligence of the mighty amateur with his 50-mile sending record. But even I would join in urging you not to swing too far toward the popular type of radio magazine.

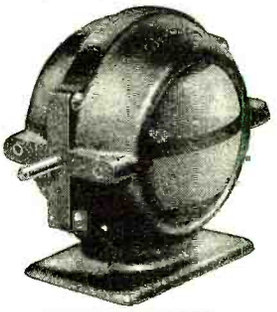
We novices, with our first sets, the bane of the existence of some amateurs, are not so green as to fail to grasp the fact that a multiplicity of broadcasting stations would be detrimental to the best interests of radio, and we certainly would line up back of any feasible plan to prevent unnecessary duplication. We will also line up against any program on the part of a few quite rabid individuals, who believe that radio revolves around 200 meters, who would try to diminish or destroy the power for educational betterment which radiophone broadcasting can offer.

In spite of the rather low estimate of the ability of the radiophone listener held by some, there is a lot of good amateur talent which will be lost to those who feel

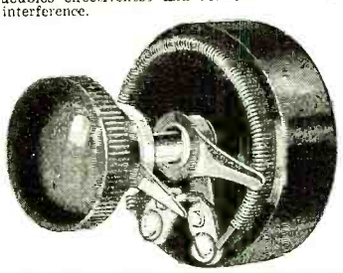
Each Instrument Guaranteed

AIR-WAY MODEL "C" RECEIVING SET
Here is a sound, practical set with detector and two stage amplification. It is remarkable for its long-range reception and its fineness of tuning.

AIR-WAY MODEL "B" RECEIVING SET
This set contains so many outstanding features that radio enthusiasts have wondered at the range and accuracy of reproduction. Detector and one stage amplifier with typical "AIR-WAY" fineness of workmanship.



AIR-WAY MOULDED VARIOMETER
A combination of the finest known insulating material with precise assembly and accurate winding—careful AIR-WAY manufacture doubles effectiveness and reduces interference.



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A compact Rheostat wound with non-corrosive resistance wire over a substantial insulating ring. Trim, workmanlike, effective and durable.

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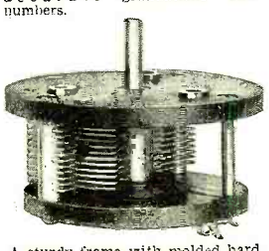

A sturdy frame with molded hard rubber endplates; uniformly mounted to assure maintained accuracy.

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GREEN SEAL RADIO EQUIPMENT

The aim of the Air-Way engineers and the policy of the Air-Way Corporation are united in the production of Radio equipment which bears the unmistakable imprint of intelligent design, expert craftsmanship, and genuine quality throughout. In the Air-Way factory there is no compromise between quality and cost. Scientifically organized production by men skilled in volume manufacture of fine electric instruments and equipment is entirely responsible for the attractive prices at which Air-Way Radio parts and complete receiving sets are offered to the public. The Air-Way Green Seal Guarantee Tag attached to each Radio instrument is a symbol of quality that is known and preferred by experienced Radio buyers.

Air-Way Electric Appliance Corporation
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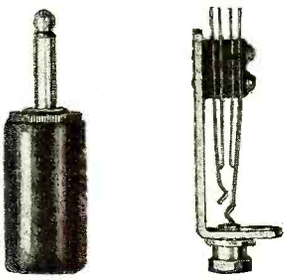
Air-Way instruments appeal most to those dealers who are wisely preparing to merit a successful and growing radio business by selling products of reputation and genuine quality at fair prices. Write for Air-Way Radio Bulletin.

AIR-WAY new, light - weight, positive contact tube sockets save bulbs and maintain perfect connections. New design.

No professional operator would ask for a more precise and enduring instrument than the AIR-WAY Green Seal Variocoupler. It is built right and stays right.



AIR-WAY Jacks and Plugs are built especially for the finer radio apparatus to do away with the loose connections for which plugs and jacks are frequently responsible.

AIR-WAY Amplifying Transformers do more to eliminate the whines and shrieks than any other similar piece of radio equipment. They prove their own merit by comparison.

that radio communication should be carried on by dots and dashes, if they persist in their unjust criticism of those just entering the game. After reading a rather narrow criticism on the part of some brass pounder I often wonder how he ever progressed enough to try out radio in the first place.

I have said more than I intended to, but looking it over I guess it sums up just how I feel, so I will give one more cheer for RADIO NEWS and call it a night.

ARTHUR R. QUACKENBUSH,
288 Parsells Ave.
Rochester, N. Y.

HELPFUL CRITICISM

Editor, RADIO NEWS:

Referring to Mr. A. G. Trenholm's article in the July RADIO NEWS, Mr. Trenholm possibly has not heard of special amateur stations, and that such stations operate on wave lengths of 200, 300, 375 and 600 meters, as the case may be. He says they are commercial stations. How does he know this if he cannot read the code (which he admits)?

I would suggest that Mr. Trenholm find out what stations are interfering and then find fault. He may have heard a special amateur station working on his 375-meter wave-length, or possibly a commercial on his 300-meter wave-length. Either being the case, why pick on them? The Spark Station was here first. The majority of said stations are within the law in reference to wave-length and decrement. Possibly the fault was due to the receiving set and not at the transmitting end of the circuit. The set which you used, Mr. Trenholm, is not considered a very selective one and this is where the fault may lie. Again, the station that interfered with you may have been only a few miles away. That would account for the interference to a great extent. Why not have your receiving set calibrated, then you will know what W. L. you are receiving on?

I have had some experience like Mr. Trenholm's and in the majority of cases found that the trouble was due to the station being very close, or the receiving set not being very selective. Friends of mine have had the same experience and invariably found the cause due to the same reasons. The radiophone listener will do well to find out who is causing the interference and how it is caused and then raise a rumpus about it.

I hope the readers will not take offense but rather think the matter over and be more discreet in their judgment.

R. H. FREY,
Bangor, Pa

WHERE AMERICAN MANUFACTURERS LOSE

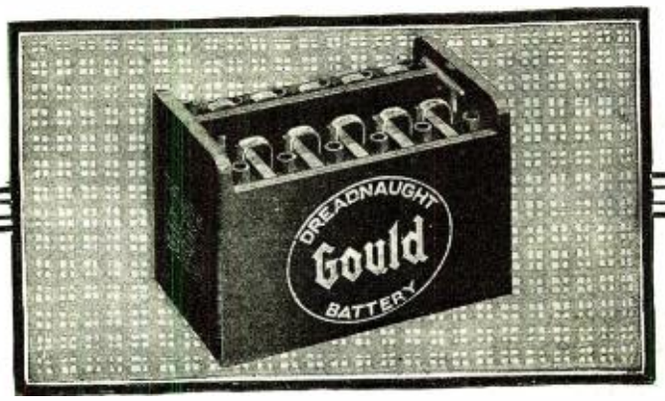
Editor, RADIO NEWS:

On Feb. 14, 1922, a meeting of a number of local wireless enthusiasts was held to discuss ways and means of importing their own radio apparatus.

This meeting was held as the result of its being almost impossible to purchase anything in the radio line in New Zealand. Practically the only firm represented here is the De Forest Co., and their prices are so high that it is beyond the average amateur to possess a decent set.

At the above meeting the writer was asked to act as agent, and was instructed to get in touch with two or three firms for their catalogs and prices. Under date of Feb. 17, 1922, I wrote to the Navy Dept. at Washington, D. C., and to the W. B. Duck Co. On the 18th I wrote to the Radio Corp. of America, the Precision Equipment Co. and others.

As these firms charge for their catalogs, I called at the Post Office in order to purchase U. S. A. stamps, but they were unprocurable. The banks would not pass a draft for a small amount such as 12 to 25 cents, but



The Gould Radio "B" Battery is uniquely designed, compact and attractive. Provides 24 volts variable in 2-volt steps. Non-slopping hard rubber case. A battery that does not detract from the appearance of the finest set and assures a steady, continuous, noiseless service. Ask any Radio Dealer.

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Many receiving troubles variously attributed to "static", weak broadcasting, etc., disappear when a Gould Radio "B" Battery is placed in the circuit.

When once the proper voltage for tubes is ascertained there is no change required in the adjustment. Gould Radio "B" Batteries maintain a practically constant voltage while in operation, and give a steady continuous noiseless service.

Compact; non-fragile; free from danger of buckling or short circuiting of plates or from acid creepage, Gould Radio "B" Batteries represent the highest attainment in storage "B" battery design and construction.

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Gould Radio "A" Batteries are used by the various Radio Branches of the U. S. Government. Built for dependable, continuous service. Made in sizes from 60 A.H. to 160 A.H.

Retail prices $17 to $29 (f.o.b. factory)

advised enclosing coins to the extent of 50% in excess of the required amount. This I did. Now for the result. Seven weeks after writing I received a reply from the Navy Dept. Three weeks later I received a reply from the W. B. Duck Co. saying that they had increased the price of their catalog to 25c. and if I would forward the extra 13c. they would then post the catalog. Is this an example of up-to-date American business practice? Losing foreign export business for 13 cents.

So far the others have not replied. If they could not change our coin, why did they not write and say so? It is not the cash we are worrying about, but the delay and inconvenience.

On March 12, I wrote to an English firm and have not only received a parcel of three dozen catalogs, with a request that I distribute them around, but offering a substantial discount on all orders I can secure. Result, I have forwarded an order for £163 worth of goods, and have another order ready for the next mail for £74.

This letter is written simply to give you an idea of how the foreign amateur is catered to by the American manufacturer.

J. P., D., New Zealand.

The Over-Neglected "C" Battery

(*Continued from page* 865)

tortion of the radio frequency waves which are later to be detected and have their envelopes passed on to the output. The same scheme of connections can be used as well. I hope that future manufacturers of amplifiers will realize the great utility of this device (which is by no means new) and consistently incorporate some provision for the "C" battery in their product.

Radio Antennae and Their Uses

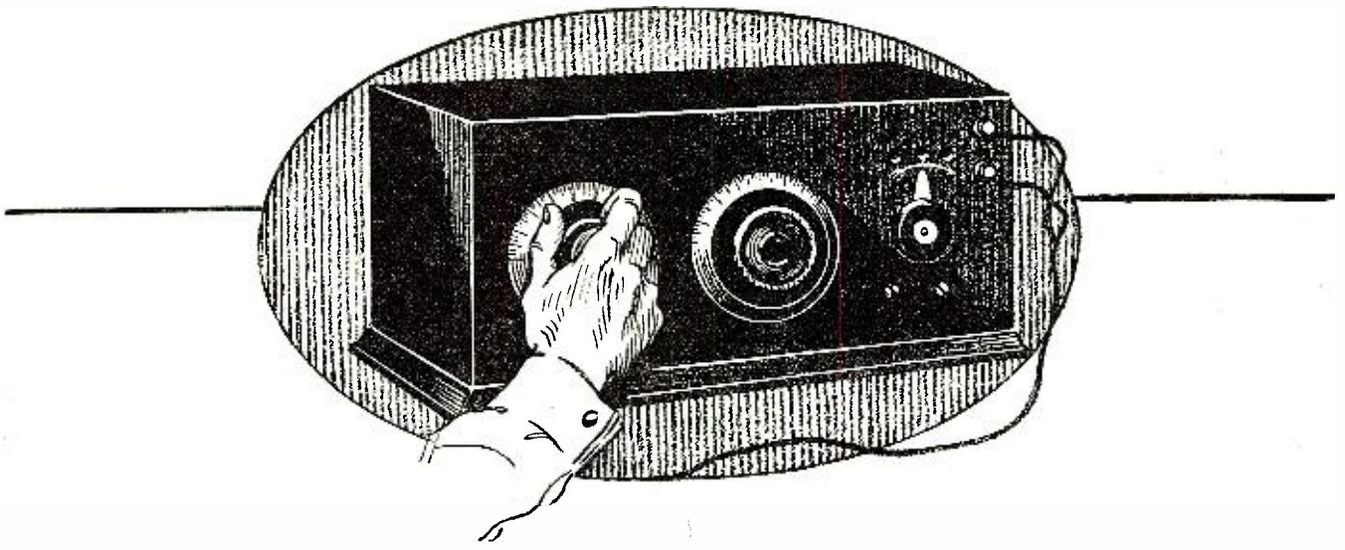
(*Continued from page* 868)

which you would set up by this method would probably not exceed 50 per second. This frequency is so low that it would not produce an audible sound. The most you could hope to do would be to create movements in the air which might be perceived in slight gusts of air upon the face or hands of those who stood nearby.

Let us consider, then, what kind of an antenna is best suited for the work.

Suppose that in our experiment we had substituted a light string for the heavy rope and had then tried to set up vibrations by the means of jerking at its end. What would have happened? Why we should not have had any vibrations at all. The wind would have blown our string hither and thither and no regular oscillatory movement would have been possible. In physics we would say that the reason for this was because the rope possessed a greater mechanical inertia. In the same way we say in radio that an antenna possesses greater self-induction. Self-induction is the result of the physical form of the antenna as well as the energy with which it is supplied. For this purpose the stranded or braided antenna, consisting of 8 or 10 wires in intimate weave, is far more efficient than ordinary copper wires. It has more "snap" to it, as we would say of the rope in comparing it with the string. This quality is equally desirable in both receiving and sending antennae, for the receiving circuit must be capable of moving in like manner to the radiating circuit.

Now let us consider another quality that is desirable to secure. Suppose in our former experiment we had used a length of stiff copper wire instead of the rope. What would result? The vibrations would be "damped" almost before we had them started. We might say that the wire did not have



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the "capacity" to store up the energy applied and use it, but instead dissipated it away on the first vibration. So in radio we need capacity in the antenna circuit so that the energy which we supply at the transmitting station and "pick up" at the receiving station may be stored up for use. The capacity of an antenna is largely dependent upon its physical form. For this reason the flat type of antenna, which offers the greatest "plate surface" in juxtaposition to the earth, is the best.

As to the manner of erection, the inverted L type of antenna is the most common in use and has distinct advantages over all other types. It is subject to high potentials at only one end, whereas the T type is subject to high potentials at both ends. The T aerial gives greater capacity for the same amount of wire, but only at the expense of a lessening of its natural period. T aerials also sag in the center and thus decrease their effective height and efficiency. Aerials made of stranded wire are more flexible under the same degree of tensile strength and this is another reason for preferring them over single copper lengths. What we need in the antenna is height for efficiency and capacity for distance. However, there is a good deal of misapprehension about this factor of height. The difference between placing an antenna 60′ above the earth on a roof and 50′ above the earth *under* the roof is not sufficient to justify the erection of the former, if it is easier to erect the latter. If you can go up 100′ or so in the air by the use of an outside aerial, by all means do so, but unless this is possible, remember that the indoor aerial will give you just as great efficiency and much less trouble.

If you are anxious to get long distance reception, steer clear of "loop" and other trick aerials. They are all right for local broadcasting, if you have sufficient amplification, but you will not find them satisfactory for all-around results.

A Super-Sensitive Receiver

(*Continued from page* 863)

be soldered. To make the connections more readily understood, the following directions may be of aid: The "P" post on the vacuum tube socket is connected to one terminal of one spider-web coil. From the other terminal of the same coil connection is made to one rotor lead. From the other rotor lead to the phone, from the phone to the positive side of the "B" battery and from the negative (-) side of the "B" battery to the ground connection. From the aerial to one connection on the variable condenser, from the other variable condenser terminals two leads are brought, one to the remaining spider-web coil, through the spider-web coil to the "G" terminal of the tube socket. The other lead is brought to the start of the outer winding on the coupler. (The rotor ball should be located at this end of the form.) The switch blade is connected to the ground terminal. The filament circuit is quite simple, the rheostat, "A" battery and filament being in series. Connection is made to the positive side of the "A" battery from the ground terminal. After the set is in operation, it would be well to try reversing the leads to one of the spider-web coils. The connection which gives the maximum results should be employed.

The operation of this receiver is very simple. Wave-length variation is had by adjusting the series variable condenser and the inductance switch. Regeneration may be controlled by varying the coupling of the rotor.

In selecting apparatus, it would be well to bear in mind that the best material, even though it should be more or less expensive,

will give the best results over an indefinite period of time.

Either a hard or soft tube will give satisfaction in this circuit. The regular detector tube is to be preferred. No grid condenser is necessary, although one may be inserted for trial. The apparatus should be mounted on a bakelite panel, set in a suitable cabinet. It would be well to shield the panel to eliminate body capacity effects.

This receiver will function from the lowest amateur wave, 150 meters, to the short wave limit at 800 meters. The results obtained with a good 100′ aerial (outdoor) will well repay the constructor for the time, energy and money invested.

Hints On Elimination of Static

(*Continued from page* 863)

The second aid to the static ridden victim is in the type of amplification employed. Static is largely an audio frequency phenomenon, that is, static produces audio frequency currents. Hence if audio frequency amplification is employed, static interference will be considerably magnified. However, if radio amplification is employed, static will not be amplified much at all, thus producing very little interference in comparison. Hence if the layman will utilize radio frequency amplification he will be less disturbed by static. Too much cannot be said for the radio method of amplification. Unfortunately little data has been published on this method and it is, therefore, not very well known. However, this method will come more and more in vogue with resultant increased satisfaction on the part of the user. The writer has now a loose coupled receiver with two stages of radio frequency amplification, detector and one stage audio amplification. I can safely say that compared with the detector and two-step audio amplifying set, which I had before, my present receiver is excellent and static is entirely absent.

The final means which the writer employs and which does its little bit in the reduction of static is the use of a loop instead of an outside antenna. With a radio frequency amplifier, a loop will be just as efficient, possibly more so, in the reception of phone signals as an outdoor aerial. As far as strays go, the loop is ideal as compared with the outdoor antenna, for the following reasons: In the first place, the loop picks up less energy than the outdoor aerial. While it is true that the loop also picks up only a small percentage of phone signals compared with the aerial, it is also true that the loop picks up a smaller percentage of static as compared to the aerial. In other words, with a loop the so-called signal to static ratio is higher than with an aerial. In the second place the directional effect of the loops assists greatly in reducing static interference. Experiment shows that static comes from all directions. Outdoor aerials are not very directional at best and consequently the outdoor aerial picks up static from all directions. As the loop antenna is extremely directional, it follows that it picks up static most from one direction only and cuts out the static from other directions, thus reducing static interference tremendously.

The three methods herein outlined have proved to be very efficacious in reducing static considerably and are approved by the very best engineers. Loose coupling between antenna and secondary of receiver, the use of a loop instead of an outdoor antenna, and the use of radio frequency amplification as much as possible in preference to audio. A combination of radio and audio amplification will be good. The use of radio frequency amplification immediately eliminates, any

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EVEREADY "A" BATTERIES

—hardwood box, mahogany finish
—convenient handle, nickel plated
—rubber feet protect the table
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No. 6860—90 Amp. Hrs.—45 Lbs..... $18.00

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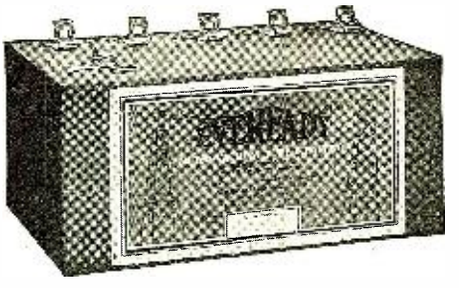
EVEREADY "B" BATTERIES

No. 766 is the most popular size in use. Contains 15 cells and has a long service life. Equipped with five positive Fahnestock Spring Clip Binding Posts ranging from 16½ to 22½ volts, making it the most desirable type for use with vacuum detector tubes, such as Radiotron, Model UV-200. Dimensions:—Length, 6⅝″; width, 4″; height, 3″. Weight 3 lbs. 7 oz. **Price, $3.00.**



EVEREADY "B" BATTERIES can also be obtained in the following types:

No. 763

Especially suitable for use where light weight or small space is essential, such as in small portable sets. Contains 15 cells, enclosed in waterproof cardboard box, equipped with two coil wire leads. Initial voltage of 22½ volts. Dimensions:—Length, 3⅜″; width, 2″; height, 2½″. Weight, 13 oz.

Price, $1.75

No. 767

Contains 30 cells of the same size as in No. 766 and is therefore approximately twice the dimensions. It has the same voltage taps as the No. 766 and in addition has a 45-volt tap; all Fahnestock Spring Clip connections. The lower range of voltage taps is to be used in connection with the detector tube, and the 45-volt tap for the amplifier tubes.

Price, $5.50

No. 746

Consists of 72 cells equipped with two coil wire leads enclosed in a wooden box, made airtight. It gives 108 volts and is most widely used in conjunction with loud speaking devices, such as the Magnavox. It is especially suitable for theater and auditorium use, or outdoors, where the message must be carried to the longest distance required. Dimensions:—Length, 17″; width, 9″; height, 3½″. Weight, 20 lbs.

Price, $15.00

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objections to the use of the loop, since the weak signals are amplified.

Good sets employing these means can be bought on the market from reliable concerns, and the industrious novice will find it to his great advantage and experience to put up an outfit like the above. He will be repaid many times over for his trouble by the results and satisfaction he will get.

Contributed by L. R. FELDER.

Start a Radio Chart

(*Continued from page* 840)

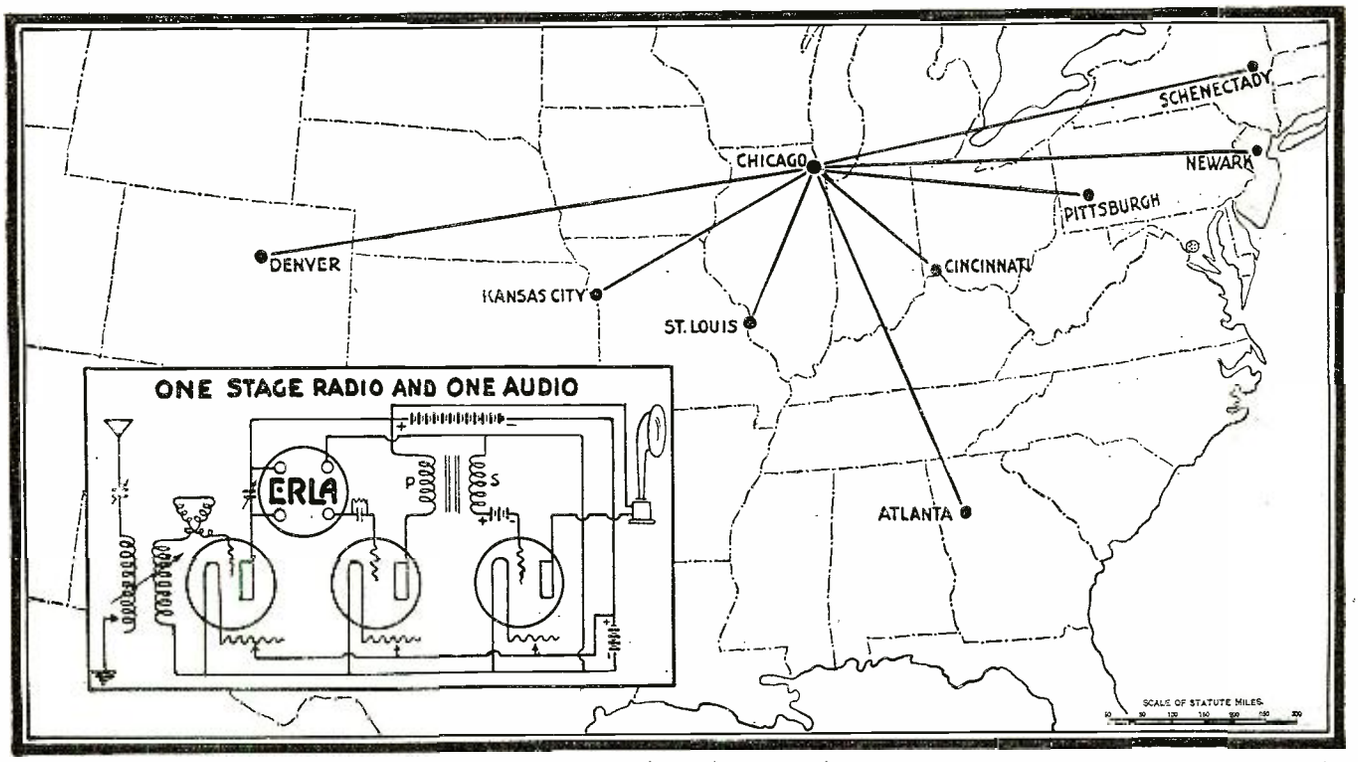
four hours." As this reached me at 8 a. m., I was sure there must be some mistake. The twenty-four hours would not be up until afternoon about the time the paper would be circulated in the cabins.

I mentioned the matter to "Sparks." He laughed, and showed me his chart. The position of each radio-equipped ship on the Atlantic was indicated thereon by a pin. Knowing the range of his radio outfit and all the others, he called each ship he wanted only when she was near enough to hear. Also, knowing our speed and theirs he was able to predict how long, barring accidents, they would be able to exchange messages. The *Ivernia* was sent to the bottom by a submarine in the Mediterranean while serving as a hospital ship during the war and the *Lusitania* was sunk by the torpedoes that raised America to do her duty. A gold star for each.

The next star marks the Navy Yard at Portsmouth, Va. I took a party of Salem boys to the Jamestown Exposition. We arrived early and not much was open except the ticket office, so we entertained ourselves by seeing the points of interest in the surrounding country. The Naval officers at the yard were very kind to us and showed us even the radio room, which ordinarily was not open to visitors. There were quite a number in the party, but the operator took pains to put a telephone headset on each one of us so that we might hear the signals coming from the Navy Department in Washington. This was a rare experience, for in those days radio stations were scarce and very few persons except the employees, ever saw the inside of one. The courtesies extended showed a disposition on the part of the Navy, which it has always retained, to take an interest in boys. A majority of the members of that party became officers in our fighting forces ten or eleven years later, when they were needed.

Then I have a star on Brooklyn, New York. I went to work in the Central Y. M. C. A. there in 1910 and among the first things started in the Boys' Department after my arrival were a Boy Scout troop and a Wireless Club; Lloyd Espenschied was the leader of the latter group. A few years earlier he had gone to Camp Dudley, the first organized Y. M. C. A. boys' camp. A wireless instructor had been engaged, but he did not come. Espenschied's tentmate informed the campmaster that Lloyd had a trunkful of wireless stuff with him. Espenschied was asked to take the place of the absent instructor and he made good. So he knew all about boys and wireless and when he was invited to become the leader of the club at home he gave the best sort of instruction. He was the man selected in 1915 to operate the receiver in Hawaii that brought in the voices from Arlington and New York in the first radio telephone test that spanned a continent and an ocean.

Star number five on my chart is beside Car Pond, rechristened Lake Stahahee in later years, one of the liquid gems in the great Interstate Palisades Park west of the Hudson River. In 1914 I attended a Boy Scout Camp there. P. B. Colleson of the Marconi Company was the official radio operator. He had what for those days was a good outfit. He used to let me listen in and get the time signals from



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Write for literature and prices on tube sockets, phone plugs, bezels, grid leaks, grid condensers and other standard ERLA products.

Voice and music a thousand miles distant are heard perfectly through a loud speaker with the hook-up shown above, using one stage of ERLA radio frequency amplification. And this result is accomplished with a complete absence of the tube noises and distortion that so frequently take the pleasure out of radio reception. Furthermore, tuning is extremely simple and non-critical, so that even the most inexperienced amateur has no difficulty in getting perfect results.

The purity and tone quality of voice and music received with ERLA radio frequency will prove a revelation. Using a loud speaker, and one stage of audio amplification, the tone volume and quality of reproduction are equal to a first class phonograph. Radio reception is a real and genuine pleasure, a never ending source of interest and enjoyment, when ERLA radio frequency amplification is employed. Write us for diagrams of guaranteed circuits using one or more stages of ERLA radio frequency. Do it today.

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ERLA

TRADE MARK REGISTERED

Arlington. This experience had a punch which the others had lacked. We were miles from a railroad or telephone station. The war had broken out in Europe and everybody was anxious to know how it was developing. To get the news up there in the mountains and give it to the Scouts and their officials was thrilling.

Over in Manhattan I have a star, showing where I took a course in radio theory at the East Side Y. M. C. A. radio school and secured a commercial operator's license.

The transport radio operators gave me many helpful tips and let me listen in as much as I wanted to. Once they scared me blue by leaving me all alone with the set while they went down to hit the Java pot. This experience helped me to realize the difference between theoretical and practical education. The effort of concentration required to catch even a slowly transmitted call, when I knew I was responsible for getting it, put me in a perspiration and half an hour of this tension tired me more than a hard day of work that I was accustomed to.

There was a chart above the receiver and three or four times each trip the operators would put red spots along our course. I found that these indicated floating mines reported by the hydrographic service. We missed one of these by about two yards.

Both of these transports were using crystal detector sets. Of course the operators were longing for vacuum tubes that would enable them to keep in touch with one coast or the other all the way across, but their ships did not rate them and they could not be secured from the Navy nor in the market. One of my "Y" instructors picked up two tubes and I bought the accessories and we installed a tube receiver on the first transport. Then he got a tube for the other one and the operators installed that. In both cases the ship's officers expressed appreciation. On another transport I copied, while a thousand miles at sea, a greeting from a national organization to a delegation of its members on board. The operator was talking with the captain. The message was included in a Navy broadcast, which would not be repeated. Had it not been for my knowledge of code and Navy schedules it would not have been received.

A star at Douglaston, Long Island, marks the first radio set I ever owned and installed for myself. I put that in as soon as the withdrawal of the war-time restrictions permitted. Constant practice with this simple outfit, which cost only a few dollars, developed speed in code reception. It was here that I discovered the Amateur Broadcast transmitted daily by the Radio Amateur Bureau of the Third Naval District. In the craze for radio amusement the benefit to be derived from these broadcasts is now overlooked by many who could get more pleasure and profit from concentrating on code for fifteen minutes a day than they do from tuning in one concert or lecture after another merely for the sake of saying that they heard them. Anyone, even a party line telephone subscriber, can listen in and hear English conversation, but only a man with a purpose and a will to achieve it can master code, which is used for most messages that need to be accurately recorded.

Copying Government broadcasts, acknowledging them when replies were asked for, and doing what I could to interest others in them, I became Radio Amateur No. 1 on the list of the Radio Amateur Bureau and Seascout Radio Commodore of the Boy Scouts of America, whose official announcements are transmitted in connection with the Amateur Broadcast. These appointments indicate that, while technical radio ability is not hard to find, civilians who are actively interested in promoting free Government radio service for the public are scarce. All I had was a limited knowledge of radio and the desire to make it useful to somebody.

There is no radio amateur or novice in

this country who could not, within a short time, become an important factor in the life of his community and of his country by doing simple things that are easily within the range of his ability. While technical amateurs try for distance on one hand and concert listeners spend their time seeking amusement on the other, much of the value of government broadcasts is lost in every community for the lack of one amateur operator enough interested in the welfare of his town to pick up the information transmitted and post or publish it. "Deadly dull" said one typical technical amateur of this public service. So is any work unless the worker's heart is in it. The technical amateur has proved himself to be a valuable asset to his country. He comes to the front in emergencies like the storm in Wisconsin last February and by reason of his experience gained in experimentation provides communication when the railroads and wire lines are wrecked. But there is a greater and a constant need for amateurs who, backed by local boards of trade and chambers of commerce, will devote an hour a day or more to getting for their towns the benefits which technical radioists have made possible. As the matter stands today the average town and city is like a hamlet which stands beside a transcontinental railroad carrying all sorts of commodities that its citizens need, but gets nothing but the smell of soft coal smoke.

After Douglaston, Manhattan got another star. On moving into the city, I installed my first vacuum tube set. Then I began sticking stars and dots all over the map, showing the stations I heard. Some of these were as far away as Cuba and Porto Rico. But hearing a distant station was less interesting than inviting others to listen in. I made it a practice to invite editors, writers and others whom I knew were going to exert an influence on public opinion concerning radio to try my outfit, and quite a number had their first radio experience here.

In the summer of 1921 I took my outfit to my old home town in Pennsylvania, where I started some Boy Scouts to building receivers and talked and demonstrated radio to scores of other persons. A year later I found that the Scouts had succeeded well with their home-made outfits and that the American Legion building was equipped with a good receiver. The star up there in the mountains will be kept bright by other visits, though the fact that the Scouts selected the trapping of skunks as the best means of raising money to buy radio material prevents my being as popular as I would like to be. They caught them alive and kept them in cages in the back yard, where they eventually skinned them.

Later in the season, I went to the Interstate Palisades Park again to set up and operate a station. The single Boy Scout camp of 1914 had grown to a group of twenty or more under one management and a number of scouts were operating stations in the different camps. I installed mine at the general headquarters and the daily Navy press was copied and posted. Before I was aware how much my outfit, with a high and long aerial, had increased the range that it had in the city, a Scout who worked with me tuned in French, German and British stations.

Then radio became a national craze. I went to Washington to keep in touch with the Government departments concerned with the use and regulation of the new means of communication. I had experiences there aplenty that deserve stars on my chart. In one station I heard Lyons, France. The receiving outfit occupied about half of an ordinary sized desk. Antenna and all were there. There was no outdoor wire connecting with the receiver. A few minutes there convinced me that it is going to be much harder for nation to plot in secret against nation than it has been. They can all hear each other too easily now. Soon

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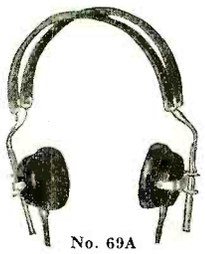
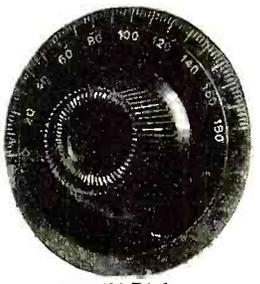


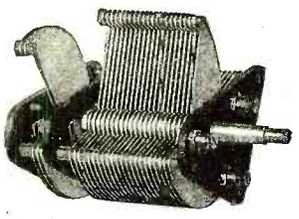
No. 69A
Head Set, $12.00

No. 21 Microphone, $7.35

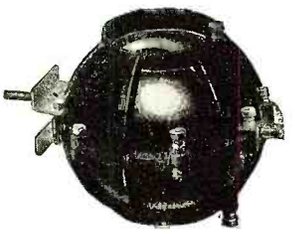
No. 2
Tube Socket, 75c



No. 501 Dial



No. 505 Variable Condenser



No. 501 Variometer

Grid Condenser, 75c; with No. 502 Mtg., 45c; complete, $1.20

Air Choke Coil, $3.50

No. 501 Four Conductor Jack, $1.10

Grid Leak, 25c; and Condenser, 75c with No. 503 Mtg., 85c; complete, $1.85

Iron Core Choke Coil, $1.00

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Set of 501 Condenser Mtg. Clips, 20c

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is made in standard resistances and ratings. Only the highest grade material is used, and first-class workmanship assures a product that guarantees high efficiency and durability.

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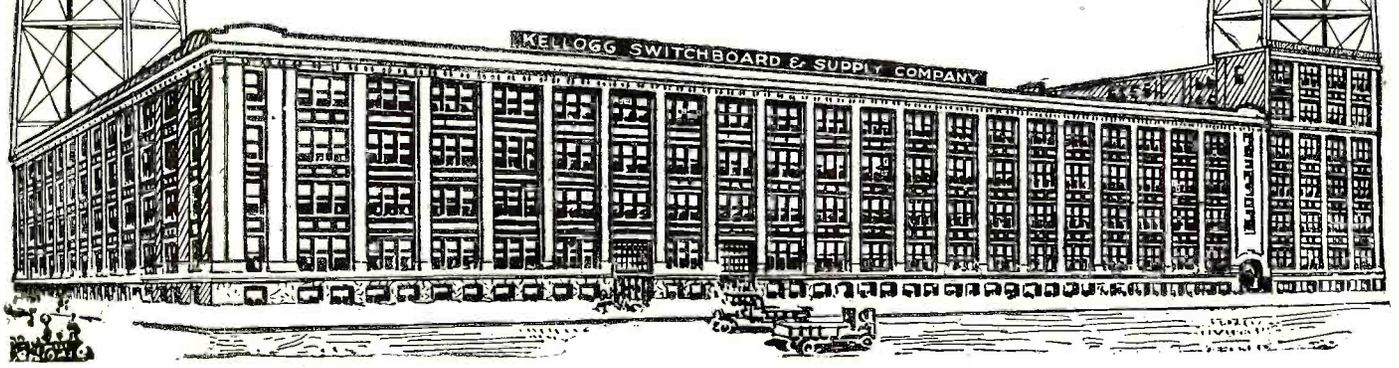


after that I was told about the Navy's high powered transmitting stations that pump the truth about America into China and other distant nations in a flood that cannot be dammed, unless you spell the verb another way. Other nations object. They would like to be able to censor what is said about America in countries where they have financial and other interests that do not thrive in the face of American competition.

For eight months the receiver I operated myself was a crystal detector set that cost $25. The dealer who sold it to me said the crystal detector was obsolete. The technical amateurs laughed at me as though I had gone back to playing with the ABC blocks of my childhood. But I heard more lectures all the way through, copied more useful code messages and gave better radio concerts and sermons to my friends than any of the fellows I knew who were working tube sets. I picked up several messages from President Harding and other officials high in the Government service. I heard of the *Roma* disaster immediately after it occurred as I happened to be listening to communications between airplanes overhead and the Naval Air Station at Anacostia. I had interesting entertainment whenever I cared to put on the phones.

Trips from Washington brought me into contact with other towns. I stuck a star on Waterford, Virginia, where a physics instructor who taught radio listened interestedly to the time signals from the Naval Observatory that my receiver brought in and learned about the system by which it was broadcasted. Harrisonburg, Virginia, has a star because there I listened in at the store of a local merchant who was covering his territory for radio by using a systematic plan which it would be hard to beat. He had divided his field into districts and devoted his first selling effort to placing a good receiver with a representative citizen in each district. After these sets were installed the advertising took care of itself to quite an extent. Better than this he sought out a young man who had been confined to his bed for 17 years on account of an accident that stiffened his spine. He had enough use of his hands to operate a receiver and one was installed. One evening he had a thrill, which cannot be understood by those who have never been isolated from the world, of hearing music, lectures and other entertainment from half a dozen distant stations. For him it was like rising from the grave. Once more he has a life before him.

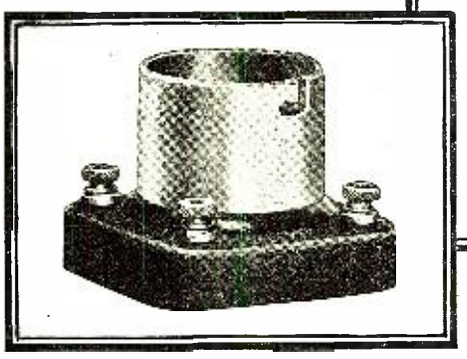
While I have been but lightly inoculated with the itch for distance I have scanned with interest the charts of amateurs who are accomplishing wonders. Hastings of Washington seems able to get Catalina Islands, off the coast of California, almost any time he wants to and frequently he hears Hawaii. There is a young Scout half his age in the city who hears Seattle.

If radio development continues at its present pace we may as well all get a map of the world and stick a star on every town of any size. It seems probable that in the near future we will be hearing them all. Six miles from Washington I heard a weak station in that city, with a suitcase. Of course the bag had a receiver in it. The whole receiver was inside, antenna and all. Now E. H. Armstrong comes along with his super-regenerative hook-up which is many times as sensitive as the best we have had heretofore. Transmitting stations are multiplying their power and efficiency. The Department of Commerce tells us that regulations will be made and enforced that will give us a chance to hear one station at a time instead of a babel.

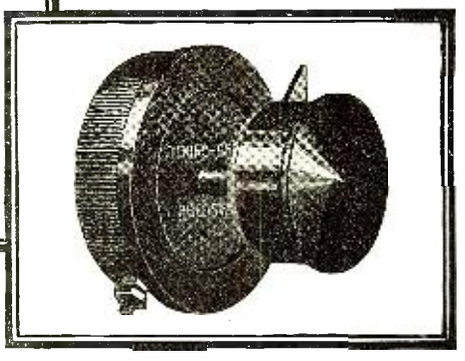
Whatever may be the course of radio, the radio chart will add to the enjoyment of the game. A broadcasting chart and schedules are necessary in order to know what we want to hear and when we can hear it. A receiver's chart is just as

The Thoro-bred Dial Type CD-5. This "raised axis" keeps the edge of the dial 1/64" from your panel at all times, effecting easy operation and no scraping of panels. Combining all features essential to perfect operation without friction and other difficulties. One of the indispensable trio. Price 90c.

The Thoro-bred Rheostat. Type R-90. Has a resistance of five ohms. No vernier adjustments necessary. Adaptable for either table or panel mounting. Silver plated, highly polished. One of indispensable trio. Price $1.10.



Thoro-bred Tube Socket Type S-12. Base of molded bakelite which unlike ordinary shellac compositions used, reduces leakage to a minimum. Price $1.00.



The Indispensable Trio

THE Thoro-bred Rheostat, Dial and Vacuum Tube Socket are an indispensable trio for every tube set. Without these three you will not know the best results your receiving set can give. Here's why.

The Thoro-bred Rheostat enables you to secure the maximum detector action through its extremely close adjustment of the filament control. It has a resistance of five ohms, which eliminates the use of a vernier adjustment, since the resistance of one of its turns of wire on the resistive element is so small that the effect is not noticeable on the tube. All metal points are silver plated. It is adaptable for either table or panel mounting. Molded parts are of Bakelite. Knob is supplied with pointer and is of the same design as the dial. Patent applied for. Price, $1.10.

The Thoro-bred Tube Socket is the second of this indispensable trio. The tube insert is of brass, heavy nickel plated with high polish. The base is of moulded bakelite, making it possible to withstand high heat. The leakage from the grid to the filament is reduced to a minimum. Bakelite used in the Thoro-bred Socket does not absorb the moisture or cause the leakage as in other sockets employing the common shellac composition. It gives a better appearance and holds the original finish. Price, $1.00.

The Thoro-bred Dial was the first genuine Bakelite dial to be offered with both Clock-wise and Counter-Clock-wise Readings. This dial was also the first to introduce the popular *"raised axis"* which eliminates all panel scraping and friction and permits easy operation. The Brass insert employed—does away with any wobbliness that might otherwise develop. Patent applied for. Price, 90c.

The indispensable trio can be obtained at your nearest dealer. If, for some reason he is not already supplied, send us his name, and your money direct.

THE MARSHALL-GERKEN COMPANY

TOLEDO, OHIO, U. S. A.

Thoro-bred

RADIO PRODUCTS

necessary for recording the high spots in our individual experience and leading us on to greater endeavor. The stars on our charts will be more meaningful if they are associated with incidents in which we helped other fellows to get some of the fun.

Does the Public Expect Too Much of Radio?

(*Continued from page* 840)

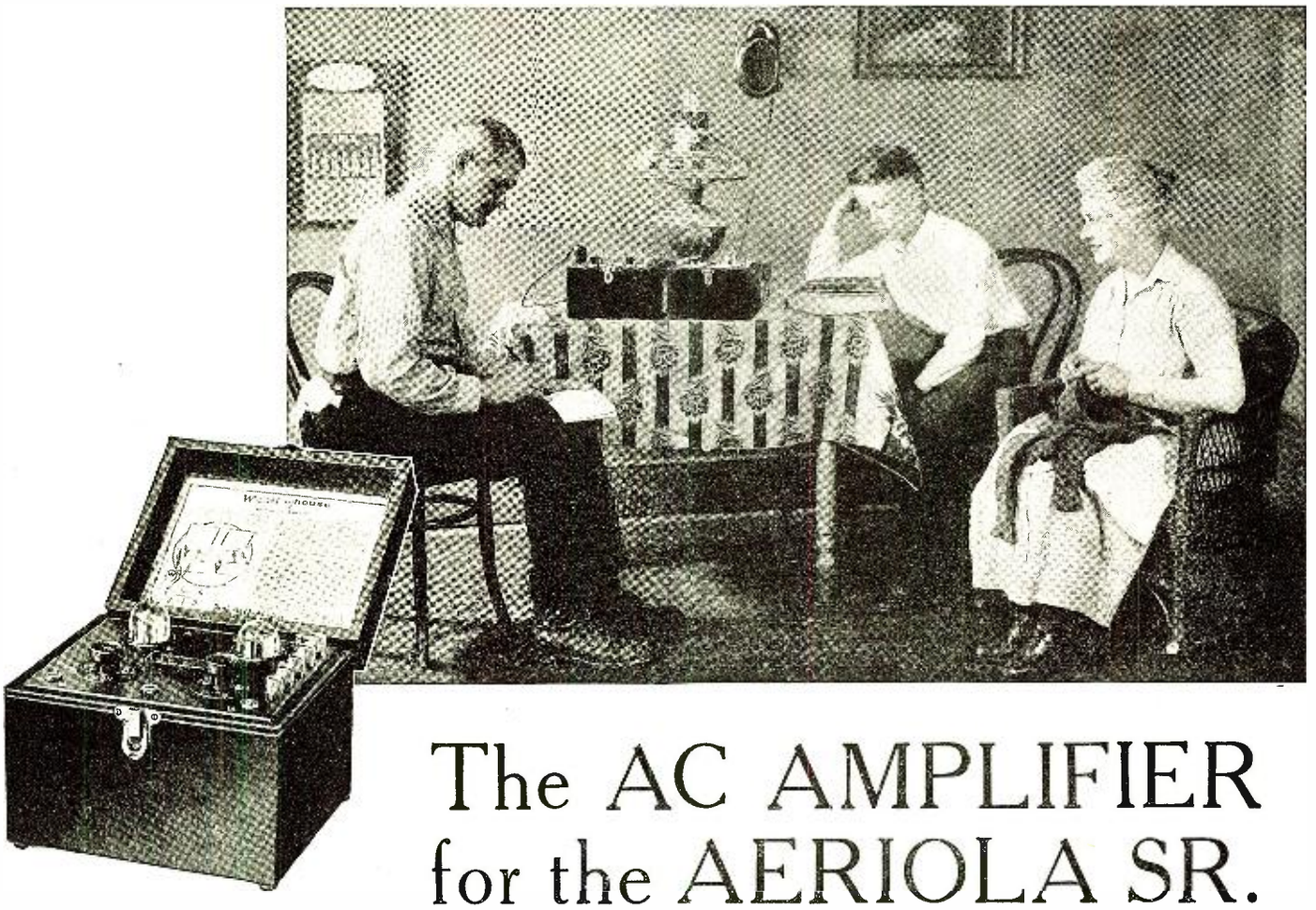
find to require many more stages of amplification before results equal to a regenerative circuit are obtained; another cause for dissatisfaction. Then the question of spark interference arose. Too many manufacturers claim that their equipment positively eliminates such interfering signals. This is absurd; it is not entirely up to the receiving set to do this; the best set is powerless to eliminate interference from a nearby station if that station is broadly tuned. All the tuning in the world will not eliminate the spark set of a special amateur in the next block, working on 375 meters, perhaps a bit broad, when you are tuned to a wave of 360.

Remember, radio is far from perfect. We are just dabblers in the art so far. There are many obstacles yet to be overcome, and they will be overcome, but this will take time, it must. There is no greater science than radio, and as in any of the other marvelous discoveries and inventions, they were not perfected overnight.

Remember further, that any radio receiving set has the following limitations: They *will* pick up static disturbances, or they will involve such a multitude of circuits and controls for its elimination, that *you*, the average man, cannot handle it. Static elimination is not yet complete; what decreasing of this troublesome interference is in practical radio use is in the large high power stations, which have spent thousands of dollars to filter some of it out, to enable reception of trans-oceanic signals.

Interference from telegraph stations has already been discussed, but a word further may not be out of place. If you live practically under the towers of some commercial station, or within a mile or so of a high powered arc installation, you cannot get good results with *any* receiving set. The minute the commercial station opens up with his powerful transmitter, even if he be on 600 meters, you will experience troublesome interference. There *are* receivers which *can* eliminate this by using wave-traps, directional loops, etc., but again, *you*, as the average man, would have a most difficult time trying to find your concert through it. Similarly, if the arc station strikes its arc, the signals you had been hearing will be "blanketed" or greatly reduced in strength, if not eliminated. You cannot do a thing to prevent this. Complaints against the amateur telegraph transmitters, which have been all too foolishly frequent, are not justified. If an amateur station is working on its lawful wave-length, with low enough decrement to comply with the law, and not actually creating wilful interference to destroy your chances of copying a broadcast program, HE HAS THE SAME RIGHT TO THE AIR AS YOU HAVE, AND IS DOUBTLESS ACCOMPLISHING MORE BY A GREAT DEAL THAN YOU! Also a commercial static is certainly of greater value on the air, handling commercial traffic and maintaining a watch over the ships at sea than any matter which might come to you from a popular broadcasting station.

The average radiophone listener is inclined to be an "ether hog." He wants all day and half the night to listen to whom he pleases. This is certainly not fair, and before you purchase your set make up your mind to SHARE THE AIR. Radio is for EVERYBODY, not a select few, and if you



The AC AMPLIFIER for the AERIOLA SR.

AERIOLA AMPLIFIER
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Complete with 2WD-11A vacuum tubes (without batteries)
$68.00

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RCA

This symbol of quality is your protection.

Before buying radio apparatus, always consult the book "Radio Enters the Home." Price 35 cents by mail.

The Aeriola Sr., simplest and most efficient of all single-tube receiving sets, becomes still more efficient with the new model AC amplifier.

No storage battery is required. With only two dry cells, two tubes, and a 45-volt plate battery the model AC amplifier greatly increases the Aeriola Sr.'s range of reception. Used with the Vocarola loud-speaker, the amplifier connected with an Aeriola Sr. fills a whole room with concerts received over distances of 10 to 30 miles.

Anybody can make the simple connections required, including mother and the girls.

Because there are no storage batteries to charge, because both the Aeriola Sr. and this new model AC amplifier are so light and handy, the combination is ideal for Boy Scouts and for campers.

Radio Corporation of America
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Sales Dept. Suite 2070
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New York City

District Office
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Chicago, Ill.

hope only to hear the broadcasted speeches, concerts and entertainments, you ARE expecting too much of radio in 1922. Five or ten years hence it will be possible to do *all* the things you cannot do now. So let's be patient.

Poulsen Plant of German Radio Station

(*Continued from page* 831)

while the rotation of the variometer coil is effected by rope transmission from the handle on the central panel.

The high frequency generator (Poulsen-Lorenz Arc) is installed in a metal case, the flame compartment, where the arc burns between two electrodes. The double-walled mantle of this compartment is cooled by water supplied by a small centrifugal pump to the hollow copper electrode and thence to the flame compartment. After then traversing the water flow controller, the heated water returns to the reservoir, in order to be re-cooled.

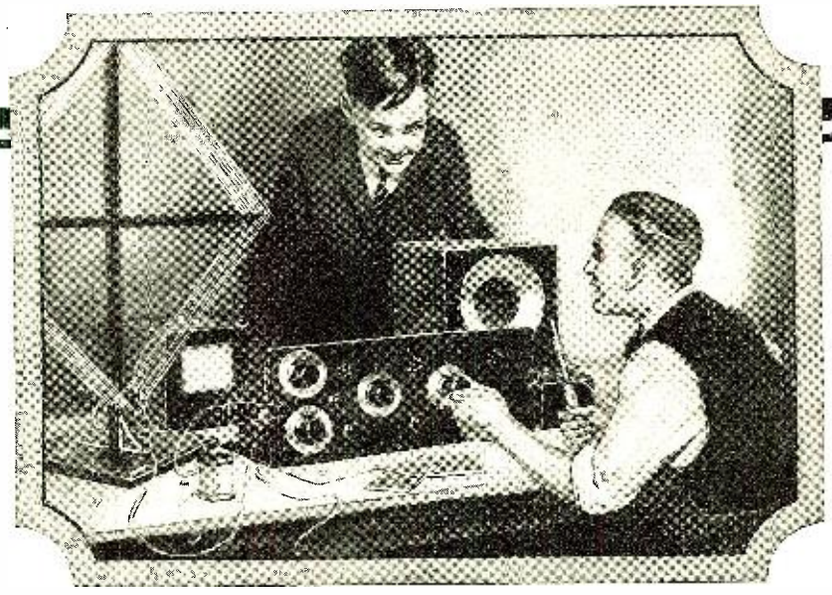
The positive (rear) electrode of the sender at first consisted of a hollow copper body comprising a supply and an escape pipe for the cooling water. This has now been replaced by a rotary carbon electrode. The negative electrode is exchangeable and consists of a round carbon rod kept in a special sleeve. A uniform wear of the carbon as required to render vibrations constant, is insured by slowly rotating the carbon around its longitudinal axis. The hydrogen required is supplied in the form of alcohol from a dropping device and is evaporated at the high temperature of the flame compartment.

The magnetic field where the flame arc is burning is provided between two iron cores penetrating sideways into the flame compartment. These cores are made of Swedish ingot iron and are short-circuited magnetically by an iron bow below the flame compartment. Each core carries six magnet coils excited by the arc current. The automatic ignition of the arc is actuated electro-magnetically on passing from "receiving" to "sending." A magnetic shunt relay, as it is termed, causes the ignition of the vibration generator to be dependent on the magnetism excited in its magnet legs.

The 32-K.W. Poulsen Set at Köenigswusterhausen. In addition to the generator proper comprising the arc destined to generate vibrations, the plant comprises a number of further apparatus, which either form part of the high frequency circuit or are required for controlling the direct current.

As regards, first, the generator, this converts the high tension direct current (of about 1,000 volts) into alternate current of very high frequency. The main portion is the flame compartment from the front and rear sides of which respectively the two electrodes are projecting at an angle, the magnet cores required for the magnetic air-blast and the exciter coils being attached to the right and left respectively. The upper section of the flame compartment, which is subject to the impact of the whole heat from the arc, has been made double-walled with water circulation in the interval. To the front wall of the flame chamber there has been screwed a marble plate carrying two show glasses for choking the water flow and alcohol dropping device (for providing a hydrogen atmosphere in the interior of the chamber) respectively. The two electrodes, placed at right angles to one another, are set rotating at the speed of three to four turns per minute.

A number of switches are required to control the sending service. The wavelength to be used should be adjusted for, machines supplying direct current should be



"The fun in radio is—building your own"

THERE'S no denying it's far more pleasure to build your own radio set than in just buying it ready made. When you make it yourself you know the purpose of every part. Experimenting to get distant stations becomes an absorbing game. You become an authority on radio to whom others look for advice.

The Sleeper Radio Corporation offers a wonderful series of Construction sets. All the difficult, tedious part of the work is done for you. You need only a pair of pliers, a screw driver, and a soldering iron to put them together, follow out the hook-ups, and get ready to tune in on distant broadcasting stations.

Each Sleeper Construction Set is packed in an individual box, complete to the last binding post. The set includes specially prepared instructions by M. B. Sleeper, Editor of Radio and Model Engineering. Every Sleeper Part is standard and interchangeable and can be used for further combinations to secure even greater range.

You can buy the Sleeper Construction Set described below, or any other Sleeper Set, at radio and electrical stores, for a fraction of the cost of a factory finished set. If your nearest dealer cannot supply you, write us and we will see that you are taken care of. If you will also enclose 50c. in stamps we will send you the book, "Design of Modern Radio Receiving Sets," which tells you how to build the latest types of radio equipment. We will also send you *free* the current issue of "Radio and Model Engineering" and a catalog of Sleeper Radio Construction Sets and Parts. THE SLEEPER RADIO CORPORATION, DEPT. 9, 88 Park Place, New York City.

Sleeper Construction Set, Type 2400
with two-step amplifier, Type 3100

PRICE $42.12. This combination of the Compact Receiver, listing separately for $14.12 and the two-stage amplifier listing at $28.00, makes an ideal receiving equipment for all-around use. It gives all variation of wave-lengths of from 100 to 700 meters. The receiver is a one-tube set complete in itself, specially good for portable purposes. With the two-step amplifier the signal strength is increased powerfully, permitting the use of a loud speaker. The amplifier is equipped with three jacks so the detector can be used alone or with one or two stages of amplification. The best for all around service.

SLEEPER
Radio
CONSTRUCTION SETS

started and regulated, auxiliary apparatus, such as the motors driving the rotary electrodes, the water pumps, fans, etc., should be started and stopped; voltmeters and ammeters in the case of direct current and wave-meters, vibration controllers and ground-ammeters in the case of high frequency currents are used to watch the electrical phenomena. All the checking apparatus and controlling handles are combined on a switchboard installed in the sender compartment between the generator and coil system.

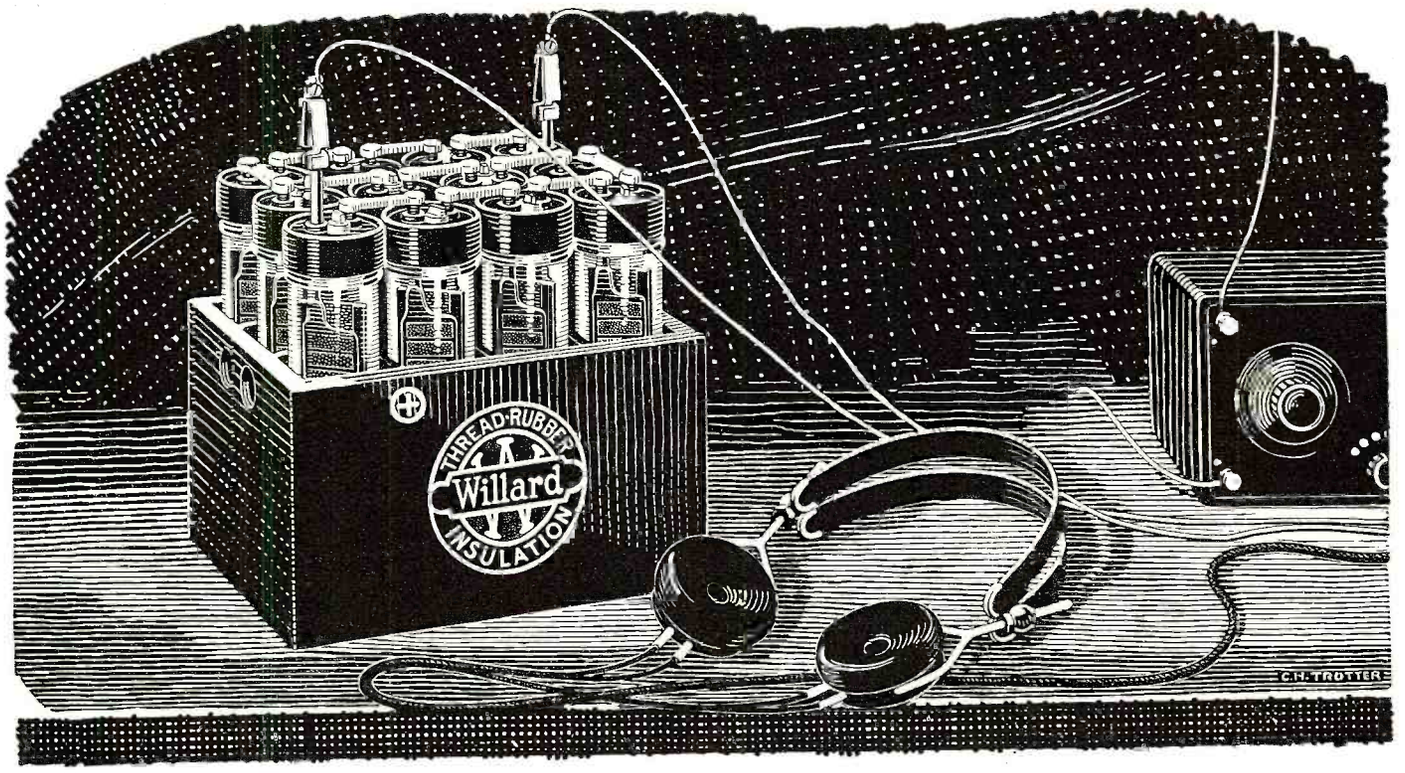
In order to be able within given limits to send with any wave desired, suitable coils have been provided which are switched into the antenna circuit, in addition to which there are used two variometers arranged in series. Two sets of coils (comprising six and nine cases, respectively) serve to obtain waves of up to 20,000 meters.

Inasmuch as, in sending out Morse signals, it would be unsuitable (because of their tension and intensity) to make and break the sending currents directly by the hand key, the latter is only used to close a direct current of small intensity and the voltage corresponding to the local mains, which, in its turn, by means of magnet coils, closes and opens the sending current proper. The diagram of connections of this *key relay* is shown in Fig 12: T is the hand key, H an auxiliary relay, S_I, S_{II}, S_{III} are three pairs of coils the current of which is interrupted by the contact levers K_1 and K_2. The contacts controlling the paths of the high frequency current are set moving by the magnetic effect of the double coils I, II and III, coils I and III comprising stationary iron cores, while the core of coil II is movable in the direction of the axis. The pairs of coils I and III are permanently traversed by current, so that the magnetic field of the one is opposite to that of the other pair of coils. In the case of the middle pair of coils, however, the direction of the current and, accordingly, that of the magnetic flux, are kept changing under the influence of hand key operation, so that the movable core, in accordance with Morse signals, will alternately move in an upward and downward direction.

The following current path can be made out in telegraphing: Coils I and III are permanently kept supplied with current from the mains. As long as the key is open, the magnet coil of the auxilliary relay H will not receive any current, so that the tongue of the relay, thanks to the resilience of the spring f, is applied to the contact b. No current is allowed to flow through S_{II}, the cycle still being interrupted at K_2. As, however, the key is pressed down, the coil of H will receive the current, so that the resilience of the spring f being overcome, contact is made at a, thus providing a closed current path from the positive pole across a, K_1, S_{II}, K_2, to the negative pole and causing the magnet core in S_{II} to move upwards, until the extensions of the magnet core also throw the levers K_1 and K_2 upwards (dotted position). The current through S_{II} *is interrupted at* K_2, the magnet core being only kept by attraction clinging to the upper position. As the key is released, the auxiliary relay H will become unmagnetical, the spring f making the contact b, so that now from the positive pole across contact b, *lever* K_2, S_{II} and K_1, to the negative pole, there is flowing a current of opposite direction to the former, until the resulting downward motion of the magnet core has caused also K_1 *and* K_2 to change their contacts and thus again to interrupt the current path at K_2. The magnet core only remains in its lowest position until the key is pressed down anew.

A self-recording wave-meter enables the wave-length to be read from a scale as simply as voltages and current intensities are read from voltmeters and ammeters respectively.

The same as it is necessary accurately to ascertain the wave-length radiated from

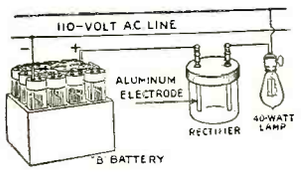


Your Phones Tell You the Difference!

Quiet! *You'll* notice it; and anybody else who listens in on a set equipped with Willard Radio "B" Batteries will at once get the answer to Willard popularity in the radio field.

The Willard "B" Battery is a 24-volt rechargeable battery with special radio plates, Threaded Rubber Insulation, and well-spaced glass jars with rubber screw-tops. This special construction *prevents the leakage* that is responsible for two things in the ordinary battery: First, the disturbing hissing and scratching noises; and, second, rapid discharge of the battery.

Willard Radio "B" Batteries hold their charge for surprisingly long periods under radio operating conditions, and can be recharged and made practically new, at slight cost. See the Willard "B" Battery—also the 6-volt All Rubber Willard "A" Battery—at your dealer's, or the nearest Willard Battery Station.



This Willard Colloid Rectifier will keep your "B" Battery charged at *practically no cost* for current.

WILLARD STORAGE BATTERY CO., Cleveland, Ohio

Made in Canada by the
Willard Storage Battery Company of Canada, Limited, Toronto, Ontario

Willard THREADED RUBBER BATTERY

the antenna, the vibratory condition of the antenna current must be submitted to permanent supervision. The vibration tester represented in Fig. 8 has proved a valuable means of solving this task in actual service. It comprises a small motor the axis of which carries a hard rubber disc inserted in a brass ring; a readily exchangeable helium tube inserted into the latter is at one of its terminals connected with the brass ring and at the other with the motor body. The hard rubber disc rotates within another, a stationary brass ring supplying current to the helium tube. When, as shown, two incandescent tubes are arranged on the rotating disc, the vibratory condition can be observed permanently in two circles. A uniformly lighting disc, as in Fig. 9, tells the official in charge of the service that the vibration circuit in question is traversed by currents of constant amplitude. The apparatus is especially valuable in wireless telephony for ascertaining the influence of spoken words on the course of vibrations in the radiating system. Fig. 10 shows records of the spoken vowels *"a"* (as in "father") and *"o"* respectively, as obtained by means of the vibration tester.

A Swiss C.W. Transmitting Station

(*Continued from page* 831)

supplied from a power station into direct current, while the other, viz. a gasoline engine designed to be coupled to the direct current, feeds an alternate current converter supplying the 500-cycle alternate current required for operating the sender.

The sender is a standard Telefunken 1-K.W. tube set, deriving its anode tension from the alternating current, previously transformed to 3,000 volts and rectified. The alternating current, moreover, serves to heat the filaments of the sending tubes. The transmitter, with a range of wavelengths from 400 to 5,500 meters, will bridge distances of 1,000 to 1,500 kms., the key being either operated by hand or by means of a Siemens high-speed telegraph, through distant control from five different Swiss cities. The key-relay will readily deal with 120 words per minute. Additional apparatus for wireless telephony has been provided.

The corresponding receiver plant at Dübendorf comprises two separate receivers which are either used in connection with a vertical or with a loop antenna. Morse recorders have been provided.

It is hoped to use this station not only for direct radio communication with Berlin, Paris, Rome, Vienna and Prague, but for an economic broadcasting service on the lines of the one arranged in Germany.

Tremendous Possibilities of Radio

(*Continued from page* 833)

apparatus, which he can carry in his kit with ease, and before he departs arranges with the power plant owners for service; then when he reaches his destination, no matter how wild and inaccessible it may be, he can be supplied with all the light and power which he may need.

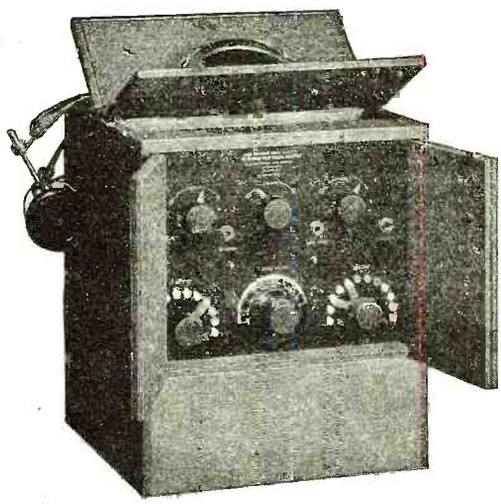
I am looking with the greatest confidence to an application of the wireless principle for purposes of lighting on a vast scale, but this will not interfere with the lighting of cities and populated districts from central plants.

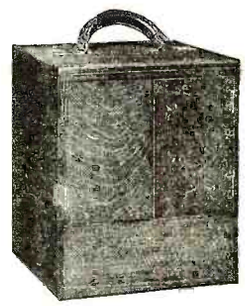
The new art will be of small effect, in itself, on the cost of production. There is an idea in the popular mind that wireless power will be had for nothing, but this is

The A-P Special

A marvelous new A-P Receiver which requires no ground no aerial

The set thousands have been waiting for, made possible by a recent scientific development—*"The Oard Phantom No-ground Circuit"*. The set whose wonderful achievements are astounding the radio world. The set that operates at full efficiency over short or long distances without aerial or ground connection.





"It's all inside"

Purchase this set and enjoy radio at home, enjoy it in your automobile while you are traveling, enjoy it indoors or out of doors wherever you go.

The Oard Phantom Receptor

"Marvelous" is really the word that best describes this A-P Special—*The Oard Phantom Receptor.* For general receiving, it requires only a single short antenna wire which may be concealed in the picture moulding, suspended at some convenient point, laid on the floor or ground, fastened to the bows of your automobile top, or wound around the cabinet of the instrument. It does not require either ground or aerial, *it operates best without them.* It enables the operator to eliminate static and other interference almost entirely. It has all the apparent advantages of radio frequency amplification without its delicate or complicated adjustments. With equal ease and efficiency it receives either broadcasted programs or spark signals over short or long distances. And it works just as effectively in a speeding automobile as on the table at home. Wave-length range 300 to 1,000 meters. *"Your final choice—why not your first?"*

Write for Bulletin E-2 describing this wonderful set in detail, and name of the nearest radio dealer where you may see and hear it demonstrated.

Atlantic-Pacific Radio Supplies Co.

Radio Supplies

646-50 MISSION ST.
SAN FRANCISCO, CAL.

Receiving Sets

far from being so. The primary energy has to be provided, either from a waterfall or by burning fuel.

To sum up, I have always visualized the wireless art as being applied to fields not supplied by present systems. These will endure for a long time, until conditions economically demand the substitution of a new system.

Question: When wireless transmission of energy becomes an industrial fact, will not the larger part of the present system of fuel transportation become obsolete? Will not practically all power then be produced close to, or in, the mine and oil fields and at water power stations?

MR. TESLA: The engineering world at present is developing the so-called super-power system, which I have advocated for twenty years. It will be the means of furnishing energy more economically and over greatly increased areas. Wireless transmission would not seriously interfere with it.

Of course, there are innumerable places where power transmitted without wires would be of relatively greater value and in commercial enterprises this consideration would govern the installation of receivers.

As to the present system of hauling fuel to great distances: Engineers are centering their efforts on reduction of this waste, that being precisely one of the objects of the super-power system. But, while plants operating with wires must be favorably placed, a wireless plant can be located without reference to natural advantages. This is important.

There is a strong tendency now to erect power plants close to the coal and oil fields and the sources of water supply. Industry will be greatly benefited when this idea is carried out on an extensive scale.

Question: Will not wireless transmission of energy result in time in the moving of practically all means of transportation with electrical energy from central power stations?

MR. TESLA: No, I do not expect that such will be the case, for the transportation systems now used present certain important practical advantages which cannot be disregarded.

Question: Will not automobiles, for instance, be operated merely by the operative "cutting in" on electrical energy supplied by wireless from power stations?

MR. TESLA: I fear we shall not live to see the wireless system in general use for this purpose. It is difficult to propel an automobile by the new method for reasons with which experts are familiar. Success can be much more easily achieved in the case of airships.

In time to come it is possible that some form of automobile may be perfected that will enable this propulsion of such vehicles to be effected by power drawn from the ambient medium.

Question: Will the transmission of large amounts of electrical energy by wireless constitute any sort of menace to life and property?

MR. TESLA: None whatever. We live on a globe which is charged to a pressure of two billion volts and we do not feel it at all, although it is possible that we may be affected by this immense pressure in some way or other. Lightning discharges usually occur under a tension of 1,500,000,000 volts and yet the powerful oscillations set up are insensible. Wireless transmission will be effected by electric currents of much smaller force than this. Far from being a menace, the new art will enhance in innumerable ways the safety of life and property.

Question: Getting back to the wireless transmission of sound, will it be possible to develop voice detectors that, at a distance, say, of four or five hundred feet, will amplify sounds so they can be heard plainly?

MR. TESLA: Of course it will. The human ear, though an organ much inferior to

ACT 4 OPERA CARMEN

The New Star in the Radio World

LEADERS use the accepted rules and precedents, by which the majority bind their efforts, only as starting points for higher achievements. Mu-Rad Apparatus, embodying new principles, is the achievement of such a g oup of leading radio engineers. The very moderate prices of this apparatus makes the accomplishment the more noteworthy. Bulletin upon request.

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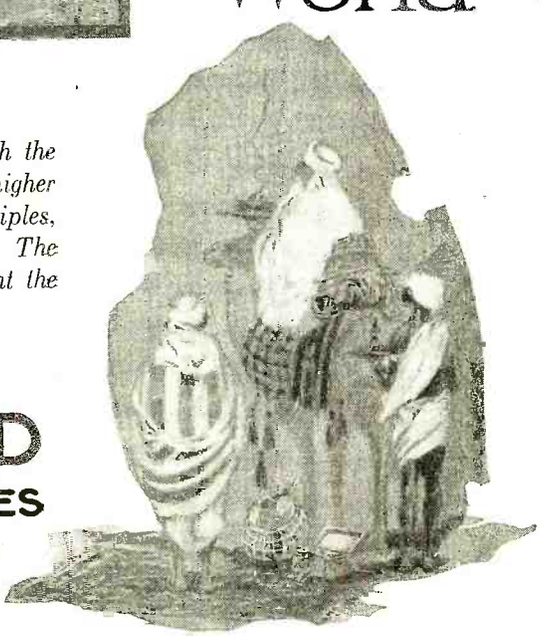

the eye, is wonderful just the same. It may be of interest for me to state that at a certain period in my life, when I suffered from hyper-excitation of the nerves, I could hear distinctly a fly walking on a table at a distance of several feet, and when he alighted I heard a strong thud.

In my experiments at my wireless plant at Colorado Springs in 1899 I could easily hear with the unaided ear thunder claps at a distance of 550 miles, although my assistants could not hear beyond 150 miles.

I believe it possible to perceive the sound of a strong explosion at a distance of 12,000 miles. If this theory is correct, it explains the extraordinary behavior of many persons afflicted with nervous diseases.

There are amplifiers of various kinds by which a sound can be multiplied a billionfold. There is virtually no limit in this direction.

Question: In one of your articles you declared you believed it possible to precipitate rainfall by means of wireless energy. Is there a probability of this being an early materialization?

MR. TESLA: That is an idea on which I have labored since 1892, when I accidently observed that a stroke of lightning caused a copious downpour. Twenty years ago I had advanced so far in the design of the means for accomplishing this purpose that I made every effort to carry out the idea on a large scale.

But I found my plans were received with skepticism. We undoubtedly will accomplish this wonder some day and then will come the lords and masters of life on this planet. We will be able, then, to obtain any amount of power almost without effort and produce lakes and rivers where all was barren before. All the work will be done by the sun; man will merely press the button.

Hitherto the interview had concerned itself solely with the utilitarian aspects of the wireless principle. At this point the following question was propounded:

The development of water power and of the wireless transmission of electrical energy produced by water power would indicate that in the far distant day when coal and oil are exhausted those countries having large quantities of water power will become exporters of electrical energy to less fortunately situated countries. Does not this mean new political adjustments and division? Or will wireless telephony, hastening the day of world peace and international progress, long before that time prepare mankind, through increased intercourse and education, for the cooperative use of natural resources?

The scientist's reply was a *proper finale.*

I have always considered the wireless art the greatest advance of all ages. That is why it has been the chief object of attainment in my life.

We will never overcome international friction and wars by pacts and agreements, however solemn, nor will we by this means abolish the barriers that separate the nations from one another and are an impediment to general progress. There is only one way of achieving this great end and that is by annihilating distance. The wireless art will accomplish this in every aspect.

Of particular importance as means for insuring peaceful relations between nations and communities will be wireless telephony and picture transmission. The latter is crude and imperfect, but carries the convincing power of a record. The time is not distant when we will have wireless television, which is immensely more difficult to accomplish and correspondingly far reaching in its effects on human life. No such apparatus is in existence, now, but the preliminary steps necessary to the successful solution of this great problem already have been made.

The combined use of the wireless telephone and the apparatus for television will put human beings in intimate aural and visual contact though thousands of miles may separate them. So to speak, a man will be able

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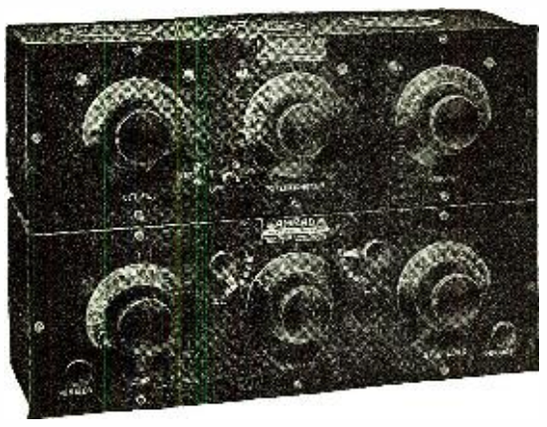

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to lean out of his window in New York and talk to his "neighbor," similarly placed in Paris.

The consequences of such an achievement are inestimable when considered in relation to our social and political progress.

A New Type of High Power Vacuum Tube

(*Continued from page* 853)

up to very large sizes. Some of these are about 1″ in width, and capable of successfully conducting a current of 150 to 200 amperes.

In the general use to which these seals are put there is no necessity for having the glass surround the circumference of the copper disc and the necessity for sharpening the edge is obviated by allowing the glass to adhere to the flat portion of the disc only, care being taken to prevent its flowing around the edge. It is necessary to have a ring of glass on both sides of the seal in order to equalize the bending stresses which would otherwise tend to break the glass and copper away from each other.

The third type of seal and the most important in connection with the present problem is the tube seal shown in Fig. 3. This furnishes the means of joining metal and glass tubes end to end and is used in the water-cooled tube to attach the anode to the glass cylinder which serves to insulate the other tube elements. As in the case of the disc seal, it can be made either with the edge of the metal not in contact with the glass, as shown at A, or with the metal sharpened to a fine edge which is in contact with the glass. The glass may be situated either inside or outside of the metal, see B and C.

The first thermionic tubes in which these seals were embodied were made of copper and were designed to operate at 10,000 volts and to give about 5 K.W. output.

A photograph of the inside of one of these tubes is shown in Fig. 4.

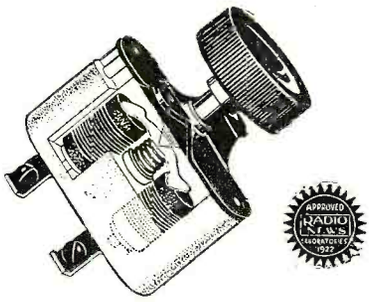
The anode consists of a copper tube 1.5″ in diameter and 7.5″ long. A copper disc is welded to one end forming a vacuum-tight joint. The other end which is turned down to a knife edge is fused directly to a glass tube.

The filament grid assembly consists of two lavite discs D and E, spaced 5″ apart by a seamless steel tube. The grid F is made in the form of a helix, and is held in position by allowing the ends of the longitudinal wires, to which the turns of the helix are welded, to pass through holes in the lavite blocks D and E. The filament G is mounted between hooks fastened to the lavite blocks and is kept taut by the springs H. The grid lead is shown at J, and the filament leads at K K. In this tube platinum seals are used for the lead wires. The use of the springs H make it necessary to supply the filament with current from the opposite end of the assembly and this is done by passing the current through the steel support tube and returning it through a lead passing through this tube and insulated from it by a quartz tube.

The whole assembly is carried by two supports B B. These supports are welded to a corrugated nickel collar A which grips the glass stem C.

The pumping of these tubes at first presented considerable difficulty, chiefly on account of the large amount of occluded gas contained by the metal parts. This caused the time of pumping of the tube to be very

Finest Filament Control We Have Ever Used, *Says Radio Guild, Inc.*



How It Works!

Graphite discs (not loose carbon grains) provide the delicate control for vacuum tubes. A single knob, without vernier, gradually applies or removes pressure from the discs, thereby changing the filament current more smoothly and noiselessly than any vernier rheostat.

Louder reproduction, quicker tuning, and a greater receiving range follow the installation of Bradleystats in your radio set. Twenty years of experience in precision control, and a one-year guarantee protect you.

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Electric Controlling Apparatus
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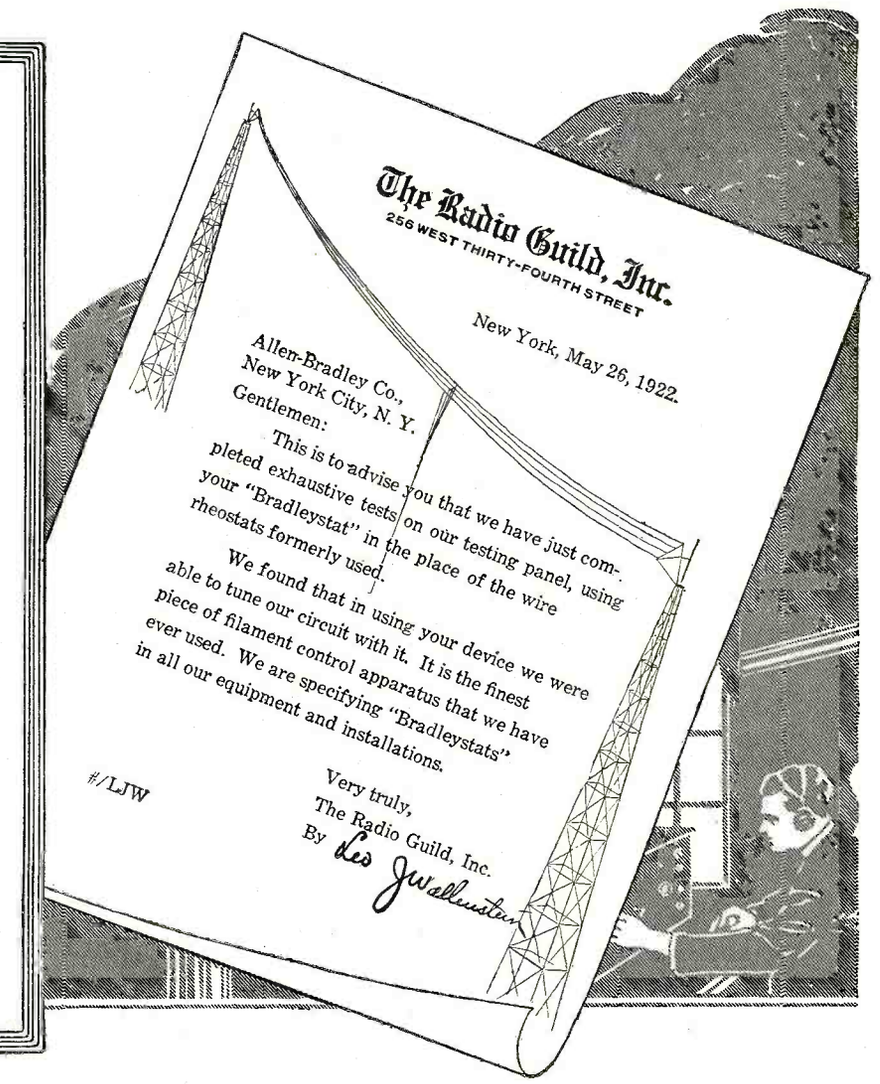

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$1.85 P.P. 10¢ Extra.

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PERFECT FILAMENT CONTROL

long and a dangerous warping of the internal structure developed owing to the fact that during exhaust the tube elements are maintained at a much higher temperature than they are subjected to during normal operation. The trouble was overcome by heating the various parts of the tube to as high a temperature as possible in a vacuum furnace, prior to the final assembly, and thus getting rid of a large amount of the occluded gases. The anode was preheated before the glass seal was made and the whole filament grid assembly was preheated just before it was mounted on the glass stem. The preheating of the parts brought about an enormous reduction in the time required for pumping and gave a much more uniform product.

Although successful from the standpoint of operation, this tube had several undesirable features that it was thought well to eliminate. In the first place the welding of the end into the tube was not particularly desirable, and in general any troubles that occurred due to leaks in the metal could be traced to this point. Further, in the assembly of the tube there were a very large number of welds to be made which constituted points of weakness at the high temperature necessary for the evacuation of the tubes. It was, therefore, decided to go to a type of tube in which the anode would be drawn in one piece and in which as many welds as possible would be eliminated in the assembly of the internal elements. At the same time it was considered desirable to go to a somewhat larger type of structure in which high tension insulation could be more easily provided and a larger tube was, therefore, designed capable of delivering 10 K.W. to an antenna at a plate voltage of 10,000 volts.

The final form adopted for this tube is shown in Figs. 5 and 6.

Starts Nov. 1st **Red Seal Battery Contest.** Closes Nov. 15th

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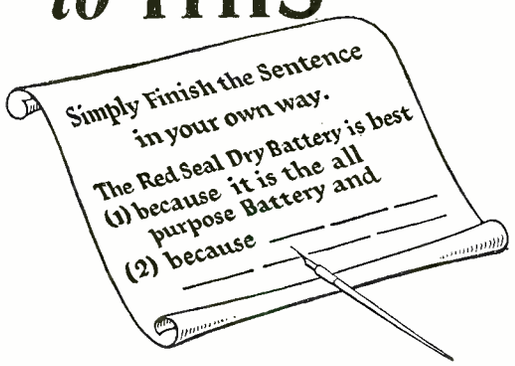
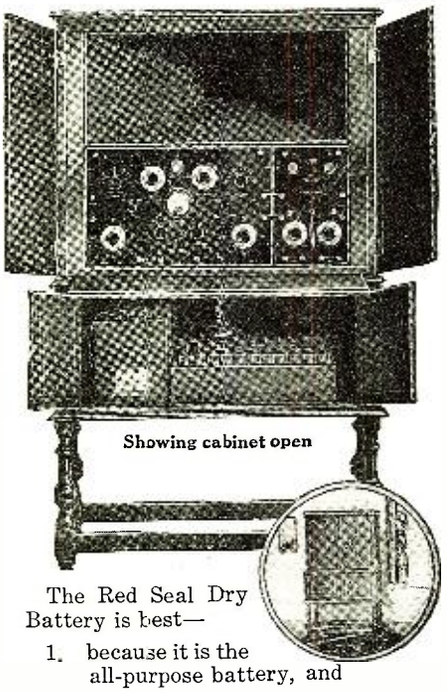


You Win THIS $725.00 Complete Radio Set-Free

Hears broadcasted concerts 400 to 600 miles away; receives wireless telegraph from Europe, South America, from ships on the high seas, etc.



Showing cabinet open

The Red Seal Dry Battery is best—

1. because it is the all-purpose battery, and
2. because .....

Important:—Only those answers written on the official Contest Blanks will be considered. Mail as many answers as you like to: Red Seal Battery Contest, Manhattan Electrical Supply Co., Inc., 17 Park Place, New York City.

The Prizes

It is appropriate that the Manhattan Electrical Supply Company should be the first to offer such Radio Sets as these. This company was one of the pioneers in selling radio, as well as being the manufacturer of Red Seal Dry Batteries used so successfully in connection with radio sets.

First Prize—$725.00 Complete Kennedy Radio Set

This Cabinet Type complete Radio Receiving Set is one of the finest and most up-to-date receiving sets yet produced. The cabinet is walnut and stands 58 inches high. Range from 400 to 600 miles for wireless telephone and 2,000 to 3,000 miles for wireless telegraph. Contained within the cabinet are all batteries, "Homcharger" battery charger and Magnavox loud speaker with special horn. Installed free, in the home of the winner.

Second Prize—$408.50 Complete Westinghouse Radio Set

It consists of the Westinghouse R. C. Receiving Set and Western Electric Loud Speaker, "Tungar" Battery Charger, Storage Battery, "B" Batteries, Set of Manhattan 3,000 ohm Headphones, 3 vacuum tubes, 2 telephone plugs and complete antenna equipment. Installed free in the home of the winner.

Third Prize—$256.50 Complete Grebe Radio Set

A complete receiving outfit made up of the well known Grebe C. R.—9 Regenerative Receiver with Two Stage Amplifier, Magnavox Loud Speaker, Storage Battery, Homcharger Battery Charger "B" Batteries, set of Manhattan 2,000 ohm Headphones, 3 vacuum tubes, 2 telephone plugs and complete antenna equipment. Installed free in the home of the winner.

50 Other Prizes

To each of 50 other contestants whose answers are meritorious will be given one of the famous Manhattan 2,000 ohm Radio Headsets. These headsets have great sensitiveness and high amplifying qualities.

How to Enter the Contest

Simply follow the instructions on the Contest Blanks given away by stores all over the U. S. A. Nov. 1 to Nov. 15. You will recognize these stores by the Red Seal Window Display pictured below.

The prizes will be awarded for the most appropriate answers completing *in your own way*, in not more than ten words the following sentence:

Look for this Window Display in Dealers' Windows Nov. 1 to Nov. 15. It identifies Dealers who will give you free Contest Entry Blanks.

The Judges

The winners will be selected by the following Judges: Mr. Llew Soule, Editor of "*Hardware Age*," New York; Mr. Howard A. Lewis, Manager of "*Electrical Merchandising*," New York, and Mr. Joseph A. Richards, President, Joseph Richards Co., Inc., Advertising Agents, New York.

Announcement of Winners

The names of the winners will be published in the ***Saturday Evening Post*** as soon as possible after the contest closes.

In case two or more persons submit winning answers, prizes identical in character with those offered will be given to each successful contestant.

Important to Dealers

Duplicates of these 53 prizes are to be given to dealers having the BEST CONTEST WINDOWS. Write us at once for full information and free window display material if you haven't already done so.

MANHATTAN

ELECTRICAL SUPPLY CO., INC. NEW YORK

Makers of the Famous Red Seal Dry Batteries and Manhattan Head Sets

The drawing of the anode does away with the leaks that were troublesome in the older tubes and the manufacture of the tube can be carried out with certainty.

With this tube as much as 12 K.W. have been obtained in an artificial antenna working at 12,000 volts. This power was obtained at a frequency of 600,000 cycles corresponding to 500 meters wave-length. The difficulties of obtaining this amount of power at this frequency using a number of smaller tubes in parallel, are obvious to anyone who is acquainted with the problem. On a D. C. test the anode was found to be capable of dissipating 26 K.W. when cooled with water.

The success which had attended the development of a tube of this high power capacity indicated the possibility of constructing still larger tubes and it was decided to proceed with the development of a tube capable of delivering at least 100 K.W. into an antenna.

The anode which is made of a piece of seamless copper tubing closed by a copper disc welded into the end, is 14" long and 3.5" in diameter. The filament is of tungsten and is .060" in diameter and 63.5" long. The current required to heat it is 91 amperes and the power consumed in it 6 K.W. The filament leads are of copper rod one-eighth of an inch in diameter and are sealed through 1" copper disc seals. The grid is of molybdenum and is wound around three molybdenum supports.

The handling of the parts of this tube during manufacture presents a task of no mean magnitude and numerous fixtures have been devised to assist in the glass working. It has been found necessary for instance to suspend the anode in gimbals during the making of the tube seal owing to its great weight, and special devices have been made to hold the filament grid assembly in place while it is being sealed in, otherwise the strains produced by its weight cause cracking of the seal.

The significance of this development in the radio art cannot be overestimated. It makes available tubes in units so large that only a very few would be necessary to operate even the largest radio stations now extant, with all the attendant flexibility of operation which accompanies the use of the vacuum tube.

From the standpoint of wireless telephony the development of these high power tubes gives us the possibility of using very much greater amounts of power than have ever been readily available before. The filaments in these tubes have been made so large that the electron emission from them will easily take care of the high peak currents accompanying the transmission of modulated power.

The 100 K.W. tube by no means represents the largest tube made possible by the present development. There is no doubt that if the demand should occur for tubes capable of handling much larger amounts of power they could be constructed along these same lines.

**Abstract from The Bell System Technical Journal.*

TEN NEW STATIONS LICENSED DURING WEEK ENDING SEPTEMBER 9, 1922

WLAO—Anthracite Radio Shop, Scranton, Pa.

WLAM—Morrow Radio Co., Springfield, Ohio.

WMAB—Radio Supply Co., Oklahoma City, Okla.

KFCC—Auto Supply Co., Wallace, Idaho.

WMAJ—Drovers Telegram Co., Kansas City, Mo.

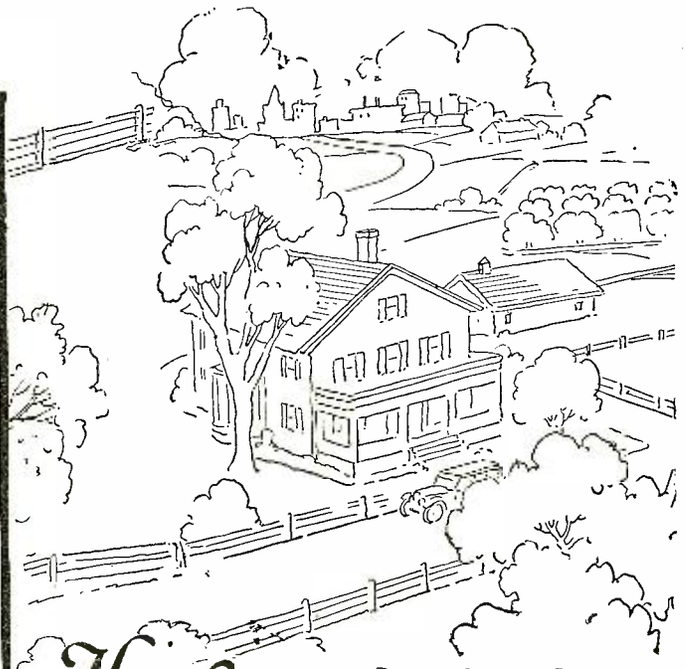
KFBQ—Savage Electric Co., Prescott, Ariz.

WLAL—Tulsa Radio Co., Tulsa, Okla.

KFCB—Nielsen Radio Supply Co., Phoenix, Ariz.

WLAG—Cutting & Washington Radio Corporation, Minneapolis, Minn.

WKAZ—Landau's Music and Jewelry Co., Wilkes-Barre, Pa.



How Science has bridged with wireless the miles between city and country

TO the health and independence of farm or suburban life, Magnavox Radio adds the large city's most envied advantage—access to wholesome, inspiring entertainment.

Magnavox Radio, the Reproducer Supreme, brings out all that is finest and best in broadcasted programs—clearness, fidelity to the original; and above all, sufficient power to be enjoyed by the entire family and their guests.

When you purchase a Magnavox Radio or Magnavox Power Amplifier you possess an instrument of the very highest quality and efficiency. Without the Magnavox, no receiving set is really complete.

Type R-3
with 14 inch horn
(illustrated above)
$45.00

Type R-2
with 18 inch horn
$85.00

Model C
Power Amplifier
2 stage
AC-2-C . . $80.00
3 stage
AC-3-C . . 110.00

The Magnavox products may be had of good dealers everywhere.

THE MAGNAVOX COMPANY Oakland, California
New York Office: 370 Seventh Avenue

MAGNAVOX RADIO
The Reproducer Supreme

New Signal Corps Portable Set

(*Continued from page* 832)

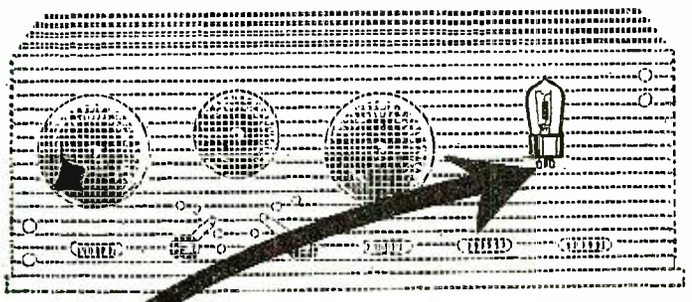
establishment of instant and dependable communication between the combat battalion of infantry and its supporting artillery, a range of 8,000 yards admirably served the desired ends. Other than the virtues already attributed to this diminutive wireless apparatus, there is additional merit to be found in a "break-in" arrangement, whereby the transmission from a distant station may be interrupted at any moment at the receiving point.

Rapid and dependable communication between the attacking infantry and its supporting artillery, probably the most essential form of communication to be dealt with in war, was not available to a satisfactory degree when America entered the World War. This war-created difficulty gave birth to the SCR-77-A radio-telegraph set just described. It proved efficacious in operation from a dug-out, upon the condition that no portion of the latter was closer than two feet to the antenna. The proximity of a wall or any object closer than this alters the capacity of the antenna and thereby results in a discordant condition with respect to tuning the equipment to radio-telegraph sets of like nature. This two-man portable outfit has a range of nine distinct wave-lengths. This variety of frequencies enables each combat infantry battalion, each regimental headquarters, to employ a specific wave-length inviting constant attention for a call from other transmitting units. An operator, desiring to call another radio-telegraph set, adjusts his transmitter for the pre-arranged wave-length of the station being called, and sends on that wave-length, provided no other station is found in communication with the desired point.

Will the 47-pound duplex radio-telegraph equipment, useful in times of strife, lend itself to service in peace-time applications? Evidently, the Signal Corps of the United States has faith in this direction. The training section just now is engaged in the preparation of a Government paper dedicated to the exploitation of the advantages of SCR-77-A. Likewise, the writer understands the quantity production of this rugged and simple wireless set has been authorized.

Wireless experimenters can likely copy a page from the leaf of experience of the Signal Corps in the development of this outfit, weighing less than half a hundred pounds. Why not develop a duplex radio-telephone set that would incorporate the desirable features of this radio-telegraph outfit? The presence of summer, with its insistent opportunities for camping trips and excursions into the great out-of-doors, impresses upon one the convenience of strapping his wireless outfit across his shoulders and hiking it far from what we of the city call civilization. The suitcase, matchbox, ring, garter and other more or less freak apparatus, are limited to the reception of wireless music and speech. Why not develop a 50-pound unit for both the transmission and reception of communications?

Camp, yachts, summer schools, forest-ranger stations, bathing resorts, field maneuvers of the organization of Boy Scouts of America, are possible opportunities for pleasure and profit in demonstrating the service of a modified form of a compact transmitting and receiving set of the Signal Corps. Fishermen, sitting on the proverbial rock waiting all day for the finny tribe to nibble, by the use of such a system of communication could derive much pleasure from keeping in touch with camp headquarters during the day. Persons on jaunts through the forests could



This is the *point*

We have on hand fuses for these tubes: **Electron Relay, A-P Amplifying, Double Filament Audiotron, Cunningham C300 and C301, Radio Corp. UV200, UV201, UV202, and Western Electric VT1 ("J") and VT2 ("E").**

When ordering state what tube fuses are wanted for.

Why let a filament burn out, "kill" a tube and interrupt the operation of your set when, at few cents cost, the

RADECO SAFETY FUSE

(PATENT PENDING)

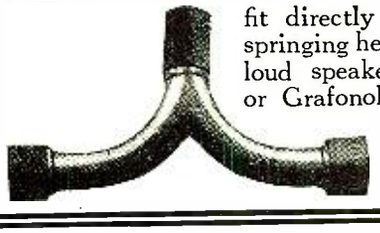
slipped on the filament terminals assures absolute protection against such accident. Positive in its action. Fits any standard bulb in any standard socket. Does not affect efficiency. Not a makeshift but a specially designed protector that has made good on thousands of sets. In standard package of

4 for $1

At your dealer's or by mail.

Caution: Do not ***force*** *fuse on filament terminals. If contact solder is rough, file or sand-paper down so that fuse slips on easily. Filament terminals are the two farthest from the locking projection on base of tube.*

NEW TYPE PHONE ADAPTERS

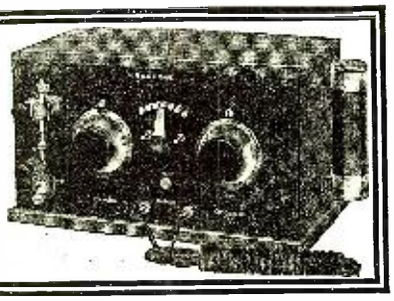


fit directly on phones without springing headpiece and attach to loud speaker of Victrola or Grafonola - - - - - **$2**

Add postage on 2 lbs.

CRYSTAL SET

biggest value on market. Has Var. Condenser, Vario Coupler, Tapped Primary, Buzzer, Cord Tipped Jacks, Bakelite Panel **$20**



45V VAR. UNIT "B" BATTERIES - $3.60

KEYSTONE ARRESTERS - - - - - $1.20

We carry a complete stock of standard sets and parts at standard prices. Order from any standard catalog

Reliable Goods at Right Prices

RADIO EQUIPMENT CO.

630 Washington Street Boston, Mass.

New England's Oldest Exclusive Radio House

We Carry Only Standard Quality Radio Goods

maintain contact with headquarters by strapping such an outfit across the shoulders. The apparatus can be readily installed.

Moreover, SCR-77-A is a model of compactness and ruggedness which offers an unlimited field of interesting experimentation for radio amateurs whose unfailing effort is in the direction of robbing wireless apparatus of some of its cumbersomeness. The fascination of the injunction, "strap your radio outfit across your shoulders," may be a phrase possessing more than a fanciful appeal in a few years, thanks to the untiring energies of radio experimenters.

Radio Lessens Lightning Danger for Aircraft

(*Continued from page 832*)

600′ in the air. However, when the altitude was doubled, the electrostatic current concentrated in the balloon circuit was of such strength as to burn out the thermo-element in the testing apparatus. When the connection between the balloon circuit and the ground was severed, under the conditions just mentioned, the electric charge was vigorous enough to span a one-fourth-foot gap between the cable and a blunt-pointed jumper wire. Such a spark gap represents in excess of 5,000 volts, and, obviously, is dangerous to handle. For example, one of the investigators in the course of this test barely touched the cable and was hurled for a distance of three feet.

Capacity measurements were continued by the application of a hot-wire ammeter, the latter possessing a considerable current-carrying capacity. The capacity measurements indicated that when the balloon was at an altitude of 600′ the capacity of the aircraft circuit was 394 microfarads at 3,600 meters, and when the kite balloon had climbed to a height of 1,200′, the circuit capacity was 668 microfarads at 5,000 meters. Having made known the capacity of the balloon circuit and the values of inductance employed for loading purposes, the effective inductance and normal wave-length were readily computed. At a height of 600′, the natural period or wave-length of the balloon circuit was 1,454 meters, and when the aircraft was 1,200′ in the clouds, the wave-length of the circuit was 2,128 meters. The inductance at an altitude of 600′ was 1,511 microhenries, and when the balloon was elevated to 1,200′, the inductance of its electric circuit was 1,906 microhenries.

Subsequently the radio-frequency resistance of the balloon circuit was measured. This data were obtained by applying the so-termed Miller method of resistance measurement. The radio-frequency resistances proved to be as follows: When the balloon had climbed to a height of 600′ and the wave-length of the balloon circuit was 1,545 meters the resistance was 76 9/10 ohms; at a wave-length of 1,630 meters the resistance was 80 5/10 ohms, and when the wave-length was 3,560 meters the resistance was 92 1/10 ohms. By elevating the aircraft to an altitude of 1,200′, and with the wave-length at 4,550 meters the radio-frequency resistance was 91 ohms. The direct-current resistance of the cable for the 600′ and 1,200′ lengths proved to be 1 3/10 and 2 5/10 ohms, respectively. These resistance values were made known by measuring the cable stretched on the ground, employing a Wheatstone bridge for the purpose.

The primary purpose for revealing the electrical constants of the balloon circuits is readily explained. Once these values have been determined, it is apparent what unit of resistance should be placed in the balloon circuit to dampen out oscillatory currents created in the circuit either by lightning or brush discharge. Radio engineers are quite familiar with the established conclusion that any circuit having inductance and capacity, similar to that in a balloon circuit when

Musio
The Voice from the Air

Radio for Everybody

THIS is the radio for which thousands have been waiting, a real receiving set (not a toy) complete with 100 ft. Copperweld Antenna, Run-In and Ground-Wire, Insulators, Knobs, Tubes, Ground-Clamp, and, above all, the famous, perfected Musio Crystal Detector. We believe this to be the most extraordinary value ever offered in radio.

Only $12.50 Complete

(Without Earphones)

Perfection Attained at Low Cost

Compare Musio with any other Crystal Detector Radio Receiving Set at twice the price or more. There is nothing like it: For the first time, radio fans can obtain a crystal detector set that comes up to every expectation. Most modern manufacturing methods and resources have at last been applied to the production of a real radio at little cost—less than you could buy the parts.

Not a Toy

Don't confuse Musio with sets of ordinary character, crudely assembled from makeshift parts. It is a model of mechanical and electrical perfection, highly finished in mahogany and a credit to any drawing room.

Fine Details

Musio is quality to the last detail. The binding posts are all highly nickeled, the tuning dial and coil are of the costlier type, the internal wiring is firmly soldered and the condenser the best.

The Musio Crystal Detector

It cannot be found on any other radio receiving set other than Musio, or is it sold separately. With a minimum of effort you find the sensitive spots on the galena; no more desultory stabbing of the crystal; no more loss of galenas and patience by scratching and pitting. A pull and turn of the handy knob and the right connection is made. Used with Musio special galena crystals, there never was a crystal detector like this one. It goes far to make Musio the popular radio of today.

Range and Clarity

Try a Musio if you have difficulty getting broadcasting stations 30 miles away. Musio has received at a radius of 100 miles at times. Range and clarity are features of Musio.

Big Radio Value

Now is the time to get your aerials up for a winter of keen enjoyment. Ask your nearest dealer for Musio today. If he hasn't got it we will send you a set prepaid for the price, $12.50, with all the accessories mentioned above and full instructions for installation and operation. Musio is absolutely guaranteed to be satisfactory or money refunded. Don't pass up this big radio value.

MUSIO-RADIO CO., Inc., RN-1-Nernst Bldg., Pittsburgh, Pa.

Dealers: It is freely predicted that Musio, at this extremely low retail price of $12.50, will be the biggest seller in radio. There is big value for the purchaser and extra fine profits for the dealer. Musio will make friends and customers for you. Write today in preparation for the big demand.

acted upon by a lightning or spark discharge will permit oscillating currents to be generated in the circuit. The lightning protective device being described in this article functions best when these oscillating currents are eliminated. This is accomplished by introducing a resistance of 5,000 ohms in series with the cable. Such resistance may take the form of a carbon or graphite rod, approximately ¾" in diameter and 8" long. These units are commercial products, being offered in resistance values ranging from 500 to 30,000 ohms.

The Crossley lightning arrester for use on aircraft soaring in the clouds counteracts or averts an accumulation of static electricity in the vicinity of balloons, a condition heretofore responsible for fire which consumed the craft. A discharge at the peak of the balloon as well as the metal covering of the latter are connected electrically to the downhaul, thus facilitating the passage of the excessive charge of electricity to the earth. Even when an electrical storm is raging in proximity to the flying bag the 5,000-ohm resistance unit will come into action and put a stop to the oscillatory currents in the balloon circuit. Practical tests have determined that lighter-than-air craft is immune from destruction by electrical disturbances when this lightning arrester of the clouds is operative. It is an effective equalizing force, relaying excessive electrical discharges from the clouds in vicinity of the balloon to the earth.

Contributed by S. R. WINTERS.

A Wonderful Station

(*Continued from page* 845)

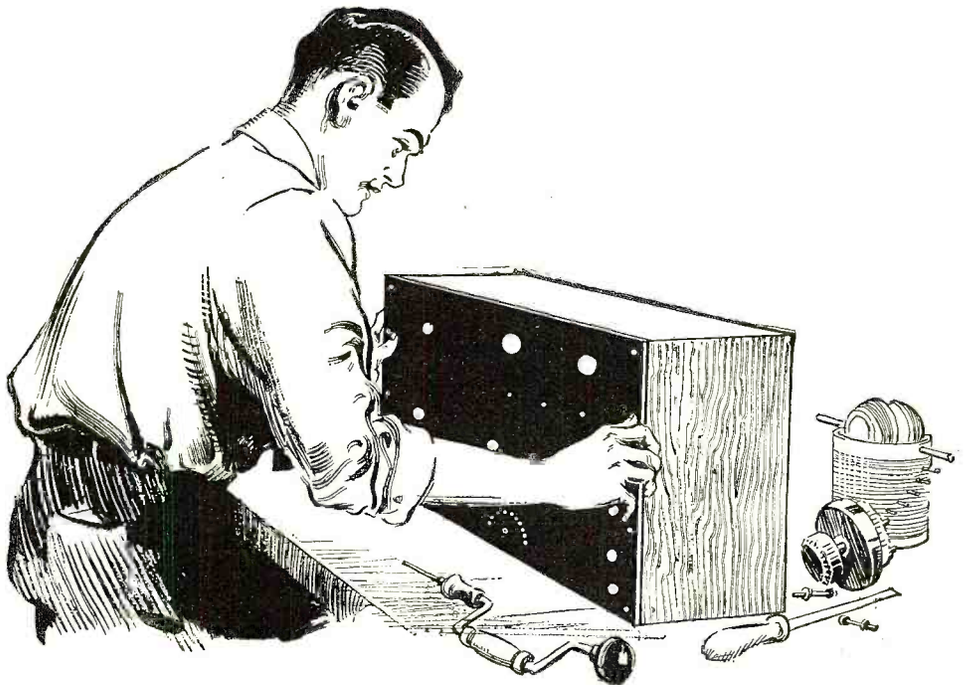
erators, all mounted on the same frame and connected by a flexible coupling. The two generators are between the motor and exciter. The unit is rated at 2 K.W. output at 4,000 volts, and is used primarily for No. 11 and No. 15; incidentally, it attains full speed in two seconds. At the other end of the room is an Electric Specialty motor generator, the output of which is 1,500 volts; transmitter No. 5 is operated from it.

All kinds of voltage and current is available at the station and include the following: 10-volt 60-cycle single phase, 110-volt 60-cycle single phase, 110-volt 60-cycle three phase, 110-volt D. C., 220-volt 60-cycle single phase, 220-volt 60-cycle three phase and any voltage up to 500 volts D. C. from Edison storage batteries.

Tests are carried on with receivers as well as transmitters, as is shown by the various types, including the Armstrong Superheterodyne, the radio frequency receiver, and experiments are now being carried on with an Armstrong Super-regenerative set. Reception with loops and radio compasses has also been carried on, and there are few lines of radio work that have not been touched.

Mr. Beale was instrumental in organizing the Chester County Radio Association, and is president of this fast growing organization, which now numbers over 150 members. Portable station 301, which was built at 3ZO was a great aid in getting many new members. It is a complete operating shack mounted on a truck, and was sent to various parts of the country, to arouse interest in the association.

The antenna for this mobile station is a four-wire flat top type about 20' above the ground and fastened to two masts, one in the rear of the shack and the other in front of the radiator of the truck. The masts are built in two sections so that the upper half may be lowered while traveling, if necessary. The shack is lighted by a 32-volt Delco lighting system. The equipment in the portable station includes a Grebe CR-5 for receiving and a 10-watt radiophone for transmitting. Other apparatus is used at different times, in place of or in addition to that shown in the illustration. At one time music was transmitted from this portable station for a dance, a half mile distant.



Improve *Your* Radio Set with a Panel of

CONDENSITE CELORON

The better the insulation the finer your radio set will perform. Keep your connections tight and your insulation right. This is a radio axiom. Here is another: Get the best panel obtainable.

The essential qualities of a radio panel are non-conductivity, strength and appearance. Condensite Celoron is a strong, hard, waterproof material that will give you surface and volume resistivities, and a dielectric strength greater than you will ever need. In addition to this, this material machines readily, engraves with clean-cut characters and takes a fine, natural polish, or a beautiful, dull mat surface. Mount your equipment upon a Condensite Celoron Panel and note the improvement.

Are you a radio enthusiast? Step into your nearest radio supply store and get a Celoron Panel cut to the size you want. If by any chance that dealer cannot supply you, write us direct.

Do you make radio equipment? If you are not now using Condensite Celoron let us give you the facts.

Are you a radio dealer? Send today for our special dealer's proposition covering Celoron Panels and Parts

DIAMOND STATE FIBRE COMPANY

BRIDGEPORT (near Philadelphia), PA. Branch Factory and Warehouse, Chicago

Offices in principal cities

In Canada: Diamond State Fibre Co. of Canada, Ltd., Toronto

The work done at 3ZO and 3XW is mainly experimental, although a great deal of amateur traffic is handled as well. No. 11 is an experimental radiophone and tests are carried on each evening at 10.50 P. M., E. S. T. This rather late hour was chosen in order to minimize interference with the broadcasting stations. In these tests, phonograph records are usually used, although piano or vocal and instrumental selections are sometimes sent out. Listeners are asked to call on the telephone, or to write, regarding the manner in which they are receiving the music and voice, and telephone calls have been received from enthusiastic radio operators in the following states: Ohio, West Virginia, Maryland, Delaware, New Jersey, New York, Connecticut, New Hampshire, Vermont, Massachusetts and Maine. Correspondence has been received from all the eastern and central states, England, Arkansas, being the greatest distance from these voice tests. Experiments are being carried on all the time, and changes are made nearly every day, in order to secure greater efficiency. A special test was held on the evening of August first, but due to heavy atmospherics no reports from a greater distance than Boston or Detroit were received. In this test, soprano and bass solos, mixed quartettes, and cornet and violin solos were used for different kinds of tests. No. 11 was recently instrumental in locating relatives of H. E. Rice, assistant to the president of the American Bosch Magneto Co., of Springfield, Mass., who was fatally injured in an automobile accident at Oxford, Pa., 12 miles from Parkesburg. 3XW was asked to announce in the test the fact that the authorities were unable to locate the relatives of H. E. Rice. Less than two hours later a telephone call was received from the Springfield *Republican*, saying that relatives were on the way to Oxford, Pa., where the accident had taken place. Here is a new use for the radiophone, and shows the wonderful possibilities and various uses to which it may be adapted.

Besides the many phone calls received daily, hundreds of letters from all sections of the country give aid in checking the operation of sets and prove the efficiency of the equipment.

With an amateur station of this size, developed simply for the advancement of the new radio art, much may be expected in the future, while Mr. Beale and his staff deserve the congratulations of everyone interested in the progress of radio, for the steps which they have taken.

Berne Radio Station

(*Continued from page* 842)

receiving conditions or when receiving from stations the transmission from which is not steady enough for automatic recording or which are not equipped for working at high speed. All instruments and circuits are in duplicate so that in case of breakdown or the necessity to make any adjustment, this

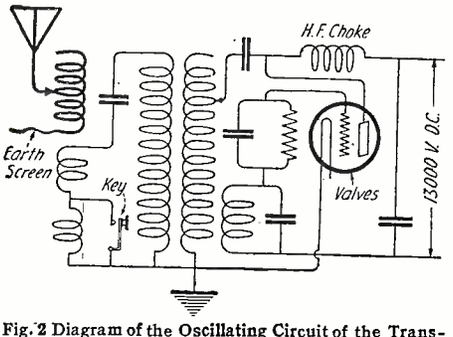


Fig. 2 Diagram of the Oscillating Circuit of the Transmitter. The Control Key Shorts One of Two Coils Opposed To Each Other.

can be done without interrupting the service. The necessary current required for the land line circuits is provided from the Berne post office central battery.

Figs. 8 and 9 are general views of the transmitting room.

**Abstract from "Wireless World."*

Litzendraht Vs. Solid Wire

(*Continued from page* 859)

The net result of unequal flux distribution is that an unequal current will flow through the wires, at some point. A little farther along the positions of the wires may be reversed so that the excess current in the wires in the first instance must have been transferred to the other wires through the mutual capacity of the strands.

Variation of inductance with frequency is sometimes noticed in coils wound with stranded cable (Litzendraht). The most probable explanation of this is as follows: If the cable is composed of 20 strands of No. 38 wire, the complete coil is in reality 20 separate coils all connected in parallel. The resulting inductance will be equivalent to the inductance of a similar coil wound with solid wire *only if the coupling between strands is unity.* In the preceding paragraph it is shown that this is not always the case. The condition of all the lines of force from one strand cutting all the other strands is affected by flux distribution and therefore by the frequency. The extent to which the electrostatic coupling between strands affects the mutual inductance between coils (considering each strand as a separate coil) is not known, but it can probably be worked out mathematically.

The above considerations have all been based on perfect Litzendraht cable insofar as each strand is continuous end to end, and are given to show that such cables do not make ideal conductors by any means. Even the slight advantage which it does have may disappear if a strand is broken. The actual extent of the losses depends upon the location of the break. Suppose that only 19 of the 20 wires composing a cable were continuous, the last wire being severed near one end. In this case:

(a) The D.C. or basic resistance is increased 5 per cent.

(b) The distributed capacity of the coil as a whole is increased considerably. On one coil tested this capacity increased to four times the initial value. This is explained as follows: Since the broken wire is not carrying current it assumes approximately the same voltage over its entire length, this potential being that of the connected end. At the broken end the wire is laying close to the other strands having a much different potential there, causing large distributed capacity effects and hence a larger natural wave-length.

(c) Another loss which may occur at some frequencies is due to the broken wire acting as an Oudin resonator—producing relatively high potentials at the free end when some frequencies are applied. On account of the sharp point at the break this may cause considerable leakage to the surrounding wires and air.

Greatest care should be used in cleaning the ends of strands for soldering. The method sometimes used—heating the ends and quickly quenching same in alcohol, has one disadvantage. The wire loses its temper at the point where the greatest strain comes and where it must be strongest. With a little practice a person can find out how to get the wires by removing enamel in this manner. Probably the easiest method and best insofar as the wire is not detempered is scraping. Great pains is necessary, how-

ever, or the wire will become nicked in one or more places.

The problem from a manufacturer's standpoint is whether to build up a circuit with stranded cables with a possible higher initial selectivity and run the risk of having it prove inferior to others after it is out in service awhile, or whether to use solid wire which can withstand much more abuse without changing its receptive characteristics.

The amateur building his own set must settle the question for himself for he alone knows how much effort he wants to put in handling the Litzendraht, and how much knocking about the coils are likely to be subjected to.

Radio in the Business Office

(*Continued from page* 846)

novelty brought about an additional stimulation. Other firms have adopted the plan of having 10-minute intermissions in the forenoon and afternoon, and by spacing these so that they come at the hour when the broadcasting of music is on, the use of the radiophone became feasible and freshened up the entire staff. The same holds good for the lunch hour in other offices.

The adaptation of the broadcasting idea to business uses on a large scale is now under way, and is fraught with the most significant developments. A great institution with branch sales offices, located throughout the country, has been at work on a plan to have a broadcasting station at headquarters which will permit talking personally to its branch managers in hundreds of cities within the range of a thousand miles. On this basis it is possible for the president or the sales manager to have frequent conversation with his staff simultaneously in all parts of the country and thus broadcast the stimulation of his own voice and words in developing his sales campaign.

Another great business opportunity provided by radio is in advertising. Indeed it is so great an opportunity that the dangers are equally great of destroying its effectiveness. While radio receiving outfits can easily "tune out" anyone not wanted, there is grave danger that by putting too much advertising into the air, the public will sicken of the entire device. Later, when finely adjusted apparatus is available, permitting accuracy in getting the precise sending station desired, and hour-schedules are wisely worked out, it will no doubt be a convenience to the housewife to know something at least of the bargains available; but the likelihood is that she will continue to prefer to read of bargains in a newspaper. Radio advertising would have too much of the insidious annoyance of barkers and criers at circuses and amusement parks, with irritation instead of value as a result. Radio advertising will require a gradual evolution in the interest of the public, and does not at present offer the sheer advertising opportunity it appears to afford. When one is entertaining a customer in one's home, one does not offensively force one's business upon them. Radio makes a situation parallel in certain ways, and standards of courtesy will be required, which as yet rather preclude any advertising from the air, except incidental advertising.

However, business will, it is certain, find increasingly ingenious applications of the radio marvel.

THEY CAN BOTH BE CHARGED

Why is the antenna like a drunkard?

Because you have to lead it into the house.

By A. J. DE LONG.

With the Sea-going Op's

(*Continued from page* 855)

Davison seems to be troubled with the very latest standard question. Hear his plea, O ye passengers! We would like to print it in 24-point type so that he could stick it on the outside of his mosquito screen.

"Many people believe that radio and wireless are entirely different. This is a fallacy and should be dispelled at once. The idea seems to be prevalent among novices and others that 'radio' refers to radiophone and 'wireless' refers to telegraphic signals. Such is not the case. Radio and wireless are one and the same. 'Radiophone' is the proper term applied to the wireless telephone. All stations, whether transmitting telegraphic signals or telephone may be called radio stations or wireless stations, but the term 'radiophone' designates a station using telephone.

"The writer is a commercial operator on a passenger vessel and the question, 'You only have wireless here; you don't have radio, do you?' is frequently asked by passengers. We usually understand what they are getting at and try to explain it to them.

"And here is another fact. Radiophone transmitters are installed on very few ships and as yet such installations are not open to commercial business. Of course, nearly everyone knows of the conversations carried on between the steamship *America* and various places ashore, but that is only one instance. Some ships, having an additional antenna, may receive radiophone concerts, etc., but the summer is a very poor time to get good results for any distance. The law requires commercial stations to listen-in on a wave length of 600 meters, therefore the additional antenna for radiophone reception.

"Do I make myself clear? I hope so.

"Newspapers please copy.

"R. L. Davison,
"S. S. Lenape."

MEDICAL SERVICE BY RADIO

Taking precedence over all but SOS calls, a new system of medical service and consultation by radio for ships at sea has been established by an American steamship company.

This service, which is primarily designed to assist vessels not carrying medical officers, is free to the ships of all nations. It has been worked out by George S. Davis, General Manager of the Radio Telegraph Department of the United Fruit Company, and announcement of the service was made by Andrew W. Preston, President of the company.

"This means," said Mr. Preston, "that the captain of any steamship requiring medical assistance may radio one of our hospitals or passenger ships, through our radio stations, details of a case of illness or accident on his vessel and receive without charge, so far as this company and its subsidiaries are concerned, experienced medical advice. While the service is mainly for ships not carrying doctors, it is also at the disposal of vessels whose medical officers desire the benefit of consultation with other physicians. For instance, in the case of an obscure malady or one where the patient's symptoms may indicate any of a number of complications, a ship's doctor may call our hospital staffs and medical men into consultation by radio, thus adding their knowledge and experience to his own as in medical practice on land."

The United Fruit Company and its subsidiaries maintain hospitals and radio stations in Panama, Costa Rica, Colombia, Guatemala and Honduras, and all of its passenger steamships carry physicians. In addition, radio stations are maintained at New Orleans and Burrwood, Louisiana; Fort Morgan, Alabama, and Swan Island in the Caribbean Sea. The company's instructions state that radiograms requesting medical advice should be signed by the captain of the ship and should give briefly but clearly the symptoms of the person afflicted. Such radiograms are to be addressed "UNIFRUITCO" (name of place), and sent to the company's hospitals at Santa Marta, Colombia; Port Limon, Costa Rica; Almirante, Panama; Tela, Honduras; Puerto Castilla, Honduras, or Puerto Barrios, Guatemala. They may also be transmitted to any of the company's passenger steamships, being addressed "Ship's Doctor," followed by the name of the ship. It is requested that when sending medical advice radiograms, radio operators check them "(number of words) DH MEDICO."

HOW WIRELESS CAME TO CENTRAL AFRICA

An English naval officer tells the following story of one of his experiences:

"It was during the East African campaign that there first arrived in Nyassaland heavy motorboats fitted with wireless installations and one mounting a powerful searchlight.

"Quickly the purpose of these new instruments became known to the inquisitive blacks, who promptly sent throughout the town of Zomba and the surrounding villages the news that their white masters had brought into the land a magic eye that could see anywhere, even on the darkest night,

and a powerful machine that could speak without a mouth and hear without ears. Yea, even from lands far distant were the words heard.

"To the superstitious savage the advent of these evidences of the white man's witchcraft—for as such were they rated—was by no means welcome. Did it not mean that their secret whisperings and their hidden doings would be disclosed to the all-knowing white man? If messages from other white men far away could be received, was it not certain that the listening machine could overhear conversations in the family huts? If the eye could pierce the darkness afar off, could it not more easily see into the black man's nearby village and there watch what happened?

"For days the Nyassaland township was in a state of constant fear. Terror weighted the heart of the man whose utterances had not always been quite loyal; oppressed was the headman whose words to the officials had not been true. Was retribution at hand?

"Not until they had been told again and again that the English used their magic powers only to learn about their enemies did the natives throw off their frightened constraint and resume their wonted careless manner of life. The explanation was to them so natural. Of course, the doings of friends would not be subject to the black arts of sorcery. To the faint-hearted the presence of a pair of aerials was a powerful argument for patriotism! Thus did wireless make its way to Central Africa."

Contributed by C. L. WHITNEY.

OPERATORS' LICENSES SUSPENDED

First-class, second-grade license No. 1359, issued at Baltimore, Md., August 29, 1921, has been suspended for a period of three months for violation of section 5, act of August 13, 1912, in that he willfully interfered with the transmission of another station.

First-class, second grade license No. 3895, issued at New York, N. Y., June 27, 1922, has been suspended for a period of three months for violation of article 6 of the International Convention service regulations in that he carried on an unofficial conversation with the operator of another vessel.

INFORMATION FROM THE BERNE INTERNATIONAL BUREAU

Great Britain.—The coast station Grimsby radio is now open, call signal GKZ. Since January 1, 1922, ships at sea have been able to obtain the following information by sending to one of the coast stations Cullercoats radio, Devizes radio, Fishguard radio, Grimsby radio, Land's End radio, Malin Head radio, Niton radio, North Foreland radio, Port Patrick radio, Seaforth radio, Valentia radio, and Wick radio a radio-telegram drawn up in the form indicated below:

Information requested

1. A report of the local weather conditions predominating at a coast station of any post office or at a signal station of Lloyd's in the United Kingdom.
2. Information on the weather in different regions of the United Kingdom or of the continent.
3. Previsions of the weather of the Meteorological Office.

Form of radiogram to use

1. Indicate weather at ——— 1. (1, write name of the station with the subject on which one desires information and the name of the ship.)
2. Indicate weather at ——— meteorological ——— 2. (2, write name of ship.)
3. Indicate forecast for next ——— 3; ——— 4; meteorological ——— 5. Indicate previsions for the ——— 3 next hours ——— 4; meteorological ——— 5. . (3, period ought to be indicated in hours and not to exceed 48 hours; 4, region or route desired; 5, name of ship.)

The tax due to the coast station for the request and the reply is 6 francs 25 centimes in case where the reply can be given from the information already in possession of the coast station with which the ship is in communication. Where the coast station has to obtain the information, the tax is 9 francs and 37½ centimes, which includes the charges for an interior telegram anywhere which may be necessary.

British West Indies.—The coast rate of the Kingston (Jamaica) station is 60 centimes per word; no minimum.

Mesopotamia.—The station Basra radio is now open to service with ships. The rate is 80 centimes per word.

Dutch Indies.—Beginning April 1 last the coast charge for all stations of the Dutch Indies open to general public correspondence is 60 centimes per word; no minimum.

Russia.—The coast charge of Russian stations open to general public service is 60 centimes per word; no minimum. The interior rate of Russia, applicable on ordinary radiograms originating in or addressed to this country and exchanged directly with coast stations of this same country, is 13 centimes per word; no minimum.

New Zealand.—The coast charge for the station Kaeweing radio is 30 centimes per word, no minimum. for radiograms exchanged with ships of Australia and New Zealand and 60 centimes per

word for vessels other than those of Australia and New Zealand.

Solomon Islands.—The coast charge of the station Kieta radio is 30 centimes per word, no minimum, for radiograms from vessels of Australia and New Zealand and 60 centimes per word, no minimum, for vessels other than those of Australia and New Zealand.

INTERFERENCE WITH ICE REPORTS

During the broadcasting of ice reports by the North Atlantic ice patrol vessel, the radio stations of ships while in the vicinity of the patrol vessels are required by Article XLV, paragraph 3, International Convention service regulations, to cease all transmitting except distress signals. A number of complaints of violation of this regulation have been recently received by the Department of Commerce, and in order to eliminate this interference the department may suspend the license of any operator who maliciously interferes with the transmission of such reports.

The following is from the *Hydrographic Bulletin,* June 28 last: "The ice patrol vessels send out information daily relative to the ice conditions, namely, 6 p. m. and 4 a. m. (seventy-fifth meridian), but owing to the use of radio by vessels . . . the interference is so great that the purpose of the patrol is not accomplished, as it is often impossible, especially at 4 a. m., for the receiving stations to secure the information desired in time to be of the fullest benefit to shipping."

EIFFEL TOWER TIME SIGNALS

Time signals are now transmitted from Eiffel Tower at 9:25 a. m. and 10:45 p. m., instead of 10 a. m. and 11:45 p. m.

LOUISBURG (CAPE BRETON) STATION

The Marconi Wireless Telegraph Co. of Canada has opened a continuous wave coast station at Louisburg, call signal VAS, normal transmitting wave, 2200. Coast rate, 10 cents per word.

SCHEDULE OF LEAFIELD AND CLIFDEN STATIONS

The period during which the high power continuous wave station Oxford-Radio (Leafield) will transmit radiograms to ships will be 0100-0150 G. M. T. daily instead of 2300-2400 G. M. T., as heretofore. In consequence of the above it has been necessary to change the times of transmission of private messages and press from the Clifden station. Therefore, on and from the morning of June 6, Clifden commenced the program to ships at 0200 G. M. T. instead of 0100 G. M. T. Arrangements have been made for the notification of the alteration to be broadcasted from both Leafield and Clifden.

RADIO FOG-SIGNAL STATIONS OPERATED BY LIGHTHOUSE SERVICE

Stations for transmitting fog signals now in commission are Ambrose Channel Light Vessel, Fire Island Light Vessel, Sea Girt (N. J.) Light Stations, and San Francisco (Calif.) Light Vessel. The three stations first named were selected so as to enable vessels approaching or leaving New York to locate themselves conveniently by cross bearings and to furnish convenient leading marks to approach the harbor. The stations are identified by the characteristics of the signals. Thus, Ambrose Channel sends one dash, Fire Island a group of two dashes, Sea Girt a group of three dashes, and San Francisco a group of two dashes, with brief intervals between the groups. The particular station on which a radio bearing is being taken in a fog is by this means just as definitely known as is the light on which a sight bearing is taken by the navigator of a ship identified by its color or flashes of color. The signals are operated continuously during thick or foggy weather, and also at the present time they are sent each day from 9 to 9:30 a. m. and from 3 to 3:30 p. m., so as to permit any vessel equipped with radio compass to try out the method and apparatus in clear weather. To avoid continuous interference between the signals themselves, they are sent on different time schedules, as follows: Ambrose sends for 20 seconds, silent 20 seconds; Fire Island sends for 25 seconds, silent 25 seconds; Sea Girt sends for 60 seconds, silent 6 minutes; and San Francisco sends for 30 seconds, silent 30 seconds. The signals are repeated rapidly, Sea Girt, for example, sending over 40 groups of dashes a minute.

The transmitting apparatus now in use is a commercial panel type transmitting set of simple and rugged construction of about 1-kilowatt power. In addition to this set a special automatic motor-driven timing switch for producing the desired signal at regular intervals is provided. The antennae at the transmitting stations are the same as used for ordinary communication. The wave length used at present is 1,000 meters, the present international standard for such signals, and the range of usefulness varies from 30 to 100 miles, depending upon the sensitiveness of the receiving apparatus.

About the middle of last month a new light vessel was placed in commission on Diamond Shoals, which will be provided with fog-signal apparatus, transmitting signals of two dashes grouped, 30 seconds, and 30 seconds silent.

The following-named stations are expected to be placed in operation about the first of next year: Nantucket (Mass.) Light Vessel, Boston (Mass.)

Light Vessel, Cape Charles (Va.) Light Vessel, Cape Henry (Va.) Light Station at entrance of Chesapeake Bay, Swiftsure Bank Light Vessel at entrance to Straits of Juan de Fuca, Wash., and Columbia River (Oreg.) Light Vessel at entrance of Columbia River. Further particulars regarding these stations may be had by communicating with the Commissioner of Lighthouses, Department of Commerce, Washington, D. C.

NEW LIST OF RADIO STATIONS OF THE UNITED STATES

Copies of the new list of Commercial and Government Radio Stations of the United States, edition June 30, 1922, were ready for distribution about the 15th of October and may be procured from the Superintendent of Documents, Government Printing Office, Washington, D. C. The new list of Amateur Radio Stations of the United States are also ready for distribution. A list of the broadcasting stations in operation on June 30 last will be included in the first-named publication. The list of experimental stations, technical and training school stations, and special amateur stations (special land stations) will be in both publications.

CHANGE IN RATES FOR CANADIAN STATIONS

Beginning July 1 last, the through wireless rate via the radio stations at Montreal, Grosse Isle, and Father Point will be 10 cents per word (6 cents coast tax and 4 cents ship tax). In addition to the above-mentioned stations the rate of the following-named stations will be 10 cents per word, effective on the same date: Gonzales Hill, Cape Laxo, Point Grey, Pachena, Estevan British Columbia, Bull Harbour, Dead Tree Point, Digby Island, and Alert Bay.

BEARINGS OBTAINABLE FROM FRENCH STATIONS

French radio compass stations in Algeria, France, and Morocco give bearings on 450, 600, or 800 meters, as the ship station may desire. For each bearing a charge of 6 francs is made. American ship stations should obtain these bearings on the 800-meter wave.

INFORMATION FROM THE BERNE INTERNATIONAL BUREAU

Corsica.—The wireless coast station at Bonifacio will communicate with any ship desiring information of meterological order relative to barometrical pressure, wind (direction and velocity), condition of the sky, barometrical tendency, and the visibility and condition of the sea. The land line telegraph rate is 3 cents per word and the coast station rate is 8 cents per word.

France.—The same information (given by Bonifacio) is obtainable from the station at Marseille. The rate is the same.

NEW COMPASS STATION

The Jupiter, Florida, Navy Station, NAQ, is now equipped and ready to give bearings on 800 meters.

The exact location of NAQ is 80° 04′ 57″ W. 26° 56′ 59″ N.

RADIO TELEPHONE RANGE TESTS

The Bureau of Standards is planning to conduct comprehensive tests to determine the effective working ranges of radio telephone transmitting and receiving sets. Preliminary communication when using various kinds of plans have been outlined for this work, and some correspondence conducted in regard to it.

Ship operators should co-operate with the Bureau of Standards by reporting to them any unusually distant reception of radiophone stations.

ADMIRALTY NOTICE TO MARINERS

St. John's W/T station (BZM) closed down about the end of May, 1922.

The broadcasting of synoptic weather reports by Aberdeen W/T station (call signal BYD) has ceased.

Carnsore W/T D. F. station has ceased to operate.

Particulars regarding the Kidbrooke W/T station: Position, lat. 51° 28′ N., long. 0° 02′ E. (approximately); call signal, GFA; wave length, 4,100 meters C.W.; details, weather bulletins are broadcasted daily by this station at 0830 G. M. T. (civil). The bulletin consists of a synoptic date message and contains the same details formerly transmitted by Aberdeen W/T station.

—*From Admiralty Notice to Mariners, No. 755, of the year* 1922.

COMMUNICATIONS FOR BLACK SEA PORTS

The United States Navy Department has assigned call letters NTTX as a general call for any naval vessel stationed at Constantinople. A station ship is maintained there at all times with continuous

radio watch. Any United States Shipping Board vessel having communication for Black Sea ports can clear same through this station on 600 meters without charge. The vessel also collects communications from vessels in the Black Sea intended for Shipping Board representatives at Constantinople and London or other Shipping Board vessels in that vicinity.

Soldering Wires of Radio Sets

(*Continued from page* 866)

shiny coating of solder. Repeat this process with the other sides until they are tinned. If it should happen that a soldering iron refuses to take a tin coat, heat the copper a bit more, but not red-hot; file its face and rub it on a lump of sal-ammoniac to remove any grease, then plunge into the rosin and solder flux. A few trials will enable any novice to do good tinning work.

Once the nose of an iron is "tinned," it will remain so, provided it has not been overheated so as to burn off the solder or cause it to become alloyed with the copper; this can be easily seen by its surface turning black. In cases of this kind, file and re-tin.

Having coated the tool with tin, the next thing is to use it on wires of radio outfits, it being presumed that the amateurs have practiced soldering other pieces of wire before trying this work on their instruments. A description of fluxes and their action will be gone into, as fluxes play a most important part in soldering work. The main reason for using fluxes in order to make firm joints that will not become loose, exists in the fact that a thin film of oxide always forms upon all brightened surfaces of metals; this oxide being caused by action of the air. Fluxes dissolve and prevent any further oxide forming and by thus preventing the formation of oxides, allow the solder to stick directly to a metallic body, instead of an oxide film which, sooner or later, allows the joints to come apart.

To solder twisted wires on vario-couplers, untwist them and scrape the insulation off the ends and brighten with emery or sandpaper, also coat them with rosin flux, taking care not to get any of the latter on the insulation. Heat the iron in a gas or coal fire until it has acquired the right temperature, when the solder on its tinned surface will be observed to melt; this shows it to be hot enough. Remove it from the fire, give it a quick rub on a piece of old carpet and touch it to a bar of solder. A drop of the latter will adhere to the iron and can be conveyed to the wires that need uniting. Hold the hot copper on the junction and as soon as they are hot enough, the solder will leave the iron and flow over the wires. Remove the iron but do not disturb the joint until the solder has set, which will be shown by a sudden dulling of its surface. It may be necessary to add more solder to the joint. In this case, add more flux and put on another drop of metal.

Some radio fans use aluminum wires for aerials and try to solder the joints with ordinary "half-and-half" tinners' solder and then wonder why it does not stick to them.

Aluminum has an oxide on its surface which reforms as quickly as removed. For this reason a special solder is needed. If possible, a radio enthusiast who desires to use an aluminum wire aerial should have a wire of such length that it will reach the binding posts of his set without any soldered connections in it. Should this be impracticable, then resort will have to be made to a soldered lead-in wire. If this work is done with a solder and flux of formula given, aluminum wires may be united with the least amount of trouble. The formula for aluminum solder is 80 percent tin, 20 percent

zinc and 1 percent aluminum. Place a dry grooved board with a slot cut in it the thickness of a lead pencil. Stop up both ends and pour the hot metal from the iron ladle into it. The flux is composed of equal parts stearic acid and rosin, melted and well stirred together. A bar of common yellow laundry soap melted up with a sufficient amount of rosin so as to make a mixture that can be spread on with a stick, will also make a good flux.

Heat the place on the wire with a blowpipe until it is hot enough to melt the solder (which differs from the ordinary variety in that it flows more sluggishly) then quickly rub the hot surface with flux and tin well with the solder, pushing the latter backward and forward. This removes the oxide and prevents any more from forming. When both wires are thoroughly "tinned," wind one over the other in the usual manner. Heat joint again and apply more flux and solder so as to cover both parts well. In aluminum soldering it is better to have each wire well covered with a plentiful supply of solder so as to exclude moisture. This solder will impart a strength to a joint nearly equal to the metal itself. An aluminum soldering bit will be found to work better than a copper one, although the latter can be used successfully for aluminum work. Joints on outside, aerials should be painted with several coats of a spar varnish, so as to keep out the moisture.

The Story of Mahlon Loomis

(*Continued from page* 837)

When today Dr. C. G. Abbot, assistant director of the Smithsonian Institution, is contemplating the possibility of establishing communication with the planet Venus by means of radio-telegraph, and Guglielmo Marconi is attempting to receive wireless messages from Mars, prophetic, indeed, is this notation from the diary of Mahlon Loomis, dated December, 1868—54 years ago: "Inasmuch as the earth, together with the other planets, are held in their respective places by some power or agent, I believe that power or agent to be electricity, and that being bound and connected as they are by this one element common and continuous to them all, a direct communication to and from these other planets, will sooner or later be had with as great facility as we now have from city to city."

The theory on which this pioneer in the field of radio-telegraphy based his appeal for support from Congress to the extent of $50.000 is embodied in the following presentation: That from the top of elevated points a positive condition is obtained and the immediate earth surface is in a negative condition—and as positive flows to negative and as the earth is easily disturbed, it was thought that by discharging a positive current into the earth from some elevated position a delicately pre-poised magnet could be deflected at a distance by increasing the earth's force by the positive discharge. In a letter published in the New York *Sun*, on July 23, 1870, he expressed the viewpoint: "Nothing more abundant and nothing more powerful than the celestial and terrestrial conditions bear, relatively and respectively, polarities that must always exist to disturb the equilibrium or to form a circuit." *Leslie's Weekly*, of New York City, in the year 1868, published text and illustrations descriptive of the "successful experiments in communication without the aid of wires," as conducted by Doctor Loomis.

Chesapeake Bay, the scene of present-day Government experiments in fresh adaptations of the art of radio-telegraphy and

radio-telephony, also served as experimental waters for the investigations of Mahlon Loomis half a century ago. It is recorded that demonstrations in the application of the theory of wireless telegraphy were given in establishing communication between two vessels, stationed two miles apart. On each boat was placed a telegraph instrument, which the experimenter indicated in his patent covering his new mode of telegraphing was already in use by the Morse system of communication. A wire was attached to this instrument and one end of the former deposited in the water at a moderate depth. Another insulated wire of greater length than the one just referred to was let down in the water to a considerable depth, the theory being that a cold layer of water was reached. The two layers of waters at varying temperatures, according to the investigator, when connected to a common battery formed a complete electric circuit. Thus communication was established between the two vessels anchored in the Chesapeake Bay. Pertinent in connection with these experiments is the comment of Dr. J. Harris Rogers of Hyattsville, Maryland, who developed the underground system of communication in use during the recent World War. He says: "It was my pleasure to know Doctor Loomis in the 'early days' when he was trying to convince a skeptical world of his new and wonderful discovery. So impressed was I that I went to see Professor Joseph Henry, then at the Smithsonian Institution, and unfolded to him Dr. Loomis' plans. Time has vindicated this great pioneer in the art of wireless communication." The mission of Doctor Rogers to the Smithsonian Institution in behalf of the Loomis progeny, however, was futile. The officials were skeptical as to the feasibility of his undertaking, and subsequent printed records indicate the attitude of the Smithsonian Institution toward the "Aerial Telegraph" scheme, in which the opinion is voiced that evidence was not available to show where Doctor Loomis accomplished much.

And what a revolutionary change has taken place in the attitude of the Congress of the United States in relation to the subject of communication in the absence of wires when first broached 50 years ago and today when this legislative body is now considering a bill to allocate wave-lengths for various services and bring order out of chaos in the babble of confusion attributable to the astounding growth of radio-telephony. So fascinating and all-pervading has become this method of communication that a bill has been introduced contemplating the broadcasting of the debates and deliberations of Congress by means of wireless telephony. In striking contrast is the viewpoint of our national legislators when the "Loomis Aerial Telegraph" bill was first introduced into the Senate in January, 1869—53 years ago. Senator Charles Sumner, in presenting the petition to vest a group of individuals with corporate powers to further the project of the Washington dentist artfully dodged the subject and passed the burden of consideration on to his colleague. He is verbally quoted as follows:

"I present the petition of Mahlon Loomis, M.D., of the District of Columbia, who believes that he has invented a new mode of telegraphing, which he submits as a great and valuable improvement upon any former mode known or discovered. After setting forth at some length the theory of his invention, he asks Congress for an appropriation of $50,000 under such restrictions as Congress may impose, to enable him during the next year to complete the demonstration. In presenting this petition I desire to say that I perform a duty, and I content myself with remarking that it is either a great case of moonshine or it marks a great epoch in the progress of invention. I do not undertake to express an opinion upon it. I ask the reference of the petition to the committee on patents."

The House of Representatives, true to tradition, treated the subject with much less dignity than the Senate. Sportive remarks literally punctured the debates in the lower branch of the national law-making body. The *Daily Globe* of May 21, 1872, in devoting considerable space to the debates, records that one member of the House of Representatives referred to the "Loomis Aerial Telegraph" bill as being prompted by a not infrequent impulse of generosity toward "protection" which contemplated the inclusion of "lightning" on the "free list," along with lumber, salt and "villainous saltpeter." In a somewhat flamboyant and meaningless phrase the petition was characterized as an effort to "blow up private interest and public prosperity with theoretic accuracy." Symbolic of the ridicule with which members of the House of Representatives entertained the proposal of Mahlon Loomis to complete his experiments looking toward the establishment of communication over long distances without the use of wires, are the following fragmentary discussions which this writer takes from the records:

"No, sir, I announce it with regret, we could not commit the fate of this aerial scheme to such proclivities to terrestrial upturnings, and therefore our committee, with singular unanimity, have instructed the gentleman from Indiana (Mr. Holman) and myself to report this bill to the House with favorable recommendation, and to urge its passage. We trust, also, that the measure will receive the aid of the fervid eloquence of the gentleman from Ohio (Mr. Bingham), who introduced this bill, and who is himself a living proof that magnetic influences may flow with delightful energy from the excited fountain of oratory upon the surrounding audience without the aid of transmitting wires or the propulsion of submerged batteries, but emanating from the kindled spark of genius may float upon the musical intonations of the human voice and glide upon the unseen vibrations of the all-sur-

rounding air from heart to heart, awakening passion and kindling emotion with simultaneous activity in the souls of a thousand hearers. The press, twin sister of the telegraph, 'both beautiful messengers of the intellectual emanations of gods and men,' has already endorsed the theory as plausible, and commended it to the favorable consideration of Congress and the country."

For three successive years Representative J. A. Bingham of Ohio introduced the "Loomis Aerial Telegraph" bill in the House of Representatives. This law-making body seemed to be at a loss as to what committee should have jurisdiction over the subject. Consequently, we find Representative Bingham suggesting the Committee on Commerce as the proper one when he said, "because if the project proposed should be successful, it connects itself directly with the power to regulate commerce, not only among the several States of the Union, but with all nations." Refreshing, indeed, is it to find among the voluminous published Congressional speeches on the subject one that is not prone to treat the proposal with levity. Such was the presentation of Representative Omar D. Conger of Michigan, chairman of the Committee on Commerce, in a somewhat lengthy discussion in the House of Representatives on May 21, 1872—exactly 50 years ago. His treatment, although clothed in oratorical verbiage, challenged his colleagues to lend respectful consideration to the bill. He said, "Sir, the time may come when it will be the proudest honor of those gentlemen who now listen with dreamy indifference to the hopes and aspirations of this inventory of the aerial telegraphic system to have had their names coupled with this immortal discovery, by even the empty encouragement of a reluctant affirmative vote." His remarks contain the terms "electrical vibrations or waves," words evidently prompted by the inventor, who had supplied this Congressman with data relating to his project. This was in 1872—16 years before Professor Heinrich Hertz of Karlsruhe, Germany, had produced, detected and measured the electromagnetic waves, as we know them today. This reference to "waves," however, seems to be a notable exception among all the literature examined regarding the Loomis progeny. Scientists prone to discount his contribution to wireless telegraphy express doubt that he employed electromagnetic waves in his transmission of intelligence from one peak to another, 14 miles apart, on the Blue Ridge Mountains. The speech of the Representative from Michigan, consisting as it does of probably the only serious attempt to present the petition of Mahlon Loomis to vest the promoters of his invention with corporate powers, will bear repetition in its entirety. His remarks of half a century ago were as follows:

CONGRESSIONAL GLOBE, MAY 21, 1872

Speech made by Omar D. Conger, of Michigan, Chairman of Committee on Commerce, in House of Representatives, May 21, 1872.

Mr. Speaker, the object of this bill is to enable the gentlemen interested in the invention, citizens mostly of this District, to associate in a corporate capacity and accumulate sufficient capital by the voluntary contribution of those who have faith in the theory of the inventor to develop an alleged system of control over the mysterious elements of nature, the most marvelous that ever entered into the conceptions of the human mind.

This theory assumes that the earth itself, the atmosphere surrounding it, and the infinite depths of space encompassing this aerial world, contain a succession of concentric circles or planes of electricity, of which those nearest the earth are perpetually disturbed by oceanic currents, atmospheric changes, alternations of day and night, and the ever-varying effects of solar radiation and lunar influences; but that above those, pierced, perhaps, by the tops of the loftiest mountains, are concentric circles, or vast surrounding seas of undisturbed electricity, which may be affected by any interpenetrating galvanic force from beneath, causing electrical vibrations, or waves, to pass from that point within such electric plane around the world, as upon the surface of some quiet lake one wave circlet follows another from the point of disturb-

ance to the remotest shores. So that from any other mountain top upon the globe any conductor which shall pierce this plane and receive the impression of such vibration may be connected with an indicator, which will mark the length and duration of such vibration, and indicate by any agreed system of notation convertible into human language the messages of the operator at the point of first disturbance; and thus not only from one, but many mountain tops, piercing far above the circumambient atmosphere, the devotee of science and the solemn student of nature may gather the unwritten messages of interest, or affection from the silent solitudes of nature, and the cerulean depths of heaven with unerring accuracy, and transmit them to the denizens of all lands by the mundane machinery of telegraphic instrumentalities.

Such, Mr. Speaker, in brief, is the outline of this simple but marvelous theory which the Committee on Commerce have the honor of submitting for your consideration. And, I observe, sir, with surprise, not unmingled with regret, that some of the chosen representatives of American intelligence in this Hall appear to look with incredulity, if not with indifference, upon this enunciation of a theory in no wise inconsistent with the known facts of science or the marvelous discoveries of the age; while it is refreshing to perceive that all the gentlemen of higher culture and superior intellectual endowments within the sound of my voice seem willing to render to these propositions their calm and dignified attention, and to give their favorable indorsement of these impecunious instruments of corporate efficiency!

Sir, the time may come when it will be the proudest honor of those gentlemen who now listen with dreamy indifference to the hopes and aspirations of this inventor of the aerial telegraphic system to have had their names coupled with this immortal discovery by even the empty encouragement of a reluctant affirmative vote. Aye, sir, when the names of the supporters of this bill, like those of the immortal signers of the Declaration, if not "engraved on brass" shall at least be encompassed in gilded frames and adorn alike the halls of science and the abodes of wealth. And when, too, upon that immortal roll of honor, your name, Mr. Speaker, like that of the illustrious Abou Ben Adem which was inscribed within the book of God as one who loved his fellow men, "leads all the rest."

Sir, there is an exceeding appropriateness in giving to this discovery the sanction of American legislation. There is an admirable reason, in "the eternal fitness of things," that this bill should originate in these Halls, so recently honored by the presence of the beauty and intellect of the nation, assembled to render homage and reverence to the memory of the immortal inventor of telegraphic communication! Who, among this "high imperial throng of new born legislators bright," would not desire to emulate the achievements of their colleagues who were lately honored with the glorious privilege of ministering within these Halls, at the altar of memory, whereon the free-will offering of respect and of gratitude to departed genius was laid with pious benedictions; a scene rendered impressive by the glowing oratory of living tongues, the choral harmony of human voices, the orchestral music of many-sounding messages from far-off lands and beyond the seas, which brought to our national convocation tributes of gratitude from the civilized world, and commingled in a simultaneous offering a respect and the sorrow of universal humanity.

Those messages, which came to our midst from the uttermost parts of the earth in a moment, in the twinkling of an eye, were not brought by human couriers! They came unannounced, save by the mysterious clicking of an instrument untouched by human hands! Over vast plains, through populous kingdoms, and through the mysterious depths of the oceans, they came by unknown paths! For now, as of olden time, "there is a path which no fowl knoweth, and which the vulture's eye hath not seen; the lion's whelps have not trodden it, nor the fierce lion passed by it!" Who, therefore, shall limit the possibilities of discovery? Or who shall set boundaries to the explorations of genius? Our own country is ablaze with the glory of invention, and our own country luminous with the achievements of genius!

It was in America that the lightnings of heaven were first subdued to the empire of man, and were afterward made to more than realize the poet's inspiration and girdle the round earth with the instantaneous transmission of human thought!

Sir, the genius of Shakespeare was compelled to invoke the mystery and the mechanism of the spirit-world when he produced to our delighted vision the ethereal fairy, with the promise "to put a girdle round about the earth in forty minutes," while the genius of Morse surrounded by the cold materialism of American acquisitiveness, and in the broad sunlight of American civilization, but touched the trembling wire with the electric spark, and lo! the mandates of commerce and the messages of affection encircled the earth with the velocity of thought, and traversed the unknown labyrinths of the ocean with unerring precision.

Mr. Speaker, this theory of aerial communication may be elusive; it may be entirely visionary. The earnestness and sincerity of its inventor may give sufficient guarantee of its final success. The long weary months of waiting our action may hereafter seem bright and joyous to him compared to the final disappointment of utter failure which may await the ultimate trial of this fondly cherished project. But, sir, the boon they ask is so trifling, the franchise we confer so entirely harmless and inexpensive, and the benefits to our memorialists in their estimation so important, that it would be unworthy our intelligence longer to refuse or coldly turn away. We shall use our power generously, even if this theory does seem to our comprehension utterly visionary and the dreams of its inventor wild and fantastic; aye, even if to our cooler judgment this alleged control over the mysterious powers of nature does seem the vagary of a disordered intellect.

Do we not recognize in the development of every great truth, in the evolution of every ideal triumph, this ever-existing condition; that there is always a central point around which sanity revolves in serene confidence while the soul scans its new creation, "lord of the ascendent"?

Sir, the visions of the seer are wont to be mistaken for the ravings of insanity! The sublime revelations of prophecy as well as the announcement of immortal truths have ofttimes been deemed the vagaries of those whom "much learning hath made mad." It is not given to mortals to draw asunder the veil that separates us from the spiritual world, or to catch full glimpses of the glory of the universe; yet, alike in the hour of our proudest triumph and of our bitterest affliction, the good angels of our existence minister to our souls and reveal sources of knowledge hidden from our mortal vision.

But, Mr. Speaker, I will no longer detain the House, by allusions to fanciful theories, from providing the passage of this bill for a practical solution of these alleged discoveries. Be it our privilege to grant the preliminary conditions of success; and leave the final result to the faith and energy of our memorialists.

Let us then send forth these disciples of science to explore the unknown regions of creation under the broad seal of American national organization, sustain them in the untried conflict with the forces of nature!

Whether on the summit of snow-clad mountains, or in the midnight darkness of the polar regions, let the glimmering starlight or the roseate aurora at times reveal to their delighted vision this American charter of vested rights, this parchment scroll emblazoned with a guarantee coextensive with American power, of their right to explore the untrodden realms of scientific discovery, and perchance reveal in answer to our longing aspirations the mysteries of unknown forces, and unfold to our astonished gaze the marvelous secrets of creation.

The targets and witticisms of Congress were uncompromising in their derision of the Loomis bill, intermittently, for a period of four years. Finally, the petition, robbed of its original clause that would have appropriated $50,000 in furtherance of the cause, was granted favorable consideration. President Ulysses Grant affixed his signature to the bill in 1873. The act of incorporation contains the names of Mahlon Loomis, Alexander Elliott and William N. Chamberlain of Washington, D. C.; P. R. Ammidon of Boston, Mass., and Isaiah Lukens of Delaware. Succinctly expressed, the purpose of the organization was: "The business and objects of said corporation shall be to develop and utilize the principles and powers of natural electricity to be used in telegraphy, generating light, heat and motive power, and otherwise make and operate any machinery run by electricity for any purpose."

With the incorporation papers in their possession, this band of promoters in a pioneer field laid their plans for enlisting financial aid in behalf of their project. The efforts to solicit support from Wall Street were thwarted a-borning. The panic, known as "Black Friday," put to naught this, as well as other enterprises, to finance promotion schemes. Turning to wealthy interests

in Chicago, an expedition was shaping to undertake experiments in establishing wireless communications between two mountain peaks in the Sierras when the disastrous Chicago fire gutted the premises of the promoters. Tradition has it that still another desperate attempt of Mahlon Loomis, single-handed, to obtain funds with which to further his inventive creations was to seek political influence in having himself appointed consul to Honolulu. He had been informed that there was an abundance of amber on this island and that by assembling it and placing it on the market, funds in furtherance of the practical realization of his so-called "aerial telegraphy" would be thus consummated. His ambitions in this direction, as well as all other ways devised for securing financial resources, came to naught.

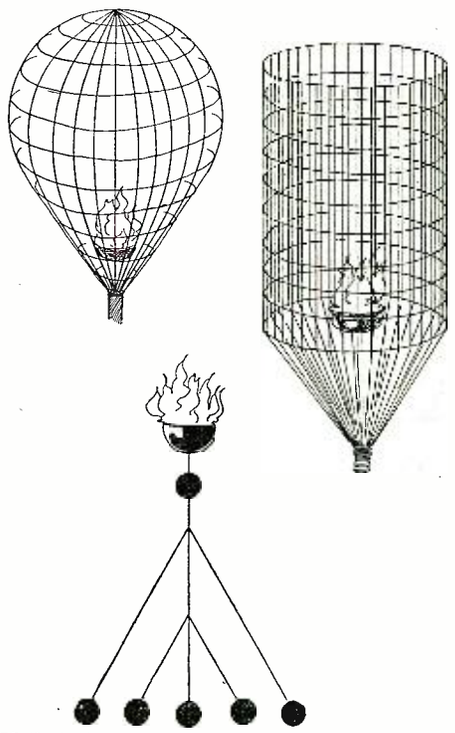
The magazines and newspapers of 50 years ago, as is true today, were in the vanguard of progress with reference to the encouragement of inventive developments. Far in the lead of Congress and their contemporary readers were the majority of the newspapers of that period in lending support to the claims of Mahlon Loomis. Columns upon columns of space were devoted to the exploitation of the "Loomis Aerial Telegraph" Congressional bill and the experiments of the investigator conducted in the Blue Ridge Mountains and on the Chesapeake Bay. With reference to the encouragement from the press, is to be found this published conclusion, "The 'Loomis Aerial Telegraph' bill for $50,000 capitalization is seriously supported by Wendell Phillips and the newspapers." Among the latter were the following that carried lengthy accounts of the developments relating to this mode of telegraphing: New York *Journal of Commerce*, Springfield *Republican*, New York *Tribune*, Philadelphia *Press*, New York *Times*, Washington *Evening Star*, Washington *Post*, New York *Commercial Advertiser*, Baltimore *Sun*, Peru *Herald*, Buffalo *Express*, and Washington *Sunday Chronicle*. Of some of these newspapers their attitude toward the untried proposal might be likened to that of Congress—"dreamy indifference."

The Baltimore *Sun*, of all the newspapers noted, was most outspokenly derisive of the Loomis scheme. This member of the Fourth Estate, with mockery, said: "This looks as though Mr. Bingham (referring to Representative J. A. Bingham of Ohio, who introduced the 'Loomis Aerial Telegraph' bill in the House of Representatives) had got hold of some great novelty in the management of lightning. Can it be said that he is going to establish a telegraph without wires, or posts, or cables? If that be so, we vote for his project. What a benefit it would be, for instance, to have this city relieved of the hateful posts which stand so thickly in our streets, and of the ugly wires which extend between them." The Buffalo *Express*, devoid of cynical remarks, assumed a humorous vein, when, on February 24, 1873, the editor wrote: "We have not heard yet whether, under this plan, there are to be any stations in the low districts (contemplating that the Loomis system of telegraphy would have its source of strength from mountain peaks). It would be a fatal objection of the popularity of the system if people had to go to the top of Mount Hood, Chimborazo, Popocatepetl, or to the crests of the Himalayas and Andes to send their dispatches." The New York *Commercial Advertiser* referred to the "idea of girdling the earth with a vocal electric current without the intervention of wires on land or cables beneath the sea." Does not this suggestion savor strongly of a prophecy of our present radio-telephony and immensely popular broadcasting services? The *Daily Patriot*, still another newspaper, observed, under the date of December 28, 1871, that "Dr. Loomis was meeting with as much opposition and ridicule as did Fulton, Franklin, Morse, or Field."

The temerity of one newspaper reporter was so great as to prompt him to propound the question of Mahlon Loomis, "Where did you learn anything about electricity?" or a question of similar purport. The reply was illuminating and is not foreign to the subject matter of this series of articles. He indicated that he had consistently studied electrical science and meteorology for 12 or 15 years. He had attended a course of lectures on the subject of electricity delivered at Lowell Institute, Boston, in 1852. His researches had included intensive explorations into the published works of Lovering, De La Rive, Poggendorff, Guillemen, Ampere, and others. Magnetism, electricity, galvanism, and electromagnetism had come within the scope of his painstaking observations. Obviously, this Washington dentist was vitally concerned with other subjects and duties than that of pulling aching molars. The biography of his boyhood days characterizes his mind as always "inventing something." Other than the false-tooth plate, the invention of which prompted Queen Victoria to signally honor him, he was granted a patent for having invented a "convertible valise" for railway travelers. The *World's Work* in an issue contemporaneous with that date characterizes this valise as a reminder of Goldsmith's phrase, "Chest contrived a double debt to pay, a bed by night a chest of drawers by day." This device was patented May 10, 1881.

Seemingly, for a time at least, undaunted by the successive failures to enlist support for his enterprise which at various times he described as the "grandest conception," Mahlon Loomis delivered a lecture at the Franklin Institute, in Philadelphia, and elsewhere. This comprehensively set forth his plans to compel the natural electricity to do the bidding of man in the transmission of wireless communications and as a source of motive power and heat. A copy of an extended lecture preserved in his own handwriting, has been found among the personal effects of this Washington dentist. This hitherto unpublished manuscript is made available for incorporation into this article through his cousin, Miss Mary Texanna Loomis, who has founded a school of radio engineering in his honor. This lecture, written January 7, 1872, describes the upper atmosphere as the "great electrical battery of nature." The superiority of this source of electricity over artificial batteries was compared to the variation in the sun and a tallow candle. His theory was to utilize this free electricity in the art of telegraphy, indicating that in the displacing of the cable alone such a method would result in the saving of $125,000 yearly to the Western Union Telegraph Company. Beautiful and picturesque are his figures of speech; however impractical some of his theories may be. Listen to this: "Disarming the tornado and the thunderstorm of their terror, and subduing their power to useful purposes—even as in times past have been the waterfall and steam power, this element will come forth from its heavenly home the willing messenger of glad tidings and great power." Again, both prophetic and limitless in his vision is this bit of eloquent speech: "The mill and factory will then run with a more subtle power, although the waterwheel stands dry and idle. Our dwellings will glow with wholesome heat on wintry days, and be illuminated with clear, unwavering light in the night time from the steady and exhaustless flow of this vital element; and the miner of coal shall leave his toil in the shaft for a nobler handicraft among his fellows up in the sunlight and the world." And, then sensitive to the scorn to which he had been subjected by an unsympathetic public, he tells his listeners: "And if this, my plan, which promises so much for the benefit of man is erroneous or unimportant, then prick it as a bubble and expose its empty nothingness. But, meantime, I am firm in the faith that this immense belt, like rings around our

sister planet Saturn, will yet form the halo of greatness and intelligence about our heads." This lecture, as visionary as it may appear in part, representing as it does the advanced thought of the scientist who first used the vertical conductor in wireless telegraphy, may well be preserved in published form in a magazine. The unpublished manuscript, unabridged, is appended to this sketch:



Methods Suggested by Loomis for the Harnessing of Electricity from the Atmosphere

COPY OF HAND-WRITTEN ARTICLE SIGNED BY DR. MAHLON LOOMIS, JANUARY 7, 1872

(This is believed to be the lecture given by him in several places, and referred to in his other writings a number of times.)

What I contemplate in this undertaking, which is based upon acknowledged scientific facts and mathematical truth, is to send messages from Continent to Continent across the oceans without the use of a cable or artificial battery; or between two stations on the earth, however distant from each other, without intervening wires.

This is the primary undertaking, but with it comes also the ability to draw light, heat and motive power for all purposes, and that without expense beyond the original outlay for cost of apparatus. This is to be accomplished by using the Electrical Element from the inexhaustible supply of nature; not by using artificial batteries and chemical compounds which are but an imitation of nature's, as I shall presently attend to, but by drawing from the great aerial reservoir ready-made and never-failing. Where do we look for the greatest display of might and power but to the atmosphere with its restless and appalling thunderbolt, coming unforeseen and shooting at fatal random. In all nature nothing is so powerful, nor so terrible because powerful. And yet this great element goes to utterly idle waste, often causing death and devastation; strange to say, no attempt is ever made to utilize this immense wealth to the purposes of man. But when we consider the expense and imperfection of oceanic telegraphy in its present condition; when we consider the expense of fuel, and heat, of motive power, whether from animals, the waterfall or steam, when we consider these things, I say, and contrast them with the proposition to furnish for all of these, *one subtle Element*, tractable and obedient, inexhaustible and utterly without cost, or tax or tariff, then that proposition becomes fraught with an importance of the greatest magnitude.

In the first place, *is* there such an element? It is a well established fact of science that free electricity abounds in our atmosphere; that scarcely any traces of it are found less than four feet from the ground or surface of the earth; but on attaining greater height, it becomes more apparent, and the greater the altitude the more this element abounds; so that in reaching an elevation above the clouds it becomes so prevalent as to form a continuous and distinct element, in which our globe with its surrounding atmosphere lies and floats. That is a demonstrated scientific fact.

It is a well established fact in all electrical phenomena that certain *electrical conditions*, called "positive" and "negative," must exist in order to form a "circuit" or current with the electrical

fluid. And these conditions we find most admirably arranged in the great electrical battery of nature. The earth, like the outside of a Leyden jar, or the copper plate of a galvanic battery, is always highly charged with negative electricity. The atmosphere, like the inside of a Leyden jar, or the zinc plate of a galvanic battery, is always highly charged with positive electricity, and the intervening air, like the glass of the Leyden jar, or the separated poles of the galvanic battery, is a perfect non-conductor, thus forming and constituting the most complete and colossal electric battery that ever gave an electric spark, but standing all unused. It is *just as much* superior to all artificial batteries combined as the sun is superior to our tallow candles.

It is, indeed, a mooted question with philosophers *how* this electricity comes there—whether the earth was primarily formed magnetic, and this atmospheric electricity is an "inductive" element, or whether it is eliminated from space and source unknown; but whether it is the one, or the other, the *great fact of its existence* remains, and pending the disagreement of the doctors as to its origin I simply make use of the elements as I find them.

Although it be a well-established fact that this element pervades space around our planet as abundantly and in the same manner as our atmosphere does, still can we reach and control it, and will it answer our purposes if we can do so?

Whatever methods may be devised in the future I am not competent to say, but there is *one way already demonstrated by experiments* by which we can reach and avail sources of its benefit and value, and that is to *seek the highest mountain tops,* and thus penetrate this immense and unexplored field, whose virgin soil awaits the plowshare for a fruitful seedtime and harvest. Common hilltops, or inconsiderable mountain ranges, are inadequate to a successful demonstration, as ascending currents of heated air, or dampness and mists particularly peculiar to the elevation of the generality of clouds, would necessarily prevent the successful working of a long line of range, when attempted for permanent telegraphic purposes. But at an elevation of twelve or sixteen thousand feet, which is easily reached on the Rocky Mountains and the Alps, we may tap the storehouse of the mighty thunder and make it whisper glad tidings over the seas.

And this fluid, abounding as it does without limit, is the very kind or nature most desirable for our uses, from its uniform tension and persistent quality, being superior in kind and better in practical action than that generated by artificial means, and all that remains to be done to make it available in telegraphing and the varied purposes of life is to properly reach forth and pluck it from its slumbering bed. That it will thus fulfill our requirements is recognized by scientific axioms and abundantly demonstrated by common and familiar occurrences in casual meteorology.

It is within the knowledge of almost everyone that during severe and heavy thunderstorms, or in the time of brilliant displays of the Northern lights, long lines of telegraph have been worked by the inductive force of these meteoric displays, which, although casual occurrences firing themselves into notice, nevertheless has cumulative evidence in behalf of my proposition (system). For absolute date of time and place, I will refer to one distinct instance out of many as illustrating the inductive effect of the electricity of the atmosphere working a telegraph line. On the 2d of September, 1859, communications were sent over the wire between South Braintree and Fall River stations in Massachusetts, a distance of 40 miles, with the aid of the celestial battery alone. This was during the appearance of the Northern lights, which are computed to be, on the average, from two to five miles in height and frequently to possess a strength of current equal to that produced by a battery of 200 Grose cups. Many cases are recorded also of communications having been made during thunder storms. And let me here observe that these local and limited displays are similar in their effect to the great overlying stratum which will forever yield its power without diminution; and furthermore, that the first telegraph with its double wire to form the circuit bears the same relation to the one now in use (since one wire has been abandoned, making use of the earth in its stead), as the present system bears to the one which I now actuate. The earth now forms one-half of the circuit in all the telegraph lines, and I simply propose to discard the remaining wire or cable and penetrate the insulating medium of the dense atmosphere reaching the electrical stratum above and around the earth, to form the other half as well, or to make this atmospheric element practically and usefully reciprocate its fellow element of the earth. The advantages gained in this, simply in the art of telegraphy, are immense and greater than might at first appear. Aside from the saving of a cable (which is $12,500 per annum for the W. U. Co.) is that also of the battery power, and yet a persistent current of volume and intensity is supplied, like the air we breathe freely, abundantly and without cost.

Independent of its use in the art of telegraphy, it will otherwise result beneficially, almost beyond computation. Disarming the tornado and the thunderstorm of their terror and subduing their power to useful purposes, even as in times passed have been the waterfall and steam power, this element will come forth from its heavenly home the willing messenger of glad tidings and great power.

Professor Smee, of London, in the last edition of his work on electricity, says: "The value of the steam engine over electrical contrivances depends upon the cheapness of coals as compared with zinc, for if ever the philosopher should discover an effective carbon battery where there is no decomposition of zinc, then will the steam engine

cease, then will gas companies be compelled to stop their works and a total revolution will be produced in all the physical forces employed by man."

I say, the great battery of nature is most essentially and emphatically this "carbon battery," for it consumes no metal, its volume is unlimited and its working power inexhaustible and without diminution.

And now it remains for us to simply avail ourselves of this immense treasure yielding us the three great essentials of human life, viz., light, heat and physical power, as well as land or oceanic telegraphy, without artificial battery, wire or cable, and all without expense beyond the original outlay for construction, as it will last forever when once established.

De la Rire says: "The Aurora, or Northern lights, is due to electric discharges taking place in the polar regions between the positive electricity of the atmosphere and the negative electricity of the earth."

This is doubtless true and correct, but I will go further and say also that it is only the *accidental* reunion of the two electricities, and that it can be brought about regularly and constantly by artificial and suitably established means as well.

Lightning is the *accidental* reunion of the two separate electricities through an incidental or casual conductor, and my proposition is to harmonize its working, or systematically regulate this intermittent and unequal action, by suitable channels of communication.

We have levied upon the forests to warm our hearthstones; we have mined into the earth and made her yield up her coal, and her still more refined products of oil and gas; but the expense of them all outweighing in value the wealth of the land and the seas lies untouched and undisturbed.

The waterfall goes to waste, unless we cut and build artificial channels to avail ourselves of its power. The bed of the river is often choked with obstructions, extending in consequence its seething marshlands, which yield malarious death and devastation, until the channel is so constructed as to give it free current to the sea.

So this great electrical ocean, slumbering with giant power, untold wealth and willing aid, waits but the proper sluiceways or conducting channels to illuminate and to drive the wheelwork of the world. But in its unclaimed usefulness, its wild and random freaks only cause death and universal terror.

The mill and factory will then run with a more subtle power, although the waterwheel stands dry and idle. Our dwellings will glow with wholesome heat on wintry days and be illuminated with clear, unwavering light in the night time from the steady and exhaustless flow of this vital element, and the miner of coal shall leave his toil in the shaft for a nobler handicraft among his fellows up in the sunlight and the world. The crude gold of Ophir may lie in the ground, but the pure smelted metal of Omnipotence lies in the stratum over it.

We of the present century have taken great and unwarrantable self-glorification unto ourselves for the so-called "taming of the lightnings of the heaven" or of "harnessing the thunderbolts of Jove to do our bidding." It sounds grand and intellectually powerful, but this is in fact all bombast and utterly incorrect—for the lightnings of heaven are *just as much untamed as ever.* That great natural electrical ocean from which the thunder draws its kindling spark has not yet been explored nor even invaded by the "taming" hand of man. All that man has done so far is to set up little, puny "lightning rods" all over the land to be protected in some slight degree from its untamed power and appalling demonstrations, yet shrinking with terror from their inefficiency whenever the dark cloud gathers in the sky. *Franklin* demonstrated the practicability of drawing electricity from the clouds to the earth, but not one step has since been taken to pursue that fact to a profitable practice. Thousands of human lives and millions of dollars are sacrificed because we have not "tamed" this power, and still we will not understand or heed this loud voice proclaiming from the skies what might and majesty of concentrated power the Almighty has put in store for the benefit, and not the destruction, of man. Air, fire and water are formed and transformed by this element or power-made and unmade by it. They are all convertible elements. And this electrical essence will yet melt the icebergs in the seas of Thor, and vessels may ride in safety on their "Northern passage," the entire globe made more productive, all malaria cleared from the atmosphere and the entire climates of this our planet toned and tempered by it.

When the Black Hills of the West are reported to contain in many places particles of gold dust forthwith thousands of eager toilers dare dangers, deprivations and death in hope for the uncertain pursuit. But in this limitless field—richest of all domains—how comparatively few there are to labor! Yet the certainty of its unfathomed wealth is patent to every reflecting mind. It is the new Garden of Eden of whose ripened fruits we may reach forth and partake in the way that God prescribed only, avoiding the wrath of His flaming sword by avoiding the evil of tampering with its apples through the sin of ignorance, for on the day we do that *we shall surely die.*

It is the grand element of life, as well as usefulness and power. It dallies gently with a straw and yet chains a universe of worlds in absolute obedience to its laws. Notwithstanding we know its many ways and workings, still the scalpel of chemical surgery, though honed and whetted with 60 centuries of human brain oil, cannot dissect the anatomy of its closely woven fibres, nor reach the heart of its mighty pulsebeat. We view with curious eye the several little phenomena which it produces, but we sink appalled at the terrible demonstrations of its live energy and might! The bud and leaf unfold and grow beneath its vital

force and the subtle springs of human life pulsate with its glow. 'Tis the germ-essence throughout all animated nature and the power that compels all inanimate nature into obedience to perfect law and order. It

"Warms in the sun, refreshes in the breeze,
Glows in the stars and blossoms in the trees;
Lives through all life, extends through all extent,
Spreads undivided, operates unspent."

And all serenely above the tornadoes conflict this promethean torch smoulders with lambent flame, to awaken whose majesty and might we need but touch its celestial brazier, and Neptune's strident rising from the sea will "tame" and utilize the thunder. No greater field for discovery and usefulness could possibly be opened to men, and the immense advantages that would immediately reward the opening of the ports into this Celestial Empire would transcend all the great physical works of the earth. In her youth continents spread out with broad domain teeming with the fruitage of a new inheritance, and if we charter forth but one small vessel on an expedition to its genial shores, we may rest assured that it will return laden with more than the golden sands of the memorable Castillan fleet of three.

Sanded discoveries necessarily have limits set and their outlines are well-nigh traced. But in this dominion is the home of that mystic needle which points the way to all other lands and space, and the limits of this domain are only measured by the red-winged spark from the eternal God into the dim haze of the uttermost Thule.

No great Alexander need ever weep again because he has no kingdoms to conquer, for here is ample field for noble ambition. Battalions armed with the hand of thought may march forth to profitable victory here. Here is field to construct interminable highways whose fleet chariots shall be laden with human thoughts coming and going for the good of man; and in this field new empires shall be conquered and new habitations built.

Expeditions to the ice field of the North Pole offer but a meager reward even in the event of successful return. The immense work of the Pharaoh pyramids is great in the world's history. Bridging or tunneling the Straits of Dover and opening the Suez and Darien Canals are mighty projects, which, completed with the expenditure of untold treasure, will, no doubt, add many comforts to many nations; although their immediate benefit is of a local nature, but verify this proposition and the very *world* will shake and tremble at the august consummation and the souls of all her people will rejoice and be made glad.

What is there in this proposition savoring of impossibility, when all the elements of success involved are based on acknowledged facts and laws, as it is in science. The only argument that can be brought against it is the time-honored one, ever urged with so much pertinacity—*that it never has been done*—hence it is a vision and a folly. But the history of all important projects is that they have, from the remotest antiquity, been opposed simply on the ground of their being new. New and original enterprises never lack specious arguments to show their fallacy; and that which does cause and forever has caused strongest opposition to new realities in the public mind is the mere fact that they are *new* and previously unaccomplished. Yet everyone knows the futility and folly of this. The greater the magnitude of the enterprise, the greater might is this fallacy allowed to have.

When the theory of the rotation of the earth was first asserted it was denounced as the vagary of an abberated mind, because it was new and startling.

The theory, although well established by logic and reasoning, that there was another opposite side of the world from Europe was not kindly entertained there late in the fifteenth century. Thirty years ago Morse was looked upon as a crazy man. Just previous to laying the first Atlantic cable men eminent in learning gave an abundance of sage reasoning *why* it could never be made to transmit a message.

But all these combatted truths, which come up from time to time, appearing strange and erroneous simply because they are startlingly new, and because the scientific world has never previously recognized them in a collective and distinct manner, are the very leaven of our civilization—the sword and artillery that fight the hosts of the prince of darkness and elevate the standard of humanity. Nothing was ever lost by granting breath to the new-born child of science; but the world has forever lost and suffered by attempts at strangulation or the coldness of sympathy and neglect. It is one thing to strike physical fetters from oppressed races of man and aid them in their toil for prosperity and pursuit of happiness, but it is another and still greater to unbar the imprisoned thoughts of man—these angelic slaves—struggling under the lash of derision and starving from cold neglect, especially when the purple and fine linen of our generation's pride of cultured elevation are spun and woven by the loom and anvil brain-stroke of these same enslaved and patient silent workers. But the world has from all time united in keeping them down and aided in maintaining this slavery.

The morning comes slowly, but the hour is about passed and gone when men may slight with impunity or turn indifferently away from the new-born revelations that toiling, pioneering minds garner from rugged fields planted by the living God for our higher harvest and refinement. And it is not well for any man to oppose the growth or progress of these new plants that bud and promise, for the surely avenging Nemesis will follow on the trail of him or them who dare oppress the struggling truths of God, for shame and disgrace shall come sooner or later as their well-merited inheritance.

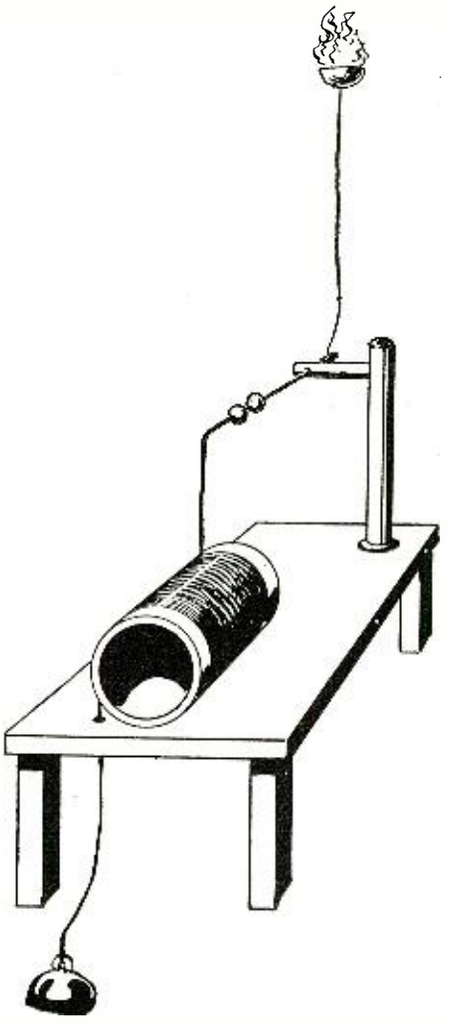
It is touching a class of sacred matters, which to the disgrace of individuals and the world has been ignored too frequently. And it is high noon of the day when the tide must turn and these slighted truths vital to our well being and our first pride of humanity must be allowed the sunlight and the helping hand.

And if this my plan which promises so much for the benefit of man is erroneous or unimportant, then prick it as a bubble and expose its empty nothingness. But meantime I am firm in the faith that this immense belt, like the rings around our sister planet Saturn, will yet form the halo of greatness and intelligence about our heads.

Common sense and intuitive perception declare it to be right; scientific facts and all the elements of earth and air array themselves in its defense; for it is founded on the solid masonry of the universe and its corner-stone was laid by the Great Builder.

MAHLON LOOMIS.

January 7, 1872.



Apparatus Set Up by Loomis for the Production of an Electrical Discharge. The Original Drawing Appeared in His Patent Papers.

No enduring testimony subscribing to the pioneering experiments of Mahlon Loomis in wireless telegraphy is to be found in the National Capital, save the documents and diagrams on file in the Library of Congress, Patent Office, and the Smithsonian Institution. The drawings illustrating this series of articles were faithfully copied from the records of the Smithsonian Institution, and the printed records are likewise included in this manuscript—the first attempt to compile in a comprehensive way the trail-blazing investigations of a pioneer in a subject that is just now gripping the world. A petition, signed by a number of citizens, requesting Congress to enact "speedy legislation in recognition of Doctor Mahlon Loomis, a citizen of the State of West Virginia, and the valuable services he rendered to science, commerce, and humanity in the discovery of wireless telegraphy in 1872, as shown in the records of the Patent Office and the passage

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Tested by the New York "Evening Mail" Radio Institute, approved and awarded Certificate of Excellence.

GREATEST TUBE EVENT IN RADIO

We have secured a quantity of genuine Western Electric V.T. 1 and V.T. 2 Vacuum Tubes They are not rejects, but are Signal Corps surplus stock. These tubes are superior in every way to other tubes on the market, and heretofore were impossible to obtain at any price.

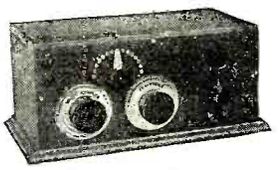
These tubes were tested by the New York "EVENING MAIL" RADIO INSTITUTE, APPROVED AND AWARDED THEIR CERTIFICATE OF EXCELLENCE.

WESTERN ELECTRIC V.T. 1 (J) TUBE, made for the U. S. Signal Corps; excellent detector and amplifier. Regular price $10.00; Sale, $7.50.

WESTERN ELECTRIC V.T. 2 TUBE, made for the U. S. Signal Corps; excellent amplifier and power tube Regular price, $12.00; Sale, $8.50.

THE FINCH VACUUM TUBE RECEIVER

Designed and Built by Men Who Know Radio



THE Finch single tube vacuum receiver is a model instrument in every respect. It has three tuning controls, which insure great selectivity and freedom from interference. All of the parts are mounted on a pure bakelite panel. The cabinet, which is beautifully finished, is of hard wood, and measures 6½ inches high, 7½ inches deep and 18⅞ inches long. The hinged top allows the user to make interior adjustments with ease. Rubber covered binding posts used throughout. This is a receiver that you will be proud to own and operate. Detector and tuning unit complete except vacuum tube, phones and batteries. **$44.50**

Dealers and Jobbers—Write for our interesting sales plan. Other Literature sent on receipt of stamp.

When you VISIT NEW YORK, call and see our EXHIBIT at the PERMANENT RADIO FAIR—RED ROOM, HOTEL IMPERIAL, Broadway and 32nd St.

FINCH RADIO MFG. CO., 303-R Fifth Ave., New York, N. Y.

RADIO MERCHANDISE

F. D. PITTS CO.

INCORPORATED

219 Columbus Avenue **BOSTON, MASS., U. S. A.**

Announces a Change of Policy—Wholesale Only

DISTRIBUTORS FOR

A. H. GREBE & CO. (New England)
RADIO CORPORATION OF AMERICA
GENERAL ELECTRIC COMPANY
WESTINGHOUSE ELECTRIC & MFG. CO.
WIRELESS SPECIALTY APPARATUS COMPANY
MAGNAVOX COMPANY
CLAPP EASTHAM COMPANY
WESTERN ELECTRIC COMPANY
ACME APPARATUS COMPANY
DEFOREST RADIO TEL. AND TEL. COMPANY
FEDERAL TEL. AND TEL. COMPANY
WM. J. MURDOCK COMPANY
ADAMS MORGAN COMPANY
PACENT ELECTRIC COMPANY
CHELSEA RADIO COMPANY
REMLER RADIO MFG. COMPANY
FRANK A. D. ANDREA
HERBERT H. FROST
ELECTROSE MFG. COMPANY
SIGNAL ELECTRIC MFG. CO.
GENERAL RADIO COMPANY
AMERICAN RADIO AND RESEARCH CORP.
JOHN FIRTH AND COMPANY
GENERAL APPARATUS CO.
C. D. TUSKA COMPANY
AMERICAN EVER READY WORKS
WIRELESS PRESS
MURAD LABORATORIES
DUBILIER CONDENSER COMPANY
WESTON ELECTRICAL INSTRUMENT COMPANY

AND OTHERS

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, Boston, Mass., Providence, R. I., and Springfield, Mass., is now operated by the "Pitts Radio Stores, Inc.," at the same addresses

in Congress of the law chartering the 'Loomis Aerial Telegraph Company'," failed to accomplish its desired ends. The thumb-worn petition, among other documents of Mahlon Loomis, alone tells the story of a futile attempt to secure recognition. It was considered by his friends that it would be fitting to place a bronze tablet in the National Museum in honor of his memory, but the plans failed of fruition. Only negatively did the Second Session of the Fifty-seventh Congress consider the claims of the Washington dentist as entitled to priority of discovery of wireless telegraphy. A resolution was offered by Senator Hoar of Massachusetts proposing that the United States give thanks to Guglielmo Marconi "for his wonderful invention and service to mankind." E. W. Whitaker, a patent lawyer of Washington, D. C., who had served Doctor Loomis in a legal capacity, supplied Senator Elkins of West Virginia with documentary evidence purporting to show that this Washington dentist was the discoverer of the mode of telegraphy dispensing with wires. The resolution of thanks to Marconi failed of passage.

Repeatedly rebuffed by a people and an age whom he far outdistanced in foreseeing inventive progress, Mahlon Loomis, with a sadness probably tinged with bitterness by continuous rebuke because of his advanced ideas, addressed a letter to the *World*. There are bits of pathos and irony in the vein of his remarks, which are quoted as follows: "The interest recently awakened by 'telegraphing through the air' induces me to make a statement, ask you a question, and lay before you a proposition. My statement is this: In 1872 I obtained letters patent from the United States Patent Office for 'Improvement in Telegraphing' without wires. About a year afterward Congress granted me an act of incorporation. I afterwards petitioned that body for an appropriation to enable me to carry out this plan to telegraph across the ocean without a cable. This was not granted. My individual means were not sufficient to accomplish the object, and after trying a while unsuccessfully to induce others to aid me, I was compelled to give it up and devote myself to my profession. But I made sufficient experiments in a private way to fully demonstrate the practicability of the theory, and now have the original 'gilded balloons' in my possession. At that time I telegraphed successfully about 20 miles from one point to another in the Blue Ridge Mountains in Virginia. This, and all subsequent experiments and information, fortify my belief to an almost positive knowledge that I can as easily telegraph across the Pacific from near San Francisco to Tokio without wire or cable."

Battered in spirit, broken in health, and rejected by his life companion because she thought his actions were those of a demented person, Mahlon Loomis retired to a farm in West Virginia to spend his remaining days far from the "madding crowd." He took up his residence with a brother, George Loomis, a judge of the sixth circuit of West Virginia. His last conversation with his brother relative to his experiments reflect a tone of one burdened with the thought of an unrequited recognition—moreover, a simple justice long delayed. His words are clothed in pathos and, not unlike other scientists who have toiled unremittingly in the face of overwhelming odds and scant recognition, he reposes faith in his project to the dying hour. His ultimatum is repeated here as told by his brother: "George, I know that I am regarded a crank, perhaps a fool by some, and as to the latter, possibly I am, for I could have discarded this thing entirely and turned my attention strictly to making money, and no doubt accumulated a few thousand dollars and would then be considered a success. But the time will come when this discovery will be regarded as of more consequence to mankind than was Columbus' discovery of a new world. I have not only discovered a new

world, but the means of invading it—not with the frail boats of human build, but with the 'invisible chariots of the Almighty.' I shall never realize anything from it, neither money nor fame—as to fame I care nothing, so the world gets the benefit of it. As to money, I only want it for my family. They have necessarily been neglected more or less while I have devoted the best energies of my life to this the greatest conception that ever occupied a human mind. My compensation is poverty, contempt, neglect, forgetfulness. In the distant future, when the possibilities of this discovery (as I see them) are more fully developed, public attention will be directed to its originator; and the Congressional records will furnish the indisputable evidence that the credit belongs to me. But what good, then? Still, there is a present satisfaction in knowing that some time the proper credit will be given. In the meantime others will reap the benefit, in wordly wealth and wordly honors. Monuments will be reared to their memory—costly monuments in the token of the world's appreciation of their genius. I ask but a rose bush to make my grave, affording a brief restingplace for passing songbirds, and I have a feeling that I shall even then be conscious of the melody of their carolings."

Radio Digest

(*Continued from page 867*)

just as closely as from an electric player board, is being furnished to the papers by the General Electric Company.

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16 NEW LIMITED COMMERCIAL OR BROADCASTING STATIONS LICENSED DURING WEEK ENDING AUGUST 26TH

WLAD—Arvanette Radio Supply Co., Hastings, Neb.
KFBN—Borch Radio Corp., Oakland, Cal.
WLAF—Johnson Radio Co., Lincoln, Neb.
WKAM—Adam Breede, Hastings *Daily Tribune*, Hastings, Neb.
WKAL—Gray & Gray, Orange, Tex.
WKAR—Michigan Agri. College, East Lansing, Mich.
WKAK—*Okfuskee County News*, Okemah, Okla.
WMAM—Beaumont Radio Equipment Co., Beaumont, Tex.
WKAT—Frankfort *Morning Times*, Frankfort, Ind.
WMAH—General Supply Co., Lincoln, Neb.
WLAB—George F. Grossman, Carrollton, Mo.
WKAV—Laconia Radio Club, Laconia, N. H.
WKAS—L. E. Lines Music Co., Springfield, Mo.
KFDB—John D. McKee, Lombard & Kearney, San Francisco, Cal.
WNAL—R. J. Rockwell, Omaha, Neb.
WKAW—Turner Cycle Co., Beloit, Wis.

VETERANS' BUREAU TRAINING IN RADIO

Already the Veterans' Bureau has rehabilitated a large number of veterans in radio, and to date 282 are in training.

Some of these new operators have secured sea-employment in the Shipping Board, and on privately operated vessels, while others have gone into various commercial companies, through the Radio Want Ads broadcasted through NOF, Anacostia. The bureau now expects to furnish radio operators for land service from the surplus radio men trained, which threatens to accumulate.

One hundred men have been trained in

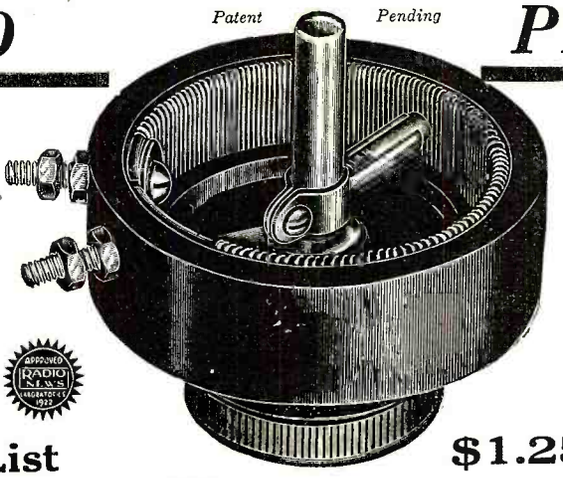
SUNRAID PRODUCTS

Patent Pending

List Price 3 in. $1.00 4 in. $1.50

Dials

The new improved SUNRAID DIALS are of one solid piece of moulded condensite. The Dials are so constructed that when mounted on a panel they set off $\frac{1}{32}$ of an inch from the surface of the panel, which gives a maximum of efficiency in smooth operation — no gripping.



List $1.25

Rheostats

Radio men who want a Rheostat of high-class workmanship that gives a maximum amount of service will find it worth their while to buy the SUNRAID RHEOSTAT. It gives perfect contact against winding at all times. (See spring attachment in above photograph.)

Windings guaranteed not to jump out.

SPECIAL NOTE TO DISTRIBUTORS AND DEALERS

Another Sunraid product is now ready for delivery. A crystal set of the same high-class workmanship as our products. Enclosed in Mahogany-wood box, highly finished, 5″x5″x5″ with mahoganized panel-enclosed crystal detector and 10 switch points.

These sets will be packed separately in Christmas boxes especially fitted for the Christmas trade. Sample set sent upon request. List Price...$5.00

Very attractive discounts

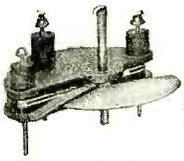
Amateurs. If your dealer cannot supply you with our crystal set, order direct, sending 25c extra for postage. Total $5.25.

SUNRAID PRODUCTS are guaranteed. Distributors wanted for all parts of the world. Write for proposition.
AMATEURS—If dealer cannot supply you, write direct and send dealer's name and address.
DISTRIBUTORS—Samples will be sent to you C. O. D. upon request.

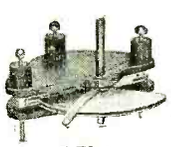
SUNRAID RADIO CO.

534 EIGHTH AVENUE — SUNRAID PRODUCTS *Trade Mark* — **NEW YORK CITY, U.S.A.**

SPECIAL ANNOUNCEMENT on MARSHALL CONDENSERS



3 Plate Vernier Price $2.50

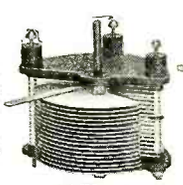


5 Plate $2.75

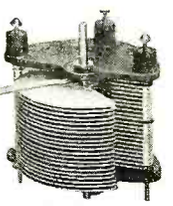
9 Plate $3.50

17 Plate $4.25

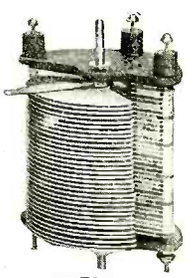
23 Plate $5.25



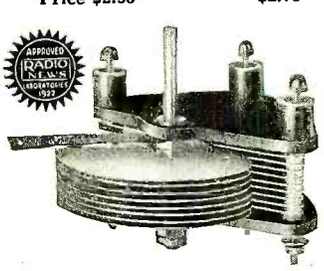
35 Plate $6.00



43 Plate $6.25



67 Plate $10.00



Use some of these condensers in your set. Be certain that you're getting large plate capacities, assuring high oscillative power factor with a minimum of interference. Exceptionally high degree of (hard rubber) insulation. A straight line precision instrument and a zero capacity that is practically capacity of your aerial and coils.

MARSHALL VARIABLE AIR CONDENSERS will hold a static charge at least 48 hours and if placed on insulators in a container of oil will make a scientific, high capacity oil condenser.

These are the Highest Grade Condensers on the American Market. Note Purchase Coupon Below. It is Worth at least 25c to You, and as Much More as You Care to Make It.

Standardize your set on Marshall Condensers and the Coupon will be worth several dollars to you. Insist on the genuine Marshall Condensers. If your dealer has none in stock we will ship postpaid on receipt of coupon and balance.

A Hint to Parents—order your Xmas radio presents now—save money—get really reliable radio instruments. Fill Out This Coupon for As Many Condensers As You Need and Hand It to Your Local Dealer.

NEW HAVEN RADIO COMPANY, Chapel and Hamilton Streets, NEW HAVEN, CONN.

Coupon good until November 10, anywhere in the world. Order today as many condensers as you need as we will not make this offer again.

Messrs.... (Dealer's name and address) (Date).....

Please deliver to me the Marshall Variable Air Condensers I have checked, (Write in squares number of each desired)

3 Plate	5 Plate	9 Plate	17 Plate	23 Plate	35 Plate	43 Plate	67 Plate	5-23 Plate Outfit Radio Expert Size

and accept this coupon in payment of.....dollars and.....cents of the cost of same, (10% of the retail price) the balance to be paid for in cash.

Name..... Address.....

RETAILERS AND JOBBERS:—We, the New Haven Radio Company, authorize you to accept this coupon. We will accept it from you at its face value when properly filled out and signed, in partial payment on any order for assembled Marshall Variable Air Condensers, placed with us either by the retail dealer direct or through his jobber, until December 1, 1922. Our references: Dun or Bradstreet, or any bank in New Haven. **NEW HAVEN RADIO CO., NEW HAVEN, CONN.**

radio at the Nola Radio School, New Orleans; forty at Loomis Radio School in Washington; and seventy at the Service Radio Institute, also in Washington.

FORTHCOMING CHICAGO EXPOSITION

January has been selected as the month when the second annual National Radio Exposition will be held in Chicago. This was chosen for several reasons. By that time the radio industrial atmosphere will have sufficiently cleared to enable the manufacturer, jobber and dealer to know where he stands; the annual inventories will have been taken, and an adjustment will have been reached in this rapidly growing industry which will have stabilized it to a large degree.

There was another factor in causing the advisory committee of the second National Radio Exposition to select this particular time for the second national show. Consultation with exhibitors in the first national exposition, held in the Leiter Building, Chicago, June 26 to July 1, revealed the fact that the big men in the industry were convinced that with the opening of the new year will come many changes in the radio situation, new inventions will have relegated to the scrap heap and rendered obsolete many of the devices now used. Long distance reception will have been so much improved as to enable Chicago to hear music and world news direct from England, Scotland and Panama, as well as the most distant points in the United States.

The First Regiment Armory, 16th Street and Michigan Avenue, has been selected as the place for holding the second annual National Radio Exposition, and the dates are to be January 13 to 20, inclusive, according to Milo E. Westbrooke, who is the pioneer in staging a radio exposition truly national in character.

Many features of prime interest to the exhibitor will be inaugurated at this second national show by Manager Westbrooke. The armory has many handsomely furnished company rooms. The construction of the building, built to withstand a siege in time of war, render these rooms sound proof. These quarters will be utilized as special demonstration rooms. Exhibitors who desire to show prospective customers how their sets will get long distance reception will be enabled in these rooms to give private radio concerts without any outside interference either to detract the attention of the customer or impair the hearing of the concerts. Interested people may be taken from the exhibit booths on the main floor to the private demonstration rooms, which will accommodate from 40 to 50 persons.

As at the first national show Manager Westbrooke will regulate the loud speakers so as to eliminate the noise which might interfere with the business at the exposition. Mr. Westbrooke was highly commended by the press and the exhibitors for the efficient way in which he handled this situation at the June exposition. Profiting from this experience, the second national exposition will show a marked improvement along these lines.

Another point of interest in connection with the selection of the First Regiment Armory for the second national exposition is its location. It is outside Chicago's Loop, a fact which eliminates the difficulties of clear reception encountered in the downtown district. The armory is away from the elevated railroads and the street cars and other hindrances to radio reception found in the Loop.

One of the features of the second national exposition, as it was in the first, will be the participation of the schools. The high school boy is not only looked upon as the radio manufacturer of the future, but he is the surest vehicle to carry radio into the home.

The school exhibit at the second National Radio Exposition will be on a more extensive scale than at the first show. There are

24 high schools in Chicago, and already the students in all of these are working on the exhibits they will display in the First Regiment Armory. There are radio clubs in all these institutions, and the leaders in these organizations will take an active part in the school participation. As at the first show, the schools will have actual working exhibits showing how radio sets are made in the school work rooms by these juvenile wizards of electricity.

So great an interest was aroused by this educational feature at the first exposition that the schools throughout the entire Mississippi Valley have evinced a keen interest in the First Regiment exposition, according to the letters already received by Manager Westbrooke.

RADIO BRINGS CHEER TO THE OUTPOSTS

WSB, the radio broadcasting station of the Atlanta *Journal,* has brought untold cheer to a lonely Canadian camper—M. J. Caveney, of Sandy Falls, Timmins, Northern Ontario, 1,500 miles or so away.

He pictures in a vivid and colorful letter to the *Journal* the life he leads and the pleasure he derives from the radiophone.

His letter is commendable, if for no other reason than that it portrays in a most striking manner some of the greatest blessings ever bestowed upon mankind through the invention and use of the radiophone.

Below is a copy of the letter:

August, 1922.

TIMMINS,
Northern Ontario,
Canada.

DEAR WSB:

Suppose I ought to tell you that you are QSA here.

Am located in the Temagami Forest Reserve, Porcupine Gold area of Northern Ontario. Get a map that shows the Mettagami River, or better still, run clean up the map from where you are, just about dead north—stop round lat. 48, long. 81—that's near enough. Distance? Oh! 1,500 miles roughly, but you can work it out. Radio set is all home-made with the accent on the word "home"—tuner, detector and one step. Often don't use the last named when static gets foolish. Aerial is slung between two spruce poles 35′ high, and a handful of copper wire thrown into a hole in the ground completes the outfit.

How's the weather down Georgia way? Suppose you are picking up rather warm weather just now. It's quite different up here, though. Snow comes in November, stays till May. Had a sprinkling of frosty nights in June, July and August. After next month we will have to start and hole up

again for the winter freeze-up. During the winter the glass fusses around 25 to 35 below zero, with occasional swoons to 45 degrees below. Those are the nights I can do without headphones and wash my dishes to music. Can you imagine a winter night here, a shack with snow to the roof, and a straight plume of steam going clear up to the bright moon from the red-hot stove pipe? If you can, then if your imagination will let you go so far as to kick the snow from the lone window in the shack, you would see one uncouth gazaboo, who beats time on a couple of tin plates to a fetching fox trot, via radio.

I don't wish to be rude, old man, but honestly I don't believe you folks realize one-half the good you are doing.

The winds of circumstance are forever blowing specks of humanity into the more remote quarters of the globe.

You'll find them crawling over sun-baked deserts, or shuffling behind a string of wolf dogs in the Arctic, wandering until they eventually slip over the edge of everything.

As regards communication with the outside—well, silence reigns supreme.

But you folks have changed all this.

The silent nights that so often drove lone men to talk to the stars, the sun, the moon, to a burning log, to anything that moved—just for company—those nights are going.

The radiophone has started flinging lightning—flinging it across hot deserts and drifting snows, carrying the news of the world to the "hitherto lost."

Sweet melodies that bring back fond memories, rollicking songs and the lilting laughter of crowded cities in and around the old shack, nightly now, and believe me, old man, to one not used to it it helps considerably!

Here's hoping you span the world, WSB.

Yours respectfully,
(Signed) M. J. CAVENEY,
(Canadian 3GG).

Contributed by A. A. O. BRIDGEMAN.

NAVAL RADIO DEVELOPMENT FOR AIRCRAFT—U. S. NAVAL CRAFT FIRST IN AIR

By Washington Radio News Service.

The Navy's development of radio apparatus and equipment for use in service aircraft has been one of the greatest contributions to the progress of radio communication in the air, advancing the art of flying itself. Both of these facts, experts in radio and aviation believe, are gradually placing the naval aircraft of this country in the very fore of flight and aerial telegraphy.

Today the Navy's planes rely solely on radio telegraphy for communicating with other planes and land stations or ships, the radio telephone having been practically discarded by naval pilots, although still used in the Army Air Service. The marine pilots found that telephone sets were impracticable. They were too heavy and had inferior ranges, besides being inaccurate and causing much interference. Formerly, they admit, radiophone communication was very convenient for pilots who were not telegraph operators, but today as all naval aviators are code operators, this advantage is lost. The continuous wave system, known to require skilled operators, was recently requested by the operating units of the Pacific Fleet Air Squadrons to the exclusion of all other methods.

All naval scouting planes are equipped with radio transmitters capable of sending messages 400 miles, either while in the air or on the sea. While the Navy is not saying much about them, it is known that better and more powerful radio sets are available, held in reserve, while, for economy, the older stock is being used. Spotting planes, however, are equipped with the latest designed continuous wave sets, which have given satisfactory communication when large numbers of planes in the air were transmitting simultaneously.

At Last! The Perfect Radio Loud Speaker *for the Home*

There is no other Loud Speaker like the DICTOGRAPH—made expressly for home use by the makers of world-famous Dictograph products—standard everywhere for the finest, most accurate and most sensitive sound-transmission and loud-speaking devices. No other organization in existence has the facilities, the skill, the experience of the Dictograph Products Corporation for producing a perfect Loud Speaker.

DICTOGRAPH Radio LOUD SPEAKER

Years of experience in producing the marvelously sensitive "Acousticon" for the Deaf, the Detective Dictograph and the Dictograph System of Loud-Speaking Telephones have made possible this wonderful Radio Loud Speaker that reproduces every sound—singing, speaking, instrumental music—in crystal-clear, natural tones, full volume, and FREE FROM DISTORTION AND NOISE.

The Dictograh Radio Loud Speaker gives perfect results with any vacuum tube receiving set. No alterations; no extra batteries—you simply plug in and listen.

Ask for FREE DEMONSTRATION of the Dictograph Radio Loud Speaker at any reliable radio shop. Get DICTOGRAPH quality and still save money.

DICTOGRAPH *Radio* HEAD SET

The Best Head Set At Any Price

The Dictograph Radio Head Set has established a standard of quality impossible to secure in any other head set. Its use on any receiving set, crystal detector or vacuum tube, improves reception immeasurably. 3000 ohms resistance. Price, $12—the best head set in the world. Regularly furnished as standard equipment with the leading receiving sets made.
Dealers: Order through your jobber or write for names of authorized distributors.

Price $20
Complete with 5 ft. flexible cord

The Standard of the World

A beautiful instrument! Finely constructed, richly finished. Its handsome appearance harmonizes with any home. Highly burnished, French lacquered, eleven-inch spun copper bell horn attached to die cast black enamel tone arm, finished with nickel trimmings. Cabinet, 6x5 inches base, 4 inches high, of solid, ebony-finished hardwood, mounted upon rubber knobs. Furnished complete with 5 ft. flexible cord. No extra batteries required.

THE DICTOGRAPH PRODUCTS CORPORATION
220 WEST 42d STREET (*Branches in All Principal Cities*) **NEW YORK CITY**

"Your Wants in Radio Will Be Filled at Once if You Tell Them to Missouri"

VACUUM TUBES

No. UV-200 Detector	$5.00
No. UV-201 Amplifier	6.50
No. UV-202 5 Watt Transmitter	8.00
No. UV-203 50 Watt Transmitter	30.00
No. UV-204 250 Watt Transmitter	110.00

CUNNINGHAM TUBES

No. C-300 Detector	$5.00
No. C-301 Amplifier	6.50

SOCKETS

No. 30 Paragon	$1.00
No. 550 Murdock	1.00
No. UR 542	1.00
No. UP 552	1.50
No. UP 741	2.50

AMPLIFYING TRANSFORMERS

No. 231-A General Radio	$5.00
No. A*2 Acme Semi-mounted	5.00
No. UV-712 Radio Corp	7.00

"B" BATTERIES

No. 763 Eveready, 22½ volts	$1.75
No. 5156 Burgess, 22½ volts	2.00
No. 766 Eveready, 22½ volts, extra large	3.00
No. 2156 BP Burgess, 22½ volts	3.00
No. 774 Eveready, 43 volts	5.00
No. 6880 Eveready, 110 amp. hrs.—52 lbs.	20.00

"If you do not see what you want listed here, send your order anyway. We'll fill it."

RADIO MISSOURI SUPPLY
"Service Original"

RHEOSTATS

No. 810 Remler, 4 ohms	$1.00
No. 560 Murdock	1.00
No. 120-A Fada	1.00
No. 25 Paragon	1.50

ATWATER KENT UNITS

Variometer	$8.00
Variocoupler	8.00

REGENERATIVE RECEIVERS

No. CR-3 Grebe, 150 to 1000 meters	$65.00
No. CR-4 Grebe, 175 to 680 meters	65.00
No. CR-5 Grebe, 175 to 3000 meters	80.00
No. CR-8 Grebe, 150 to 1000 meters	80.00
No. CR-9 Grebe, 175 to 3000 meters with detector and two-stage amplifier, complete	130.00
No. RA Westinghouse, 150 to 700 meters	68.00
No. RC Westinghouse, 150 to 700 meters	132.50

LOUD SPEAKERS

No. R-3 Magnavox, 14-inch horn	$45.00
No. R-2 Magnavox, 18-inch horn	85.00
No. AC-2-C 2-stage amplifier	80.00
No. AC-3-C 3-stage amplifier	110.00

TELEPHONES

No. 56 Murdock, 2000 ohms	$5.00
No. 56 Murdock, 3000 ohms	6.00
No. 2500 Manhattan, 2000 ohms	6.00
No. 2501 Manhattan, 3000 ohms	7.00

BALDWIN PHONES

Types C, E, F, G, per set	$16.00
Single Headsets, all types	9.00
Single Units (with cord)	8.00
Single Units (without cord)	7.75

ANTENNA WIRE

No. 05 Braided Wire, per 100 feet	$0.50
No. 14 Bare Copper Wire, per 100 feet	.50

Please include sufficient postage with all C. O. D. orders

MISSOURI RADIO SUPPLY COMPANY
4623 Maryland Ave. SAINT LOUIS MISSOURI

Recently developed radio apparatus today permits a disabled seaplane on the water to transmit up to 300 miles. Compass bearings sent from a distance of 400 miles have been picked up by planes resting on the surface of the sea.

THE NAVY'S RADIO LABORATORY

Most of the radio development work in the Navy has been done in a small but highly efficient radio laboratory at the Anacostia Naval Air Station, near Washington and close to NOF. There, advanced designs for transmitters and receivers are available when new apparatus is required for service uses. Among the problems now receiving attention is the design and test of radio compass equipment for aircraft, capable of receiving bearings up to 1,000 miles. A special low-lying antenna for the big airship field at Lakehurst was recently designed and is now being installed at the future home of the great ZR ships. Some of the work under way is confidential and is reserved for military use only.

Almost all the development work is also of benefit to commercial builders and operators of aircraft. The kite antenna and radio equipment for seaplanes forced down, for example, has great commercial life-saving values. The landing field indicator and piloting cable for aircraft is applicable to inter-city air lines and trans-continental air routes. It gives out an audible signal making it possible for the pilot to keep on a route in darkness or fog, and will have practical application as soon as long-distance aerial routes are established. A short while ago the aircraft teletype was successfully demonstrated between a seaplane and the Anacostia Laboratory. This scheme has been offered to the world for commercial application.

Such are a few of the radio developments, which, it is believed, are establishing the Naval aircraft of the United States as the best in the world.

FOREIGN INQUIRIES FOR RADIO APPARATUS

Inquiries are being received at the offices of American Commercial Attache McQueen, Santiago, Chile, regarding the development of wireless telephony in the United States, and it seems probable that before long serious consideration will be given to the exploitation in Chile of this new development. Legislation is now contemplated there based on the laws of the United States, and although it does not provide specifically for broadcasting stations by private enterprises, it is possible that this service will be available through the leasing of Government-owned stations during times of peace.

If American manufacturers interested in the Chilean market will send catalogs and other descriptive literature to the office of the commercial attache at Santiago, the Department of Commerce states these will be placed at the disposal of all persons inquiring for this type of apparatus.

Trade opportunities this past week include inquiries from Czecho-Slovakia as to radio transmission stations, and from the Philippine Islands comes a call for information on radio apparatus in general.

American radio exports during July totaled 225,475 pounds of apparatus, valued at $385,861, which shows that some American exporters are taking advantage of trade opportunities.

BAHAMA ISLANDS USE RADIO

About a year ago the Bahaman Government purchased three radio transmitting sets from the Shipping Board and put them in operation with such successful results that they have just purchased three more sets for inter-island communication. The equipment

is of the 1-K.W. spark type such as is used on Shipping Board vessels, which gives excellent communication between the islands of the group.

VIRGIN ISLANDS MAY BROADCAST

Very soon the Virgin Islands may install radio apparatus for broadcasting official information and entertainment, according to Adolph Sixto, Delegate from St. Thomas. Recently he visited Washington officially and called at the White House, where he told the reporters that as a member of the Manufacturers Commercial Association of the Islands, he was hoping to introduce radio broadcasting as soon as suitable equipment could be secured for sending and receiving.

RADIO COMMUNICATION AT PAN-PACIFIC COMMERCIAL CONGRESS

Rear Admiral H. J. Zeigemeier, Director of Naval Communications, who has been designated to represent the Navy at the First Pan-Pacific Commercial Conference at Honolulu, October 25-31, will speak there on communication and transportation, giving special attention to a survey of the present cable and radio activities, and will discuss the establishment of lower special rates, fixing responsibility and granting improved facilities for the press.

NEW BROADCASTERS

Thirteen limited commercial or broadcasting stations were licensed by the Department of Commerce during the week ending September 16:

WLAN—Putnam Hardware Co., Houlton, Me.

WMAF—Round Hills Radio Corp., Dartmouth, Mass.

KFCD—Salem Elect. Co., Salem, Ore.

WEAN—Shepard Co., Providence, R. I.

WNAC—Shepard Stores, Boston, Mass.

WLAQ—A. E. Shilling, Kalamazoo, Mich.

WOAI—Southern Equipment Co, San Antonio, Texas.

WLAK—Vermont Farm Machine Co., Bellows Falls, Vt.

WLAT—Chas. G. Bosch Co., Burlington, Iowa.

WLAP—W. V. Jordon, Louisville, Ky.

WLAR—Mickel Music Co., Marshalltown, Iowa.

WMAC—F. Edward Page, Fernwood, Cazenovia, N. Y.

WGAX—Radio Elect. Co., Washington Court House, Ohio.

Religion and Radio

(*Continued from page* 851)

numerous to mention but all necessary for a station of this power.

"Perhaps the most interesting feature," stated Mr. Priestly, "is the fact that the plant, with the exception of patented articles, such as transmitting tubes, etc., was designed and built entirely by volunteer labor, by men skilled in their various professions. With the exception of myself none of the men were members or connected with the First Presbyterian Church, but such was their respect for the work being done by Dr. Matthews and such was their character that they willingly devoted 1,998 long, hard hours to the building of station KTW.

"It was thought that after building the apparatus and assembling them our troubles would be nearly over," continued Mr. Priestly, "but we found that they had only started. The apparatus was assembled and set up in a room directly back of the speaker's platform or pulpit. The antenna was erected and we were ready to shoot. Then things began to happen.

"Our first difficulty arose from the peculiar habit of Dr. Matthews while speaking. He does not use a pulpit but treads freely back and forth on a platform 20 feet long by 10 feet wide. For 21 years he had tread that platform from end to end in his characteristic and forceful manner. To take away that personal mannerism was to destroy a part of his beloved personality. Hence the radio had to be designed for the man and not the man for the radio transmitter or microphone.

"A microphone suspended by rubber and set upon the platform was tried with fair results. This was then placed about 40 feet directly in front of the speaker and in the center aisle. While the microphone picked up the speaker's voice well it also gathered all the other noises such as the rattling of books and papers, coughing and sneezing from the audience. Every manner of microphone was tried and the problem was finally solved by using three Magnavox loud speakers.

"The fields were reversed in the loud speakers. The horns were turned from the audience to face the speaker and choir loft. One was placed directly in front of the speaker and one at each end of the platform. It was found that the speaker could walk from end to end of the platform and at any angle his voice was caught perfectly. The music from the large pipe organ and the choir was also picked up well. The noises from the audiences were eliminated. Thus the greatest difficulty was overcome. No longer will it be necessary for the speaker to talk directly into a horn or be confined to one place in order to transmit clearly over the radiophone.

"One of the most annoying and at the same time amusing troubles was the fact that the three large copper covered domes of the church acted as perfect receivers. At times in the most dramatic moments there would be received a fox trot or other jazz and this transmitted from our own station more powerfully than before. This was overcome by a system of grounding of the domes.

"Another peculiar difficulty was that, in the midst of our transmitting, howls and peculiar tunes would be set up. This was found to be caused by leakage from the antenna to the copper covered domes which would start vibrating and oscillating a tune all their own. Many other difficulties, each a problem in itself, were encountered. Each had to be worked out independently."

The voice current first passes through a speech amplifier before it is impressed upon the 250-watt modulating tube of the transmitter proper. All tubes are supported by rubber to prevent vibration. The aerial is composed of six wires 4′ apart and 90′ long. A counterpoise is used as a ground. The antenna and counterpoise are under a reconstruction program which calls for an additional height of 40′ and a length of 140′. There will also be constructed a tuned counterpoise.

It is predicted that this reconstruction will allow the radiating capacity to be doubled and give a longer range.

That the builders of KTW possessed a high degree of experimental ability and courage can be seen from their method of obtaining power.

Several methods were tried. A chemical rectifier and transformer stepping up the current from 110 A. C. to 2,000 D. C. was discarded as too dangerous. They are at present using four 500-volt generators operated by a 10-h.p. motor. The current is carried by means of standard wiring up to the radio room, where the 2,000-volt line is tapped. One thousand volts is applied to the 50-watt speech amplifying tube and 2,000 to the 250 tubes. During the first few broadcasts annoyance was caused by the commutator hum or ripple being transmitted to the tubes and sent out into space. This was overcome by a choke coil and condenser.

The power for the first four stages of the speech amplifier was at first obtained by the regulation dry cell method, but was also discarded by the builders as expensive and unsatisfactory. Four wet cell B batteries were made, each having a single cell voltage of two volts and a total of 50 volts each. This is used on the first two stages and on the last two stages 250 volts D.C. from the main line is applied. The filament current is obtained from two large type Edison caustic batteries.

That the radio transmission has received a much needed boost is readily admitted after reading a portion of the following letters from receiving stations and radio amateurs:

"I heard every word of your sermon by radio. I am visiting in Seattle. I compliment you on this method of preaching."

"I heard your sermon Sunday morning and your sermon Sunday evening. Every word was perfect. I want to thank you for making it possible to hear the sermons. I cannot attend church."

"I was well pleased with your sermon Sunday evening. It came in on my crystal set and every word was clear and distinct. I think it is a grand opportunity to hear the gospel."

"In a little hovel by the roadside between Seattle and Everett near Silver Lake with a very crude radio device constructed by my son, who is a cripple, the various members of our household, four in number, heard your sermon perfectly. The music and the solo were fine, and we all enjoyed the service very much."

"I am far away in a lumber camp and heard your services perfectly. Appreciate your effort and wish to say that you ought to establish a Magnavox set in every logging camp in the State. Inclosed find $5.00 as a contribution toward your radio work. I appreciate what you are doing. I hope others will help."

Alternator Versus Arc

(*Continued from page* 851)

manufacture in no way approaches the degree mentioned in the article "Arc vs. Alternator."

Arcs of European manufacture apparently produce far more interference than American arcs, when both are operated in the same manner, that is, using the old compensation method of signaling, and having the arc connected at all times to the antenna. Data relating to this point would be of interest.

Concerning the method of signaling, modern arc transmitters need not employ the compensation method, if a single wave is more desirable, and if interference caused by the compensation method is objectionable, there is no reason why it should not be eliminated.

A San Francisco concern has perfected and uses in its stations a single wave signaling system that can be installed in existing arc stations of any power, and which accomplishes the four following very desirable results:

1. Emission of but a single wave.
2. Reduction practically to zero of interfering noises and harmonics referred to as being emitted by the Eiffel Tower and Salonica Stations.
3. Reduction in the number of keys required to handle the output of the arc.
4. Practically total elimination of trouble from sparking in key contacts.

Operators in the central and middle-western States who have heard signals from the Federal Company's Pacific Coast arc stations were for a long time under the impression that they were listening to signals from high frequency alternator stations, as they were unable to detect any difference in the quality of signal or clarity of tone except that there was a complete absence of the residual hum noticeable between the dots and dashes in an alternator station.

The arc station of today that is suffering from harmonics, or rather, causes others to suffer from its harmonics, may be likened to the discordant piano, the owner of which to the dismay of the neighbors, refuses to enlist the services of an expert who has been proven capable of completely eliminating all inharmonious notes and of making adjustments that will result in the emission of no tones other than those desired.

Reference is made in "Arc vs. Alternator" to the necessity of frequent and prolonged periods of rest required by arc transmitters in order to clean the arc chamber of soot and carbon, and statement is made that it is always necessary to install duplicate arcs in a station in order that one may operate while the other is being cleaned.

Cognizance is taken of the fact that the article applied particularly to arcs manufactured and installed in Europe, but as it might easily be interpreted as applying also to arcs of American manufacture a few remarks concerning the installation of arc transmitters in American high-power stations may be in order.

During the war one high-power arc transmitting station was erected on the Atlantic Coast equipped with duplicate arc converters for the purpose of assuring a means of continuous communication between the United States and Europe in case of accident to one unit. At the same time, and for the same reason a 1,000 KW. arc station was installed in France, the completion of which, however, did not take place until after the signing of the Armistice.

Within the past 18 months a second arc converter has been installed in a high-power station on the Philippine Islands, principally because of their extremely isolated position with respect to the United States. This station, previous to the installation of the second unit, had operated continuously for a period of four years communicating with Asiatic and United States Pacific Coast stations without interruption due to failure of the radio equipment.

All other high-power stations equipped with arcs manufactured by the above mentioned company, are supplied with but a single transmitting unit, and no recorded instance is at hand to show that the service from any one of these stations has been interrupted by reason of failure of the radio apparatus or because the arcs were being cleaned.

The first real high-power arc transmitter ever designed, a 200-KW. unit, has been in daily use since 1916 in a naval station in California, and is giving better service at present than when first installed.

In the autumn of 1918 a 500-KW. arc in an Atlantic Coast station was called upon to begin a 24-hour non-stop test on the same

day the installation had been completed. This arc had never been operated prior to the moment of starting the 24-hour test, which, due to an unusual amount of traffic being handed in for transmission, was extended to a period of 40 hours, which was 16 hours longer than any high-power radio transmitting station had ever run continuously, up to that time. The arc was shut down at the end of 40 hours only because there was no more traffic on hand; it could have continued for an indefinite period had it been necessary.

For the purpose of determining how long it would run without cleaning, this arc was later operated on an average of 15 hours per day for six days without cleaning or inspection. On the sixth day a new watch electrician without orders opened and cleaned the arc chamber which was found with a deposit of brown colored soot uniformly distributed over the interior of the chamber to a depth of about one-sixteenth inch. It could have operated for an indefinite period without cleaning.

All high power Federal arc transmitters are equipped with a vacuum cleaning system that enables the operator to clean even the biggest arcs in a few minutes. All carbon and soot is sucked through an exhaust pipe at the rear of the arc chamber and blown into a dump at a distance from the building.

Men who are responsible for the operation of the 200 and 500-K.W. arc transmitters now operating on the Atlantic Coast, state that the arcs are cleaned once every three or four days, and that the average length of time required to clean the chamber and electrode holders, change electrodes and otherwise put the arc in condition for further operation is about 20 minutes. This corresponds to an average of about five minutes per day.

It is hoped that the above will rectify any erroneous ideas held by persons unfamiliar with the operation of arc converters, whose opinions may have been formed by statements made in the article entitled "Arc vs. Alternator" or by the propaganda of interests antagonistic to the arc system.

Development made on the arc system within the past year have put it as far ahead of other systems of continuous wave radio telegraphy as it was when it first entered the field and the arc today more than ever in its history, has every prospect of a brilliant future.

Radio Enters the Yachting Field

(*Continued from page* 847)

number of illustrations could be given where even finer and far more costly sets are carried aboard. As examples, we mention Cyrus H. K. Curtis' 200' "Lyndonia"; Vin-

cent Astor's new "Nourmahal"; Mortimer L. Schiff's 180' luxurious yacht, "Dolphin" and Edgar Palmer's big Diesel-electric yacht "Guinevere." During the 14,000-mile cruise made by the "Guinevere," at which time she touched many ports of the world, her radio played a big part, more than once proving of value.

So much interest has been taken by motor boats, especially in the vicinity of New York City, that the members of the New York Motor Boat Club are now forming a radio club and members are to be chosen who from time to time will give lectures, etc., on the science of radio, in an effort to get every member well acquainted with radio. Classes are already being held and the members have shown a vast interest in the project. A sensitive set is installed at the clubhouse for the benefit of the members, who take great pleasure in "listening in" to the daily concerts, etc. No doubt other boat clubs will soon be inaugurating the same scheme, as is prophesied by Mr. Joy in a communication to W. Nutting, editor of *Motor Boat*. "I am an ardent advocate of wireless for motor boats. While it is novel today, I believe that by next season an astonishing number of boats will be equipped with both receiving and sending sets. The chief link lacking for speedy stimulation of powerboat radio is the shore end of the station. The boat clubs will doubtless supply this missing link during the present season so that messages may be interchanged on the amateur basis and forwarded."

With even the smallest amount of imagination, one can readily see in what ways the boatman will profit by having radio aboard his motor boat. He can easily intercept the latest weather reports, which will prove of value while on a cruise. The radiophone broadcasting stations will also keep him informed of doings at the stock market, and then there are the concerts, baseball reports, etc. The radiophone will certainly be his daily newspaper. The high power stations will also supply him with news items, thus keeping him advised as to what is going on ashore, or "in the States," if he be in foreign waters. Radio outfits aboard motorcraft will also prove popular in races. How fine it would be to advise the race committee at the yacht club as to your whereabouts, condition of the sea, weather, or how much better it would be to "chew the rag" with one of the other contestants, in this way finding out where he is, all this tending to make the time pass much faster.

Radio and the Boom

(*Continued from page* 858)

products and manufacturing is to take a standard similar product which is already on the market, copy the constants and general design features and then produce.

These remarks are not written with any malice aforethought, but depict an actual condition. Any industry entering upon such an active period as radio has recently experienced is bound to be infested with charlatans. Lacking radio intelligence they resort to other methods of inveigling a gullible and interested public; sensational advertising and making extravagant and preposterous claims are some of the methods. Occasionally one sees interviews given by some of these "experts" with the picture of the hero attached, in which interview the latest mythical patent sensation is described. Recently the writer read such an interview given by a phonograph dealer, now a radio expert, who probably never heard of a three-element valve before the radio boom. In this interview he described his latest patented bulb containing multiple elements, which bulb is, of course, bound to change entirely the

present status of radio. No photograph, only a mere sketch, is given, and no patent numbers are given.

This aspect of the boom is the most unfortunate one, but as the public becomes more and more educated to radio the effect of the charlatan will be less felt. It is entirely up to the radio periodicals to disseminate this radio education and to assist the general public in discriminating between the good and the bad. Time will, of course, eventually result in a weeding out of the fraudulent, the incompetent, and those who, like the Hairy Ape "do not belong."

Radio Messages Typed Automatically from Aeroplane to Ground

(*Continued from page* 839)

in force and a heterodyne receiver used. Two stages of amplification were employed in the oscillating electron tube. The output of the amplifier was connected to an automatic relay recorder, shown in Fig. 6, recently perfected by F. W. Dunmore of the Radio Communication Section of the Bureau of Standards, United States Department of Commerce. This design of radio-recorder is said to be especially selective to notes of certain frequencies. The accuracy of its tuning effect is vouchsafed in the ability to transmit three different messages on the same wave-length at varying frequencies, isolating one without interference from the others.

The Dunmore relay recorder was intimately identified with the "Teletype" coils, an armature being negotiated up and down by the latter in accordance with the receipt of incoming electric impulses. The receiving printer mechanism of the "Teletype" is controlled by this armature. A clutch-and-brake device governs the starting and stopping of the printer on the receipt of wireless signals. A central shaft through the printer operates the mechanism for determining and printing the particular characters represented by the radio signals. Or, differently expressed, upon acknowledgment of electric impulses of a certain sequence the type wheel is revolved around with dispatch to print the characters represented by those wireless signals. Shifting from an explanation of the transmitting end of this communicative system to that of the behavior observed in the reception of messages the following is noted: The depression of a key on the keyboard causes the radio-active energy from the antenna in a particular sequence which is received at the receiving point to operate the "Teletype" printer, which automatically uses discrimination and selects the character represented by the key depressed at the transmitting station and simultaneously prints that character.

Commander A. H. Taylor, in active charge of the Naval Air Station at Anacostia, suggested the possibility of the adaptation of this form of communication to aircraft as a means of exchanging intelligence with shore stations, with other units of aircraft, or between airplanes and seafaring vessels. The keyboard designed by the Morkum Company for service aloft, as shown in Fig. 7, may be manipulated in the absence of knowledge of the international code; in fact, a skilled typist can operate the keyboard in an airplane with quite the facility required in fingering the office typewriter. Compactness is a virtue of the keyboard for transportation on board aircraft, it fitting snugly into the space now required for carrying the Morse telegraph key and its flame-proof casing. The trailing-wire antenna common to the maintenance of radio-communication at present between different air-going machines and between wireless stations on the ground meet the requirements involved in the use of the "airplane radio typewriter."

The alliance of the "Teletype" and Hertzian waves is indicative of great possibilities in the future, if preliminary tests are to be accepted as a criterion of service. Secrecy in the transmission of communications from aircraft is, of course, an outstanding virtue. Communication between ships and aircraft will be thus facilitated with the element of error minimized. Printed directions to scouting and combat airplanes may be issued by the commander-in-chief of the fleet and scouting aircraft will be enabled to convey accurate and detailed information to the commanding officers. News, market quotations, weather reports, and sundry information may be faithfully copied on board passenger-carrying aircraft, if the principle of "tell it to the type" is operative as a duplex system of communication—both for the transmission and reception of wireless signals aloft.

Station 2LH at White Plains, N. Y.

(*Continued from page* 856)

trolling the charging outfit, which consists of a low-voltage transformer and rectifier tube.

Not only have good transmitting results been obtained but stations as far west as 6LC in Los Angeles have been logged and the station log shows that every district of

the United States is represented; 6LC, a spark station, has been copied several times and his transmissions confirmed.

The operators of 2LH are W. S. Halstead, who signs DC, and Frederick Sipp, signature FS. Mr. Halstead is one of the old timers in radio. He serves on the Board of Directors of the Executive Radio Council of the 2d district and is well known in 2d district affairs. Mr. Sipp is also a member of the Council, and is designing engineer for the Ravenwood Research Laboratories. 2LH is, of course, an A. R. R. L. station, and participated in the transatlantic tests last year.

There is nothing unusual about the equipment of 2LH, and it just goes to show what a good aerial and an efficiently constructed home-made outfit, mixed in with a lot of patience, will do.

Fishing in Ponds of Electromagnetic Waves

(*Continued from page* 835)

as commonly employed by the Air Service of the United States Army at present, is contained in a streamline case, and is propelled by a special regulating air-fan. The object of this arrangement is to insure a constant speed of the generator for varying aircraft and wind velocities. One type of air-fan is constructed of metal and its two blades are revolved around their longitudinal axis so that the pitch of the former will automatically vary when the speed of the air-fan through the air varies. The twist of the blades of this form of generator is counterbalanced by a set of springs and weights inside of the air-fan hub. The operation of the fan is that of a constant generator velocity of 4,000 revolutions a minute for aircraft flying at speeds varying from 50 to 200 miles per hour.

With radio-telephone equipment, ships could be given their position in ten minutes or less, it is estimated by officials of the Air Mail Service. The operation would be something like this. An air mail plane flying at night would call for its position. Radio operators in the stations from which the plane departed and to which it was going, by means of rotating finder would determine the exact direction the message came from. One station would then report the angle to the other station. This operator would draw a triangle on a map from the information received. The plane, of course, would be at the apex of the triangle. The flyer, informed of his position, could quickly make his way back to the route.

Radio will also be used to report ground conditions at the stations to planes in flight. If a heavy fog settles over San Francisco the flyer with mail will be warned to land some place else. The passenger and mail planes between England and France are equipped with radio sets for such emergencies.

Further experiments which will now be conducted by the Air Mail Service look toward simplifying the radio equipment in order to reduce the weight. The air mail plane detailed at Bolling Field now carries radio equipment which totals about 200 pounds. It is believed that this can be reduced at least one half.

The First 400-Meter Broadcasting Station

(*Continued from page* 843)

The antenna relay is mounted on top of the framework.

The four ammeters which serve to indi-

cate respectively the antenna current, the oscillator plate current, the oscillator grid current and the modulator plate current are mounted on the insulating panel, at the top front of the radio transmitter.

The cases of the oscillator plate current milliammeter and the modulator plate current milliammeter are covered with a grounded guard, in view of the fact that these instruments are subjected to the full voltage of the plate circuit generator, whose voltage may be either 1,600 or 800.

The radio transmitter is essentially a generator of radio frequency energy (an oscillation generator), with means for modulating this energy in accordance with current variations produced by the microphone operating in conjunction with the amplifier and certain other auxiliary equipment. The oscillator comprises vacuum tubes, previously described, and a tuned circuit which includes the antenna system. This tuned circuit determines the frequency or wave-length of the radiated energy.

The modulating system provides means whereby the alternating currents corresponding to speech or music are supplied in amplified form direct to the oscillator circuit.

The antenna relay is operated by means of push buttons and is used while the equipment is in operation to change connections from "send" to "receive" and vice versa. When the relay is in "receive" position an auxiliary contact is opened which renders the transmitter inactive and prevents it from interfering with local reception.

In order that the vacuum tubes used for modulating and speech amplifying purposes may operate under the most favorable conditions to prevent distortion, the grid circuits of these tubes are given a negative bias by means of a resistance connected between the negative terminal of the high potential generator and the filaments of the tubes.

The plate circuits of the vacuum tubes are supplied with direct current from a high potential generator. A noise filter is used to eliminate commutator noises and is mounted on the framework of the radio transmitter.

Under certain conditions, if the plate circuit is closed before the filament circuit, a destructive rush of current through the tubes may occur. To prevent damage due to this cause, a delayed action relay is provided. This relay which is operated by the filament current requires approximately 20 seconds to operate and its contacts are so arranged that the full plate potential is not applied to the tubes until the filaments have been lighted for this period of time.

The motor of the motor generator set is started or stopped by means of momentary contact push buttons. The main push buttons are located on the power switchboard, but similar push buttons connected in parallel are located at the operator's desk.

A circuit breaker mounted on the power switchboard is provided for the plate current supply circuit. It is usually adjusted to open under an overload of about 25 per cent.

Field rheostats are included in the field circuits of both generators, but only the low voltage generator is adjusted from the front of the panel. The rheostat of the high voltage generator is adjusted from the rear. This rheostat requires infrequent settings since when properly set and the potential of the low voltage machine is correctly adjusted, the potential of high voltage machine is established at the correct operating value.

Current to operate the microphone is supplied by an 18-volt storage battery, and is regulated by a rheostat on the input amplifier panel. Filament current for the input amplifier is obtained from the same 18-volt storage battery that supplies the current to the microphone. Suitable provision is made

for charging this battery. Current for the plate circuit of the amplifier is supplied from dry cells. A total of 130 volts is required.

George A. Clark's Station

(*Continued from page 857*)

L type aerial 65′ long, 50′ high at high end, and 15′ high at low end. The ground consists of water pipe connection and copper plates buried 6′ underground. The complete station is installed in a small house located directly under and at the end of the aerials.

GEO. A. CLARK,
147½ W. 55th St.,
Los Angeles, Cal.

A Multi-Range Regenerative Receiver

(*Continued from page 861*)

The longer this operation is continued the finer the finish will be. The panel may be finally cleaned with a rag.

In order to facilitate wiring, a certain procedure should be followed in assembling this receiver. We have noticed a good many amateurs assemble all the apparatus and then wire. This is a mistake, as much better access can be obtained to the close wiring near the panel if this work is first accomplished.

The multi-range coupler with the switch lever and stops should be attached to the panel and the wiring from the taps on the coupler to the switch points made before assembling the rest of the apparatus. This portion of the wiring can, in this manner, be performed quite easily, whereas it would be rather difficult after the receiver is completely assembled.

The complete wiring diagram is shown in Fig. 1. It will be noted that the switch lever is connected to the first switch point. This connection is made with Litz wire to permit the rotation of the switch. It is wired in this manner to permit the switch to short-circuit the unused portion of the inductance. This is one method of preventing dead-end loss. Another method is by using a double-bladed switch lever, but the method shown obtains the same results in a somewhat simpler manner. The taps on this type of coil are well adapted for soldered connections, and if solder lugs are laid on under the nuts which secure the switch points to the panel, very neat connections can be made with hard drawn wire, as shown in the photographs.

When the wiring of the taps has been completed, the variable condenser, phone jack and filament rheostat should be mounted on the panel. The tube socket and grid condenser should be screwed to the base and the panel secured to it by means of three wood screws passing through the holes at the bottom of the panel. As the base is ½″ shorter than the panel, the latter will project ¼″ at each side, permitting easy insertion of the base into the cabinet.

The binding post strips should be screwed to the back of the base and the terminals screwed tight. It will be noted that these terminals are not of the usual type, but

they are made up of stock parts. The screw is an 8/32 measuring 1⅛" in length. Over each screw is slipped a fibre spacer ½" long which is tightened down with a nickel-plated 8/32 tapped spacer. The screws project through holes in the back of the cabinet and the binding post tops are screwed down on the wires connecting the batteries.

With the apparatus entirely assembled, the wiring is completed in accordance with Fig. 1. Referring to the photographs of the back of the receiver, the four terminals at the right hand side are connected, from top to bottom, to the aerial, ground, negative and positive of the plate battery respectively. The four terminals on the left are, from top to bottom, for the output (two terminals), the negative and positive of the filament battery. The two output terminals are wired to the inside points of the double-circuit phone jack. This is the best possible arrangement of the terminals because, if an amplifier is used with this receiver, the four right hand terminals are in the proper position for connecting to it.

To obtain proper efficiency and neatness; the wiring should be made with hard drawn wire and all bends made at right angles. The photographs show this type of bus-bar wiring which we advise should be followed. The wire used in this receiver is square hard drawn tinned copper wire. Tinned wire does not rust. If the constructor has wire on hand which is soft drawn, he should insert one end of the wire in the vise and stretch two or three feet of the wire by pulling it. The free end of the wire should be given a couple of turns around a pair of pliers for a good grip while stretching.

Needless to say, all joints should be soldered. It is impossible to expect durability or efficiency from a receiver if this is not done.

The construction of the cabinet to enclose the receiver will not be described. If the amateur who intends to make a receiver from these directions is an accomplished carpenter, he will be able to make a good-looking cabinet without advice. If he is not, he will do what we did and buy one. A properly made and finished cabinet greatly enhances the appearance of a set and it can be purchased for about $5.

OPERATION OF THE RECEIVER

The operation of this receiver is similar to any single circuit regenerative tuner and is exceedingly simple. Wave-length is controlled by the switch lever and the variable condenser while regeneration or oscillation is obtained with the rotor of the multi-range coupler. The best reception of radiophone and spark signals is obtained just before the point of oscillation. With the tube oscillating, C.W. stations can be heterodyned and received. The value of inductance for any given wave-length should always be as large as possible and the condenser varied near its minimum position.

High Amperage "B" Battery

(*Continued from page* 871)

Now, put one hatchet or the pitted plate in a groove on your work-bench or in a vise with the rough side up, then place the strip of lead on the plate and hit it heavily with the other hatchet or hammer. Upon examination a print will be found similar to Fig. 2.

The short ribs which run cross-wise give mechanical strength while the increased surface gives much more electrical capacity.

Continue the stamping until the whole surface to be immersed is printed.

After the battery is put together and the electrolyte is poured in, it should be charged. For a 22½-volt battery this should take

about 30 minutes the first time, then it should be discharged as quickly as possible. When almost completely discharged the circuit for charging should be again connected but in a different direction from the first charge.

When this alternation of the direction of the current has gone on for about five times the plates will be found to be of a spongy consistency between the short ribs owing to the decomposition of the matter in the plates under the electrical action. After five changes the maximum of surface will have been obtained and the best results given. However, this alternation should not be continued longer as the ribs will begin to decompose and the mechanical strength will be so weakened that the plates will soon fall to pieces.

The charging source may be similar to that outlined in the July, 1922 issue of RADIO NEWS, page 176.

A battery of these cells may be constructed to deliver 150 to 300 volts for power amplifiers and low range transmitters. Although such a battery would involve considerable tedious work it would well repay the constructor by the efficient operation obtained.

Contributed by FRANK W. GODSEY, JR.,
Beaumont, Texas.

Variable Condensers with Die Cast Plates

(*Continued from page* 869)

nels in the cardboard for some distance, to allow the air to escape. These need not be given a definite vent connection with the outside air, as the mold works perfectly without it. The choice of metal is important, as pure lead or solder will not work right. A few pieces of linotype metal obtained from a printer friend will work very well, and this metal, which is used to cast printing types has the further advantage of being quite brittle, so that it will not bend out of shape.

After a number of plates have been cast, they are assembled as shown in the sketch. The casting gate is not broken from the fixed plate, as it is used for a connecting lug, but on the movable plate, it is broken off and the rough place smoothed down with a file. The movable plate is drilled through the center and fastened to one end of a short threaded rod by means of two nuts and washers. The nuts and washers should be filed plain so that the plate will be exactly at right angles with the rod.

The fixed plate is fastened to an insulating base, which may be either a small piece of insulating material, or the panel of the set, by two screws and nuts, one through the connecting lug, and one at the other end of the plate. A large hole is drilled through the center of this plate so that no contact with the movable plate is possible. It will be necessary either to raise the movable plate from the insulation, or to countersink the insulation so that the nut on the movable plate will not interfere with the plates being brought very close to each other.

The insulating material is then drilled and tapped so that the rod carrying the movable plate may be placed in its proper position. Connection with the movable plate is made by means of a washer riding on the rod, a wire being soldered to this washer and carried out to the other terminal. It may be necessary to use a spacing washer on the rod to prevent the two plates from touching, or a piece of mica or celluloid sheeting may be used to separate the two. A rubber binding post cap on the threaded rod completes the condenser.

Editor's Note:

If a piece of mica is cut to the size of the stationary plate and fastened to same, dan-

ger of shortage is eliminated. This is particularly beneficial if the condenser is used in shunt to the phones and "B" battery as a short here would hurt the "B" battery.

The Radio King

(*Continued from page 849*)

"for if Bradley Lane is taken from us, there will be no one with the knowledge, the skill and the courage to combat Marnee. If he dies—but he cannot die, he must not."

He clapped the receivers of his radiophone to his ears, tuned on the wavelength and called Bradley Lane; knowing that if the young scientist-detective failed to answer this, then the worst was to be believed.

But John Leyden's confidence in the Almighty was justified. Weakly, feebly, but finally, the answer came:

"Tell Ruth not to worry. I will come tonight if I can."

Bradley Lane referred to the ball to be given that night at the Leyden's, primarily to demonstrate the practicability of the Leyden amplifier connected to the radiophone. This invention, connected to an ordinary instrument which was reproducing the music of any great band at any distance, would duplicate for an entire ballroom-full the precise sounds, at the exact pitch, of the original; the band might as well have been in the next room.

"No, you must not come, Bradley. Tell him not to, father," urged Ruth, who had listened in.

"Must!" came the voice over the air circuit. "Afraid they'll use that as an excuse to come disguised as guests—Marnee, you know, Renally—some of that lot. Don't argue, Ruth, dear."

Then to John Leyden:

"The Government informs me your new tests have been successful. Watch your recalling secret. Get it on record and into a safe place as soon as you can. I will take charge tonight and convey it to the War Office."

Bradley Lane hung up. The young scientist-investigator and combatter of crime lay stretched on a chaise-lounge that had been moved into his laboratory. He had yet to recover from the shock of Marnee's attempted crime. But he had the vigorous frame of the athlete who keeps his body in perfect condition; he was in love, he had a self-appointed mission and besides he did not yet know the full extent of his nervous exhaustion.

Recovered or not, he was determined to be present at the Leyden ball that night.

Had John Leyden obeyed Bradley Lane's suggestions, all might have been well. But, with the removal of Marnee for the moment from a position where he could, as he put it, "jam the air," Leyden's secret of recalling previous radio messages from the air was working so miraculously well that the old scientist, fascinated by his success, remained in his laboratory hour after hour wresting away the air's secrets, until the pile of messages grew under his hand, sheet after sheet of closely written radiograms.

John Leyden was continuing his quest until he should pick up at least one of the messages that he knew would incriminate Marnee and give Bradley Lane the evidence against that malefactor that would result in his incarceration for life.

At last he got it: a message to the brethren in Chicago, signed with Marnee's name and Renally's. In code, of course, but one easily read by an expert like Leyden:

"Moscow gold arrived; sending your allotment distribution Middle-Western centers; enough to arm and supply with

a thousand rounds of ammunition every other Brother at various centers. Make ready for The Day."

Had Leyden been Marnee, he would have screeched in diabolical joy. As it was, he now realized no time was to be lost getting on record the secret that would convict that mad genius. The misshapen wizard would stop at nothing to get his withered talons on this. So John Leyden touched the lever of a dictagraph and began transmitting his secret to the waxen cylinder.

Had he known that unseen ears had been listening while he decoded the Marnee message, he would have hesitated. For besides his own *dictagraph* in the room, there was a *dictaphone* of which he knew nothing: one that had been installed by Marnee's orders in the dead of night a week before; cunningly concealed and connected up with the attic of a nearby house.

As Marnee heard the air give up his secret, he fairly howled his rage. Flinging down the dictaphone receivers, he signed for his ruffians to follow him. Again he sought the roofs; again he descended through a transom—this time the one to Leyden's house.

All unknowing, the old scientist continued dictating.

There was no sign of weakness apparent in the scrubbed six feet of well-tailored clubman when the butler at the Leyden's door admitted Bradley Lane.

He made his way to the ballroom, where, to all intents and purposes, a band was discoursing the lilting saccharine measures of a Strauss waltz. Ruth Leyden, the hostess, signed to her dancing partner that she wished to greet her most welcome guest.

"Bradley: thank God you're—"

She had only begun her sentence when the music ceased abruptly. The suddenly stilled ballroom became tense, expectant, the dancers stood still.

Then a high screech: "Listen to Marnee—"

"Your father—quick: where is he?" Bradley Lane demanded, taking Ruth's arm.

As though in answer to his question, the hateful yelp of triumph continued: "Look in John Leyden's room. There are two things you won't find there. One is his precious secret. Ha, ha; ha, ha; ha, ha, ha! ! !"

Brushing the others aside, Bradley Lane, his weakness forgotten, leaped up the broad stairway, taking three steps at a time. Bursting into the laboratory of John Leyden, a north-light studio affair, he recoiled in horror and consternation at what the moonbeams that flooded the dark floor just beneath the great glass pane overhead, revealed.

The stark sprawling figure of John Leyden, legs askew, hands a-splay!

"The other thing that Marnee meant was—his life," muttered Bradley Lane. His features grew rigid, his mouth became a straight line:

"From now on, Marnee, it's a personal matter between us. This world isn't big enough to hold us both!"

And, turning, he caught the weeping trembling girl, who had followed, as she would have fallen to the floor beside her father.

Chapter III.

A BATTLE OF WITS

If John Leyden were dead, as Bradley Lane and Ruth had had every reason to believe when they discovered his senseless body in his own laboratory and the disc containing his secret gone, what had become of his body?

This was the question Bradley Lane was asking himself ten minutes later; when, returning from an exhaustive search of the house in the hope of discovering some trace of Marnee, his evil genius, he found no trace of John Leyden; the body was gone.

Had Lane been present at the impromptu meeting held at Marnee's second retreat, another subterranean chamber close to the river, he would have abandoned his theory that Marnee had spirited away John Leyden's body. For, of all the people in that city on that particular night, no one was more anxious to locate John Leyden than Marnee, himself.

And this is why:

When the conspirators stood grouped about the dictagraph in Marnee's laboratory upon which they had placed the waxen disc, the needle went its way silently. No sound issued from the machine's horn. In a paroxysm of rage, Marnee clicked off the lever.

"What's to be done now, Renally? Evidently John Leyden has some specially constructed machine. Without it, this cylinder is useless to us. What are we to do?"

"There's his daughter, Ruth," Renally suggested. "He confided everything in her—"

Marnee raised one of his hands in unholy triumph, then beckoned to the Man-in-the-Cloak.

"Get your car. Take Boris and Vladimir with you. One moment. Wait! Here, you Peter Petrovitch, imitate this handwriting of Bradley Lane's—"

Marnee flung down one of a packet of letters he took from a file-box: a note stolen from Lane's desk.

"Write this. Address the envelope:

'Miss Ruth Leyden, 125 Connemara Street.'

"Then say:

'Dear Ruth:

'Come at once with the bearer to my laboratory. Something has happened that requires your immediate presence. Don't delay.

And sign it, 'Bradley.' They're on very affectionate terms, I hear."

He gave an ugly laugh.

Lane, partially disabled and desperately seeking some trace of Marnee, would have smiled had he been aware of the yearning for a radio set that fairly ate up the heart of Fatty Evarts. "Fatty" lived in the suburbs. His family was poor and totally unresponsive to Fatty's interest in radio. Vainly he read his copy of RADIO NEWS. The ads thrilled him until he came to the price. It might just as well have been a million dollars.

"Hey, Fatty, will you sell me a rabbit?"

For a moment Fatty was tempted, but before the purchaser was out of the yard he had recanted.

"No, I can't let poor 'Bunny' go, much as I want a radio. Here's your money back, mister."

And Fatty again applied himself to theoretical radio. Suddenly he saw an article telling how any boy could make a set out of makeshift material. Fatty was just as ingenious as the average American boy, and though his eyes looked out of his cheeks like a corn-fed porker's there was no fat inside his cranium.

"By jingoes," he said aloud as he slapped his fat thigh, "I'll build my own radio."

Jimmy Lawton, no older than Fatty, was thoroughly familiar with the radio. He had watched the cruel Marnee carefully, and his captor's cruelty to him had made him keen as a whip. After he had called Lane to his assistance, Marnee had told him in a fit of cruel confidence that he was wrecking vengeance on him for the slight his mother had given him in preferring another. And now Marnee had even more to avenge on the helpless boy. So when Jimmy overheard the plot to get Ruth into the scientist's den he sought an opportunity to send a warning. He found his opportunity just as Lane, using a fence railing as "ground" and his body as "antenna" was "tuning in" with an instrument concealed in a walking cane.

Here's what he heard:

"I'm Jimmy Lawton—send help to the ——river front. Marnee is having the girl brought here—save her—save me——" and then the message stopped abruptly.

Lane would still have been unable to locate the place on the "river front" had he not seen, just then, a closed car pass at such speed as to attract his attention. And just as he looked the curtain was raised a trifle and he saw the strange eyes of the "Man-in-the-Cloak." A stop in traffic enabled him to catch on to the tire carrier.

As Bradley Lane looked through the half opened door in the water front hovel, he saw an excited group about a dictaphone. He recognized Marnee, Renally—and yes, poor little Ruth—in mourning for her father and yet subject to acute mental anguish in the endeavor to extract from her the secret of the cylinder.

"But you will make the cylinder talk to save the man you love." The voice of Marnee and the torture to Ruth were too much and Lane stepped into the room, a gun in each hand. Nothing was said. Nothing need be said. Jimmy and Ruth, obeying unspoken commands, came to his side and filed before him through an iron door. Lane sprang through after them and bolted the door. As he did so he heard Marnee screech in glee:

"They have walked into my trap."

And so they had. All the windows were barred with iron. But Lane was equal to the emergency. With a pinch of powder of his own invention he instantly burned out the iron, leaving the bars as limber as willow wands. Lane bent them back

making a space large enough for a man to crawl through. But just as he was passing Jimmy through, Marnee threw a switch which lit up every metal rod in the room and in the next room with sputtering, darting flame. Like hunted animals they drew back to the center of the room.

The situation bristled with danger. Renally and his men were using every means in their power to break down the door. Marnee sat at his switchboard throwing the power of his dynamos into the far-side room, which was their only possible means of exit.

To pass through this electrical tempest was plainly impossible.

The bolted door was slowly yielding. Then a possible solution flashed upon him. Seizing the insulated copper wire, he made for the window.

"No, Bradley, no," Ruth moaned, all her love for the gallant young scientist in her voice. "You must not—shall not sacrifice your life."

But Lane saw the door slowly bending and knew that in a few minutes Marnee's men would be in the room. Standing on the window sill, just beyond the death-dealing volts, he noosed a section of copper wire for a throw. The first cast fell short, but a second loop fell over two of the terminals, short-circuiting the current. A terrible screech from behind told him that the current had boomeranged and had hurled Marnee from his position at the switchboard, at the same time creating havoc with the generators and other apparatus.

Lane dragged Ruth through the still intensely heated room, Jimmy Lawton following. They passed through the intended death-chamber into another room whose walls appeared to be absolutely blank. The fugitives stared at each other in despair. They had braved so many dangers, only to find themselves in a cul-de-sac.

A whirr and a click followed and a panel slid back, and the man whom they knew as one of their deadly enemies stood revealed—the Man-in-the-Cloak.

Bradley, with a stifled exclamation of rage, was about to hurl himself upon the foe, when, to his surprise, the person bowed profoundly and signaled them to pass. Suspecting a trap, Lane whipped his automatic from its holster, and bade the others follow him.

Hurrying to his laboratory Bradley Lane concluded one of the most strenuous days of his career, and Jimmy for the first time in years had a home.

Puzzled as they were at the action of the Man-in-the-Cloak, they would have been infinitely more puzzled if they had seen what happened after they left him, for this strange character, as soon as they were gone, crept back to the first room they had entered.

Renally and the others were trying to revive Marnee, whose face, twisted and contorted at its best, was now a veritable study of the grotesque, the pallid mask of a living gargoyle.

Fearful of losing their leader, they had devoted their whole attention to him. The Man-in-the-Cloak's eyes lighted upon the disc that contained John Leyden's secret. It lay under the needle of the abortive dictaphone.

Whipping it off and into one of his pockets, the Man-in-the-Cloak was about to steal away when Renally happened to glance in his direction.

"Get him quick!" Renally screamed. "The traitor! He's stolen the Leyden disc."

Then the Man-in-the-Cloak did a third astounding thing. He raised the disc high above his head and hurled it on to the concrete floor, smashing it into a hundred fragments.

"Take your damned disc," he snarled, and heaving a shoulder against the trap-door, he sprang up and out, slamming the door behind him, and fled from the neighborhood.

In spite of which the greatest problem in Fatty Evarts' young life was how to make a crystal detector from his father's junk pile.

The following morning found Lane closeted with high officials of the Department of Justice. While engaged in a description of the doings of the previous night, and showing them the picture he had made of the Anarchists, a code message was received from Scotland Yard, London, which was handling the English end of the vast conspiracy of which Marnee and Renally were the chief American agents.

Decoded, it read:

"Reds make temporary seizure English Channel Broadcasting Station, Island of Sark: Watch Montauk Point, the only Radio station near you to receive and send such messages. Believe plot to seize it simultaneously with Sark."

Bradley Lane, with an exclamation, hurried to the Radio room, where tuning into the Television, the machine that permits one to see scenes at distant points as though looking at a moving picture, he picked up the Montauk station. A number of men were stealthily approaching the station on the sand-dunes.

"I'm off," shouted Lane, "send your best men after me. Get Jimmy Lawton and tell him to bring me my Static Magnifier. The apparatus I showed to him last night. It's behind the Blue Boy in my room. Tell him to hurry."

But Jimmy was not destined to reach Montauk. He had no sooner seized the camera-like box containing the magnifier and hurried on his way, when that ever astounding person, the Man-in-the-Cloak, sprang upon him to wrest the box away.

Jimmy leaped upon a motorcycle that happened to stand nearby and sped away, the Man-in-the-Cloak following in his motor car. Making the best of his start, Jimmy had turned several corners ahead of his pursuer and was actually outdistancing him.

Suddenly, however, as his car swung around a corner, he saw a collision of an oncoming car with the motorcycle.

Poor Jimmy had been hurled among the stubble of a wheat-field, but as he went over he hurled the Static Magnifier into a brook.

Just as the Man-in-the-Cloak was picking up Jimmy's senseless body and placing it unresisting in the limousine, Lane himself arrived at a point near the Radio station.

The Reds, having surprised the station and captured the operators, had left a pair of guards outside to ward off interference. These flung themselves upon Lane, front and rear. He struck out at the first one, but the other brought a black-jack upon the head of the young scientist.

Lane fell face foremost in the sand.

Chapter V.

THE SHIP OF DOOM

The blow from the black-jack would have killed Lane had his head not been protected by a cap heavily padded for such emergencies. As it was, he was but momentarily stunned, and when his wits returned he thought it prudent to lie still, permitting his assailants to think they had accomplished their purpose.

When their backs were turned to him, Lane repaid his assailants in full. His stout walking-stick fell across the base of one Red's neck, and the other, wheeling, caught a second blow full on the forehead. Bradley hurried to the steps of the Radio station, drawing his automatic. Several of the Reds rushed towards him but being met with "Hands up quick," suddenly drew back. Then a whistled signal, which he knew came from a Department of Justice man caused him to glance behind, where scattered in a line of skirmishers, the Federal men came running to the station.

The Radio station was saved. No Radio messages would be received there for the Reds or sent overseas to the Island of Sark.

Renally, running to a window, escaped, and with his remaining henchmen reached a waiting boat.

Had any been in the secret of the double of the Man-in-the-Cloak he would not have been surprised to have seen him make a sudden appearance at the Leyden house at about the time Lane and the Department of Justice forces had driven Renally from Montauk. But Ruth was not in the secret.

At the first sight of him Ruth drew back. Here was the man who had kidnapped her. Then she remembered that he had also befriended her when she had been caught in Marnee's stronghold.

With his hat pulled down and huge collar turned up, he took the disc containing her father's secret from the folds of his cloak and addressed her.

"They think this is destroyed," he said. "It was a dummy I smashed before their eyes. Here is the real disc. Guard it well until Lane can get it to Washington. I am your father's friend. Farewell."

The real Man-in-the-Cloak, while en route with Jimmy Lawton to Marnee had seen his double. Leaving Jimmy in the custody of the chauffeur he had hurried to Leyden's house in a cab and had admitted himself to the house by a false key. In fact, he was in the very room when his double had delivered the true disc to Ruth.

The moment he knew his double had departed, he had leaped at Ruth and tried to snatch the disc from her.

Ruth wrenched herself free and rushed to the door.

"Thank God, Bradley," she murmured, for there was Lane, who had hurried to the house from Montauk, when assured that the Radio station was safe.

Ensued another hand-to-hand conflict. Bradley hurled himself upon the Man-in-the-Cloak. As Lane advanced upon him, jaw set, muscles tensed, the Man-in-the-Cloak with a cry of terror turned and fled. Only one way was open to him—the window.

He leaped through curtains and glass landing on the soft earth of the garden below, and, dazed though he was, took to his heels. And in the meantime Fatty Evarts had completed his radio set and set up the antenna. The crystal detector having been accomplished by aid of a safety pin as shown in his beloved RADIO NEWS.

* * * *

Meanwhile, back in the Leyden laboratory, Ruth heard the sparking of an invention of her father's by which one was instantly notified of a call by radiophone—Leyden's own special code-number.

She answered it to hear Jimmy's voice: "Marnee's got me again. Down at dock B. The *Sea-Gull*—a big schooner. Going to sail any minute now. They expect to hold up some big transatlantic liner and use her wireless to get in touch with Sark. Hurry or——"

There was an abrupt cessation of his voice. Ruth knew he had been detected and was reaping the consequences.

"Bradley," she implored, "they've got poor little Jimmy again. We've got to hurry, or they'll be far out to sea before we can save him."

Lane told her briefly to get ready while he notified the Department of Justice. But, for some reason, he was unable to get them and he knew that he dared not wait. So, taking the desperate chance single-handed, he hurried down to his car.

"Ruth," he said sternly, as he whirled toward the docks, "you are not to accompany me on board. As soon as we reach there, drive to the nearest police-station and get help."

But Ruth would not let Bradley out of her sight. So she went on the *Sea Gull* without any police assistance only to be captured ignominiously by the Reds and forced to watch her sweetheart, single-handed, battle the desperate and vengeful anarchists. By applying a fire axe to the lock of his room, Jimmy had made his way on deck just in time to intercept a knife which was aimed at Lane and instantly the two were the center of a wildly scrambling melee. Except for the dark, the confusion and the danger of hitting each other the anarchists, twenty to one, would have had an easy time. As it was, Lane and Jimmy found only one avenue of escape—up the rigging.

For a moment only they were safe. Then the Reds came swarming up the lines like rats, one with a coiled rope in his hand. Lane saw what he would do and swung Jimmy far out in the attempt to land him on the dock from which the big schooner was rapidly pulling away. The attempt was too late. Jimmy fell into the bay instead. An instant later Ruth, paralyzed with fear, saw the sailor lasso Lane and his pinioned body plunge toward the deck below.

(*To be concluded in the December Issue.*)

Best Broadcasting Stations Will Operate on Longer Wave-Lengths

(*Continued from page* 862)

inspectors the Department will license "B" stations as fast as they qualify, but probably not more than one in each city or section at first. In the event two or more stations qualify in a single district or neighborhood where interference would occur, a schedule will be arranged dividing the time between them.

The "B" stations will have to toe the mark in station efficiency and keep up to scratch on programs, the Chief Radio Inspector states, or they will lose their special wave-length and revert to 360 meters with the general broadcasting stations.

Public opinion will undoubtedly soon come to the aid of the inspectors and the Department in case large numbers of broadcasters desire Class B stations, and public opinion will be the last court, basing its recommendations on the most interesting and instructive programs. Under the present law any station can qualify, but when they get too thick both in the general and Class B field, the radio fans who listen in may have to aid officials in making selections.

As the general public is interested in broadcasting and the stations themselves will want to know the specifications for Class B, the whole amended regulations are printed as issued a few days ago:

AMENDMENTS TO REGULATIONS

To Radio Inspectors and Others Concerned:

Regulation 57, page 55, amended August 8, 1922, to read:

CLASS 2.—Limited commercial stations are not open to public service and are licensed for a specific commercial service or services defined in the license. Stations of this class must not transmit to or accept public messages from other stations. No rates are authorized. Licenses of this class are required for all transmitting radio stations used for broadcasting news, concerts, lectures and such matter. A wave-length of 360 meters is authorized for such service, and a wave-length of 485 meters is authorized for broadcasting crop reports and weather forecasts, provided the use of such wave-lengths does not interfere with ship-to-shore or ship-to-ship service.

CLASS "B" RADIO TELEPHONE BROADCASTING STATIONS

A new class of radio telephone broadcasting station license is hereby established to be known as Class "B."

A license will not be issued for a station in this class which does not comply in every respect with the specifications hereunder.

Specifications covering the requirements governing the construction, licensing, operating and service of Class "B" radio telephone broadcasting stations:

STATION

WAVE-LENGTH—The wave-length of 400 meters only will be assigned for the use of stations of this class which must be reasonably free from harmonics.

POWER—The power supply must be dependable and nonfluctuating. The minimum required will be 500 watts in the antenna and the maximum shall not exceed 1,000 watts in the antenna.

MODULATION—The system must be so arranged as to cause the generated radio frequency current to vary accurately according to the sound impressed upon the microphone system.

SPARE PARTS—Sufficient tubes and other material must be readily available to insure continuity and reliability of the announced schedule of service.

ANTENNA—The antenna must be so constructed as to prevent swinging.

SIGNALING SYSTEM—Some dependable system must be provided for communication between the operating room and the studio.

STUDIO—The radio equipment in the studio must be limited to that essential for use in the room. The room shall be so arranged as to avoid sound reverberation and to exclude external and unnecessary noises.

SERVICE

PROGRAMS—The programs must be carefully supervised and maintained to insure satisfactory service to the public.

MUSIC—Mechanically operated musical instruments may be used only in an emergency and during intermission periods in regular program.

DIVISION OF TIME—Where two or more stations of Class "B" are licensed in the same city or locality a division of time will be required if necessary.

FORFEITURE OF 400 METERS PRIVILEGE

Licenses issued for the use of the 400 meters wave-length shall specifically provide that any failure to maintain the standards prescribed for such stations may result in the cancelation of the license and requiring the station to use the 360 meters wavelength.

(signed) D. B. CARSON,
Commissioner of Navigation.

Approved.

(signed) HERBERT HOOVER,
Secretary of Commerce.

"Radio" as a Trademark for Many Forms of Merchandise

By JOHN B. BRADY*

The commercial public engaged in the pursuit of many different and varied lines of manufacture, distribution and sale of merchandise are recognizing the magic of the word "RADIO" as an asset in the sale of their goods. As evidence of the value of the word "RADIO" as a trademark in the merchandising of different kinds of goods, an investigation of the Patent Office records at Washington reveals the fact that "RADIO" has been registered as a trademark on no less than twenty different kinds of merchandise. Among these different classes of goods which the word "RADIO" has

* *Patent lawyer.*

been selected to represent are: Chemical compounds; hot air fans; varnish; denatured alcohol; insecticides; leather; sewing silks; threads; cottons; yarns; furniture polishing oil; electric batteries; ball bearings; golf balls; non-alcoholic and non-intoxicating fruit and nut beverages; garden, field and flower seeds; auto lenses; talking machines; sound boxes and needles; vehicle tires; playing cards; canned tuna fish; jewelry; writing paper and bristol board; and silk braid.

The rules of practice in the United States Patent Office concerning the registration of trademarks state that no marks will be registered which is identical with a registered or known trademark owned and in use by another, and appropriated to merchandise of the same descriptive properties, or which so nearly resembles a registered or known trademark owned and in use by another, and appropriated to merchandise of the same descriptive properties as to be likely to cause confusion or mistake in the mind of the public, or to deceive purchasers. However, the use of the same mark for absolutely different kinds of goods is permissible, the object of the registration rules being to prevent the appropriation of the same mark to merchandise of precisely the same descriptive properties as to be likely to cause confusion or mistake in the mind of the public.

Due to the sudden increase in popularity in radio broadcasting, numerous trademark registrations covering the sale of radio goods are being obtained. Among these the following are of particular interest:

Registration No. 113,751—"LENZITE" for detector crystals.

Registration No. 129,698—"RADIO AMATEUR NEWS" for periodicals.

Registration No. 140,120—"RADIO NEWS" for periodicals.

Registration No. 133,313—"RADIO-PHONE" for radio apparatus.

Registration No. 133,314—"RADIO-FONE" for radio apparatus.

Registration No. 150,948—"RADIO-TRON" for electron tubes.

Registration No. 152,961—"RADIOLA" for radio apparatus.

Registration No. 153,172—"RADIO MFG. CO." (Mark arranged within a triangular ornamentation for radio apparatus.)

Registration No. 153,238—Representation of Magnavox loud speaker with lion head protruding from horn, for loud-speaking telephone.

Registration No. 157,518—"VOCALOUD" for loud speakers.

Serial No. 161,012—"POPULAR RADIO" for monthly publication.

Registration No. 159,777—"AIR O PHONE" for radio apparatus.

The future alone can determine the number of registrations which will appear to control the business situation of this vastly growing art.

IDAHO JOINS BROADCASTING STATES

Among 12 broadcasting stations licensed by the Department of Commerce during one week recently, there were two in Idaho, one of the five states which had no broadcasting station. They are operated by an electric shop in Moscow and a firm in Lewiston. Wyoming will soon be in the broadcasting field, it is reported, and then there will be but three states with no radio news distributing stations—Mississippi, Kentucky and Delaware.

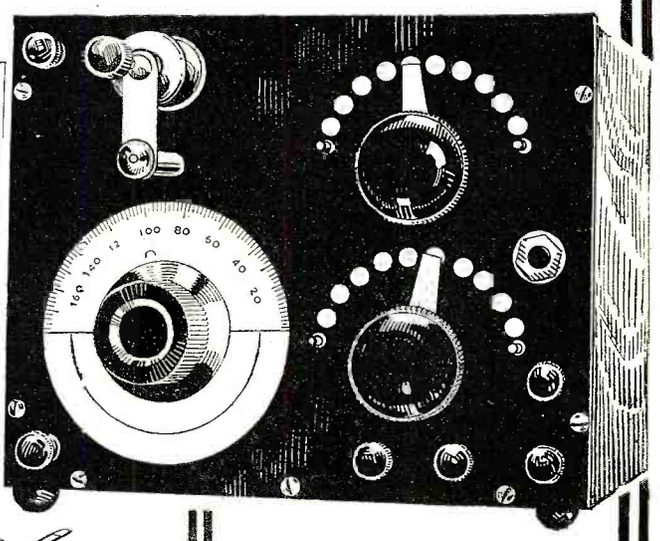
Los Angeles appears to be pretty near the saturation point, as far as radio broadcasting is concerned, as with 29 stations in the vicinity contributing to the aerial barrage of news, music and entertainment, time schedules and wave assignments will be necessary soon.

Three daily papers took up broadcasting recently, one school of music, and the city of San Jose, California.

your hands can make a

RADIO PHONE CRYSTAL SET

—at a fraction of what one would cost made up!



Pattern No. 3
of "The Radio Constructor" Series—
Making Your Own

PATTERN NO. 3: HOW TO MAKE A RADIO PHONE CRYSTAL SET

Our Complete Instructions and Blue Prints Are Designed For Those Without Technical Knowledge

No Machine Shop or Heavy Tools

You can build this splendid, reliable radio phone crystal set quite easily without a machine shop, or the use of any heavy tools. These patterns will make a handsome looking instrument with all the improvements to be found in the expensive, ready-made apparatus.

Only Standard Parts Used

One of the foremost radio engineers has constructed this set for us, especially for the amateur, and he has used only standard parts that may be procured from any supply house, and that are lowest in price.

Pattern No. 3

Complete radio phone crystal set, which, when completed and hooked to aerial, phone and ground, is ready for action! You receive a Four-Page illustrated Direction-Pamphlet Size 8½x11½ inches. One Blue-Print Pattern, Size 16x22 inches. All Contained in a Heavy Two-Color Printed Envelope, 9x12 inches.

50c

Every Pattern is Full Size

Take for instance the pattern for the panel. It is printed on heavy blue-print paper exactly the size of the panel to be used. The position of the holes and other markations are exact, so that all you have to do is to paste the pattern on top of your panel by means of ordinary library paste, and when dry drill right through the pattern wherever the marks are located.

As Simple to Make as to Read

All the fun of building your own without any of the hardship. In this set of patterns we do not merely give you pictures of how the apparatus looks, and mere diagrams, but each and every pattern supplied is full size.

This does away with all fussing and calculating, as we have done all the laying out in our own shop, and you need not worry that the final instrument does not come out right.

ORDER FROM YOUR DEALER—*or direct from us*

CONSOLIDATED RADIO CALL BOOK CO., Inc.
PUBLISHERS
98 Park Place NEW YORK CITY

The newly licensed stations include:
KFAR—O. K. Olsen, Hollywood, Calif.
KFBA—Ramey and Bryant, Lewiston, Idaho.
WHAG—University of Cincinnati, Ohio.
WHAH—J. T. Griffin, Joplin, Mo.
WHAI—Radio Equipment & Mfg. Co., Davenport, Ia.
WHAJ—Bluefield *Daily Telegraph*, W. Va.
WHAK—Roberts Hardware Co., Clarksburg, W. Va.
WHAL—Phillips, Jeffrey and Derby, Lansing, Mich.
KFAN—Electric Shop, Moscow, Idaho.
KFAP—Standard Publishing Co., Butte, Mont.
KFAQ—City of San Jose, Calif.
WHAM—School of Music, Rochester University, N. Y.

AN ENTIRE SUNDAY-SCHOOL SERVICE BY RADIO

For the first time in the Central States, and possibly the first time in the country, an entire Sunday-school program was conducted by the radiophone, at Hutchinson, Kan., May 28th.

The Business Men's Sunday-School class of the First Methodist Church, the largest Sunday-School class in the State, installed a receiving apparatus at the class-rooms, and the speaker, the orchestra, song leader and teacher of the class went to the broadcasting station of the Hutchinson Grain Radio Company, which was recently organized. The speech, the music and the songs were received much the same as any ordinary program would be received by radio, but the teacher was able to make a variation in teaching by radio, by a secret telephone connection, over which he was informed of who was present, what was happening at the class meeting, and was able to make appropriate remarks over the wireless.

It is estimated that over 10,000 men in the State heard this program, as the station is well known, especially in the central and southwestern parts of the State.

The station gives hourly market reports each day during the hours between the opening and closing of the market, and also broadcasts musical programs, and sermons on Sunday. Each night there is a popular musical concert.

When the first district convention of the Lions' Club was held in Hutchinson recently, the station broadcasted the entire musical program of one of the dinners.

By making telephone connections with the Convention Hall, the station broadcasted the entire speech of William Gibbs McAdoo there recently. This is said to be the start of the 1924 campaign, and the speech was heard over many States, and a number of newspapers received their stories by tuning in.

THE HEARER

By Blaine C. Bigler

I have heard the savage tribes of Zululand
As they bound their helpless victim to the stake;
I have heard the waves creep o'er a coral strand;
I have heard the rustling palms on Guam and Wake.

I have heard the thunder of an avalanche;
The grinding cakes of ice on Arctic seas;
The lowing herds upon a Western ranch;
The droning of a farmer's hive of bees.

I've heard the sledge dogs howl upon the trail;
The jungle king lift up his sullen roar;
I've heard a fishing boat with flapping sail;
I've heard the dancer's feet upon the floor.

No, I am no traveler as you may think;
I never had the means nor time to go,
But I've even heard a Tartar chieftain wink;
I hear the world by means of radio.

OPPORTUNITY AD-LETS

Follow these advertisements every month. Reliable advertisers from all over the country offer their most attractive specials in these columns.

Classified advertising rate fifteen cents a word for each insertion. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Objectionable or misleading advertisements not accepted. Advertisements for the January issue must reach us not later than November 1st.

THE CIRCULATION OF RADIO NEWS IS OVER 235,000

EXPERIMENTER PUBLISHING CO., INC., 53 Park Place, New York, N. Y.

Agents Wanted

We Want Men and Women Who are Desirous of Making $25.00 to $200.00 Per Week clear profit from the start in a permanent business of their own. Mitchell's Magic Marvel Washing Compound washes clothes spotlessly clean in ten to fifteen minutes. One hundred other uses in every home. Nothing else like it. Nature's mightiest cleanser. Contains no lye, lime, acid or wax. Free Samples make sales easy. Enormous repeat orders—300% profit. Exclusive territory. We guarantee sale of every package. Two other "sight sellers" and sure repeaters give our agents the fastest selling line in the country. No capital or experience required. Baker, Ohio, made $600 last month. You can do as well. Send for Free Sample and proof. L. Mitchell & Co., Desk 105, 1302-1314 E. 61st, Chicago, Ill.

Lightning—Strange Battery compound startles the world. Better than sulphuric acid. Charges discharged batteries instantly. Gallon free to agents. Lightning Co., St. Paul, Minn.

People Must Eat—Big profits introducing Mother Hubbard Foods. Goods worth $150 free. Sales guaranteed. Send for free outfit. Inthout Company, 5582 Congress, Chicago.

No dull times selling food—people must eat. Federal distributors make big money; $3,000.00 yearly and up; no capital or experience needed; guaranteed sales; unsold goods may be returned. Your name on packages builds your own business. Free Samples to customers—Repeat orders sure. Exclusive territory. Ask Now! Federal Pure Food Co., Dept. 68, Chicago.

We Wish Representatives in every community to secure subscriptions for Radio News, Science and Invention, and Practical Electrics. This is a wonderful opportunity for Amateur Radio Enthusiasts to make big money quickly. Write Experimenter Publishing Co., Inc., 53 Park Place, New York City.

Great Profits Assured capable men joining immediately national selling organization for Evenflo Self-filling ink-pencil pen. Writes with ink instead of lead. Send for Profit Proposition. Evenflo Pen Company, Dept. 64, Grand Rapids, Mich.

Amateur Agents Wanted in every city and town to sell radio apparatus. A few stocking agencies still open. Delfelco, 12 Meeting Street, Pawtucket, R. I.

Ambitious men, write today for attractive proposition, selling subscriptions to America's most popular automobile and sportsman's magazines. Quick Sales. Big profits. Pleasant work. Digest Pub. Co., Butler Bldg., Cincinnati.

Make $5,000.00 every year—$2,000.00 spare time. You share profits besides. Show "Weather Monarch" Raincoats and Waterproofed Overcoats. Ask about "Duol Coat" (No. 999). Free raincoat for your own use. Associated Raincoat Agents, Inc., B-448 North Wells, Chicago.

$75.00 to $150.00 Weekly. Free samples. Lowest priced gold window letters for stores, offices and autos. Anybody can do it. Large demand. Exclusive territory. Acme Letter Co., 2800M Congress, Chicago.

Big Money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 133, East Orange, N. J.

Agents Wanted in every city and town to sell standard radio apparatus. Attractive discounts given. If interested, write us at once stating age and radio experience. Wilmington Electrical Specialty Co., Inc., 912 Orange St., Wilmington, Delaware.

Tailoring Agents—We've got a wonderful line of all wool tailored to order suits and overcoats to retail at $29.50. They're all one price. $20 cheaper than store prices. You keep deposits, we deliver and collect. Protected territory for hustlers. Write J. B. Simpson, Dept. 173, 831-843 W. Adams, Chicago.

Automobiles

Automobile Mechanics, Owners, Garagemen, Repairmen, send for free copy America's Popular Motor Magazine. Contains helpful instructive information on overhauling, ignition wiring, carburetors, batteries, etc. Automobile Digest, 528 Butler Bldg., Cincinnati.

Batteries

BB Batteries. Make your own rechargeable from standard pasted plates. Negative or positive at $.10. Jars for same $.05. A sample postpaid for $.30. A complete stock of parts ready for immediate shipment, Magnavoxs, vacuum tubes, receivers, etc. Electric Service Shop, Bradford, Ill.

B Batteries, lowest prices yet. 22½v tapped large size $1.95, 45v tapped $3.40. 105v $10.50 all prepaid. Prompt deliveries. DEPCO, 506 East Baltimore Street, Baltimore, Md.

Correspondence Courses

Correspondence Courses at less than half original prices. Any school; any subject for men or women. Bulletin 1074 free. Courses bought. Instruction Correspondence Exchange, 1966 Broadway, New York.

Dollars Saved—Used correspondence courses of all kinds sold, rented and exchanged. List free. (Courses bought.) Lee Mountain, Pisgah, Alabama.

Books

Sexology Books only for professional and advanced student readers. Forel, Krafft-Ebing, Kisch, Robie, Ellis, Freud, Kay and other authorities. The Modern Book Association, 4150 Santa Monica Blvd., Los Angeles, Calif.

6 Different Business Publications covering Accounting, Advertising, Administration, Merchandising, Salesmanship and Taxation, all prepaid, only 25c. Value, $1.50. Instructive, educational, practical. Walhamore Co., Lafayette Bldg., Philadelphia, Pa.

Vibrations — Light — Color — Sound Literature. Free. Stevens Publishers, 242 Powell, San Francisco.

Electricians' Examinations: Book of questions and answers with diagrams, symbols, tables, notes and formulas for preparation for license. $1.25 by mail. Aaron Shapiro, 132 West 24th St., New York.

Vibrations, Sounds, Lights and Colors Illustrated. Stevens Publishing Company, San Francisco, California.

Study Human Nature, know people, make more money. Send 10c for "Personal Power," a little book that points the way. Address Progress League, 31-A. G. Union Square, New York, N. Y.

We Buy and Sell back issues of Radio Amateur News and Electrical Experimenter. Boston Magazine Exchange, 109 Mountfort St., Boston, Mass.

Interested in Journalism? The Star Reporter is for Journalists. 50c annually. 5c sample. Box 55, Times Square Station, New York.

Business Opportunities

$100.00 Weekly Manufacturing automobile specialties, Repainting, Retrimming automobiles. Easily Learned at Home, Modern Methods, Indispensable to all automobile trades people, motorists, etc. Fred DeWilde, Sheboygan, Wis.

Become a Landscape Architect. Dignified, Exclusive Profession. Little competition. $5,000.00 to $10,000.00 income for experts. Easy by our method. Begin earning 3 weeks after you enroll. Write today. American Landscape School, 11R, Newark, N. Y.

Chemistry

Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our full page ad on page 885 of this issue. Chemical Institute of New York, 140 Liberty Street, New York City.

Dogs, Pets, Etc.

Dog Owners, amateur or professional. Here is your opportunity. New book, "Care of Dogs," free; contains helpful instructive information on feeding, training, diseases. Every dog owner needs it. Book mailed free with a 3 months' trial subscription to "Sportsman's Digest"—America's popular illustrated Dog and Hunting Magazine. Send 25c today (coin or stamps). "Sportsman's Digest" Publishing Co., 528 Butler Bldg., Cincinnati, Ohio.

Exchange

Sacrifice: Brand new Baldwin LS Loud-speaking Reproducer, $15.00. Cost $18.00. No use—have purchased Magnavox. Edw. Wahla, Minden City, Mich.

Complete Twenty-Watt C. W. Set—Roller-Smith Meters, $95.00. Receiving Set cheap. Photos. Frank Smith, Fayetteville, Ark.

Receiving Tuner—175-3,000 meters, complete description on request, $27.50. Also Clap-Eastham type ZRD audion control, $7.50. Or, what have you? Both A1 Condition. John Ramsey, 153 Lothrop Avenue, Detroit, Mich.

Set Hawkins Guides, $5.00. 15-dial Omnigraph, $14.00. F. O. B. Muscatine, Ia. R1 Bx. 57.

For Sale: Black Fibre Panels, nicely finished, 7x18x3/16, $1.25—cut to order any size, .01 sq. in. Immediate delivery. Geo. H. Mollahan, Lowell, Mass.

For Sale: Triple Honeycomb Receiver with detector, 2 stage and condensers, vernier, worth $125.00, price, $85.00. E. Klavon, 210 William Street, Fairhaven, Pittsburgh, Pa.

Mold for Sale: Best offer takes hundred cavity mold for 5/8-inch diameter hard rubber knobs. Also 10,000 brass inserts for same; 8/32 thread. Garfinkel, 221 Bryson Bldg., Los Angeles, Calif.

Amateur Agents wanted in every city and town to sell radio apparatus. A few stocking agencies still open. Delfelco, 12 Meeting Street, Pawtucket, R. I.

200-20,000 Meter Receiver, including Radiotron, $55.00. Box 205, Williamsport, Pa.

Self-Half Kilowatt transmitter and regenerative audion receiver. Ralph Bransby, Woodstock, Ill.

For Sale: 350-volt Motor Generator Set. Only used short while. Good as new. Stanley F. Northcott, 1204 N. Birney St., Bay City, Michigan.

Ford Owners

Sport Cars, fast, saucy, hug the turns and stick to the road—make you glad you're a Ford owner. Can easily be built by aid of life-size "Red-i-Kut" patterns and picture instructions. The "Pal" system delivered complete with pressed metal streamline tail for $6.40. Garage men make big money building them. Send for prospectus on making sport cars—Jiffy Tops and Gosum Windshields. Kuempel Co., 311 Kuempel Bldg., Guttenberg, Iowa.

For Inventors

Inventors and Manufacturers, for developing your invention, designing and constructing automatic machinery, labor-saving devices for all purposes, coin-controlled beverage and food-dispensing machines. Consult John Frick, Mechanical Engineer, 1105 Arch Street, Philadelphia, Pa.

Health

Pyorrhea (Riggs's disease—bleeding or swollen gums)—hundreds have been helped by "Pyorrdent" the successful home pyorrhea treatment. Purifying, healing, preventative. Full month's treatment, consisting of a very beneficial massage paste and an antiseptic tooth-cleansing paste to be used in place of your ordinary dentifrice, together with full directions for treatment. $1 postpaid. Or write for free booklet "R." Pyorrdent Mfg. Co., 439 Seventh St., Brooklyn, N. Y.

Tobacco or Snuff Habit Cured or no pay; $1 if cured. Remedy sent on trial. Superba Co., S.B., Baltimore, Md.

Help Wanted

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 5665, St. Louis, Mo.

Be a Mirror Expert, $3-$10 a day; spare time home at first; no capital; we train, start you making and silvering mirrors. French method. Free prospectus. W. R. Derr Pres. 26 McKinley St., Baldwin, N. Y.

Detectives Earn Big Money. Excellent opportunity. Travel. Experience unnecessary. Particulars free. Write, American Detective System, 1968 Broadway, N. Y.

Instruction

Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our full page ad on page 885 of this issue. Chemical Institute of New York, 140 Liberty Street, New York City.

Mouth-organ Instructor, 25c. Play in one hour. Elsea Company, Bowling Green, Ohio.

Vibrations, Lights, Colors, Sound (illustrated) Electronic Radio Active principles. Write for table contents, 242 Powell, San Francisco, Calif.

Mail Order Business

Start little Mail order business anywhere. Home employment evenings. Stamp brings instructive booklet. Bernard Pier, 72 Cortlandt Street, New York.

500 Things to Sell by Mail. Remarkable new publication. Workable plans and methods. Loose-leaf, cloth binder. Prepaid, $1.00. Walhamore Company, Lafayette Bldg., Philadelphia, Pa.

Manufacturing

We are equipped to manufacture all kinds of wire and light metal goods. Stampings, Dies and Tools, Punch Press work. Patented articles wanted. Safety Wire Gas Globe Company, Columbus, Ohio.

Miscellaneous

Sell your Snap Shots at $5.00 Each. Kodak prints needed by 25,000 publishers. Make vacations pay. We teach you how and where to sell. Write Walhamore Institute, Lafayette Bldg., Philadelphia, Pa.

We specialize in Advertising-Pencils. Sample, with your ad. imprinted in Gold, 10c. Musial & Co., 423 Walnut Street, Yonkers, N. Y.

Send us your Metal Work. We are equipped to do metal stamping, power press work, soldering and plating, etc. Estimates furnished. T. E. Bennett Co., 7 Beverly Street, Providence, R. I.

Motorcycles—Bicycles

Used parts for all motorcycles cheap. State wants. Schuck Cycle Company, 1922 Westlake, Seattle, Wash.

Don't buy a Bicycle Motor Attachment until you get our catalog and prices. Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

Electrical Supplies and Appliances

Electric Tattooing Outfits, Illustrated Catalogue, 10c. Waters Mfg., 1050 Randolph, Detroit.

Musical Instruments

Cornetists, Trombonists, Saxophonists, Clarinetists, send for "Free Pointers." mention instrument. Virtuoso School, Buffalo, N. Y.

News Correspondents

Earn $25 Weekly, spare time writing for newspapers, magazines. Experience unnecessary, details free. Press Syndicate, 566 St. Louis, Mo.

Office Devices

Save half on office machines, equipment, addressers, Multigraphs, Duplicators, Dictaphones. Pruitt Company, 172 North Wells, Chicago, Ill.

Patent Attorneys

Inventors: Protect your invention through A. M. Wilson, Inc., Washington, D. C. Over 20 years of efficient, expert, confidential service. Skilled in Radio-Electrical, Chemical and Mechanical fields. Our 1922 illustrated Booklet, giving much necessary and very useful information which every inventor should know, will be sent free upon request. Prompt and careful attention. Highest references. Moderate fees. Send sketch or model for our careful opinion and preliminary advice. Write today to A. M. Wilson, Inc., (Radio 3 ARH), 312 Victor Bldg., Washington, D. C. (Successor to business established in 1891 by A. M. Wilson.)

Patent application filed on partial payment plan. Trademarks, copyrights, etc. Milo B. Stevens and Company, 694 F' Street, Washington, D. C. Established 1864.

Inventors aided. Ideas developed and patented. Practice in all courts and departments. C. E. Richardson, 31 Albee Bldg., Washington, D. C.

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Patents—Send for form "Evidence of Conception" to be signed and witnessed. Form fee schedule, information free. Lancaster and Allwine, 269 Ouray Bldg., Washington, D. C.

Patents Secured. Prompt service. Avoid dangerous delays. Send for our "Record of Invention" form and Free Book telling How to Obtain a Patent. Send sketch or model for examination. Preliminary advice without charge. Highest references. Write today. J. L. Jackson & Co., 356 Ouray Bldg., Washington, D. C.

Patent. Electrical cases a specialty. Pre-war charges. B. P. Fishburne, 340 McGill Bldg., Washington, D. C.

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Patents. Send drawing or model for examination and report as to patentability. Advice and booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 624 F Street, Washington, D. C.

Patents. Trademarks. Moderate Fees. Easy payments. Eugene Stevens, Jr., 380 Barrister Bldg., Washington, D. C.

Patents, Trade Marks, Etc.

Patents Trademarks—30 years of confidential service; expert advice, prompt action, reasonable fees. Send for free Book No. 64, Edgar Tate & Co., 245 Broadway New York: 635 F Street, Washington, D. C.

Personal

Your horoscope, character, friends, enemies, opportunities. Send name, birth date and 10c (stamps) for test reading. Sanya, 202-B West 105th Street, New York.

Printing

Everything Printed.—Long run specialists. Samples. Quality Printery, Marietta, Ohio.

Radio Outfits and Supplies

Westinghouse and Other Standard Radio Sets and Parts. Liberal commissions paid for interesting others which enable you easily to Earn your Set and Make Money. Write for price list and proposition. Wheeler-Thomas Radio Co., Dept. 31, Holland, N. Y.

Salesmen Wanted

Wanted: First-class Salesmen in New York City, Chicago, Detroit, Philadelphia, New Orleans, Los Angeles and San Francisco, to sell on commission high-grade line of radio products. Must be experienced radio salesmen. Exclusive territory. Address Box 40, Care Radio News.

Scenery to Rent

Settings for Opera, Plays, Minstrels. Plush Drops. Address Amelia Grain, Philadelphia.

Song Poems Wanted

Stories, Poems, Essays, Plays Wanted. We teach you how to write; where and when to sell. Publication of your work guaranteed by new method. Walhamore Institute, Dept. J, Lafayette Bldg., Philadelphia, Pa.

Song Writers

Song Writers!—Learn of the public's demand for songs suitable for dancing and the opportunities greatly changed conditions offer new writers, obtainable only in our "Song Writers' Manual and Guide," sent free. Submit your ideas for songs at once for free criticism and advice. We revise poems, compose music, secure copyright and facilitate free publication or outright sale of songs. Knickerbocker Studios, 319 Gaiety Bldg., New York.

Stamps and Coins

Stamps, 50 Varieties, Africa, Brazil, Peru, Cuba, Mexico, etc., 10c. 50 different U. S., 25c; 1,000 mixed, 40c; 1,000 hinges, 10c. List free. C. Stegman, 5956 Cote Brilliante, St. Louis, Mo.

Telegraphy

Telegraphy—(Morse and Wireless) and Railway Accounting taught thoroughly. Big salaries. Great opportunities. Oldest, largest school. All expenses low—can earn large part. Catalog free. Dodge's Institute, M St., Valparaiso, Indiana.

Wireless

B & B "Special" Receiver assures remarkable results. Phones, tube and B battery included, $27.50. Send for circular. The B & B Radio Co., 507 Bigelow Street, Peoria, Ill.

Distortionless Power Amplifier. Our one-stage power tube amplifier when used in addition to the regular two-stage amplifier will give surprising results remarkably free from distortion. Write for descriptive matter of our one, two and three-stage amplifiers. Central Mfg. Co., Fairfield, Iowa.

Going to add an amplifier and provide real enjoyment for all these cool evenings? We have the best, at lowest prices. Complete parts for two-step audio-frequency amplifier, including Gorton Engraved Panel and Sub-Panel; Cabinet; transformers, sockets, rheostats, jacks—everything except tubes—for $26.75 postpaid. Immediate shipment. Coast Radio, Inc., El Monte, Calif.

Regenerative Sets—Below Cost—Variometers, variocoupler, detector, two-stage amplifier, jack control, complete, $45.00. Caverly, 4744 Winthrop Avenue, Chicago.

Use Radio Frequency and learn what real radio signals are. Our Miller Radio Frequency Units (patented) are equally efficient at all waves. Far ahead of anything heretofore. Write for full information, prices, hook-ups, etc. Coast Radio, Inc., El Monte, Calif.

Clarion Loud-Speaker Unit. For horn or phonograph attachment. Type 3-C, $5.00. Few Brandes Trans-Atlantic head sets. List, $12.00. Our price to you, $6.50. Enclose check and address: Citizen Wireless Service, Hornell, New York.

Stromberg-Carlson Phones. The professional headset at the amateur's price. Super-sensitive, comfortable, durable. Impedance correct for phone work with modern vacuum tubes. Equipped with five-foot polarity indicating, moisture-proof silk cords. A real radio headset for $7.50. Carrollton Radio Shop, Carrollton, Missouri.

Mounted Crystals. Three for 35c. Sensitiveness guaranteed. Cook Co., 162 No. Grove Street, East Orange, N. J.

For That Radio Receiver. Unassembled variable air condensers. Send prepaid on receipt of price. 43 plate, $1.95; 23, $1.75. Emmerling Engineering Co., Johnstown, Pa.

Variable Condenser Parts—All Size Condensers, Knocked-Down or assembled. Stamp brings pamphlet. Gravenstede, 84 Hancock Avenue, Jersey City, N. J.

Look: Formica Panels 6-12, 95c; 6-21, $1.65; Cabinets to fit respectively, $3.00 and $4.00; VT sockets, $1.15; Fones Murdocks, $4.50; Manhattans, $5.40. Other supplies. Home Radio Company, 140 Liberty Street, Bowling Green, Ohio.

Dealers, Attention—Write for circular on our Xmas Crystal set. Machine Made, imitation leather case, nickel fittings, made to sell and sell fast, retails for less than $3.00. Large profits—don't wait. Write now! Harrison Mfg. Co., Dept. C, 2529 Grand River, Detroit, Mich.

We can save you money! Write for our prices on any standard make. H & G Radio Co., 12 Elm Street, Flushing, N. Y.

$10.00 Variometers—$3.00 while they last, manufacturers' samples. Horton, Christie Street, Ridgefield Park, N. J.

Radio Spot Puzzle, latest thing out, 25c prepaid. We also sell the best made tuning coil for least money. Send 2c stamp for circular. Nifty Novelty Co., Newark, N. J.

Postage Paid — Radiotrons UV-200 detectors, $4.60. UV-201 amplifiers, $6.00. Fred Pacholke, 408 Walnut Street, Dowagiac, Mich.

Eliminate static 50 per cent. Reduce filament voltage 35 per cent. on tuner constructed for 50c. Send $1.00 for instructions and hookup. R. Packingham, Peru, Ill.

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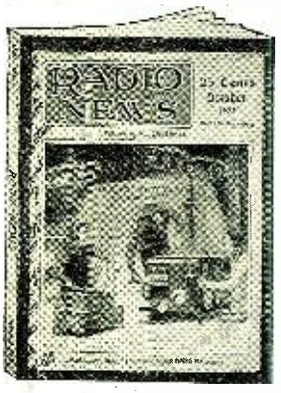

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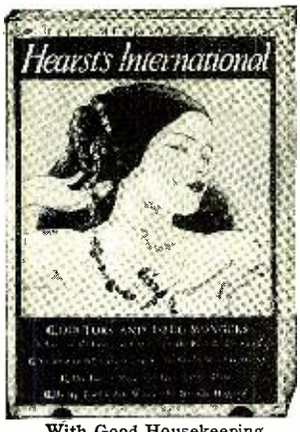

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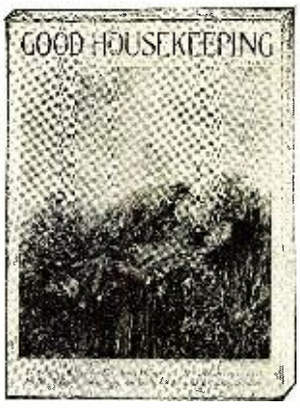

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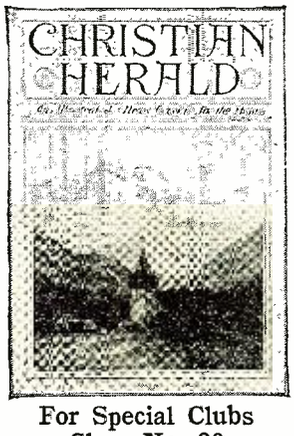

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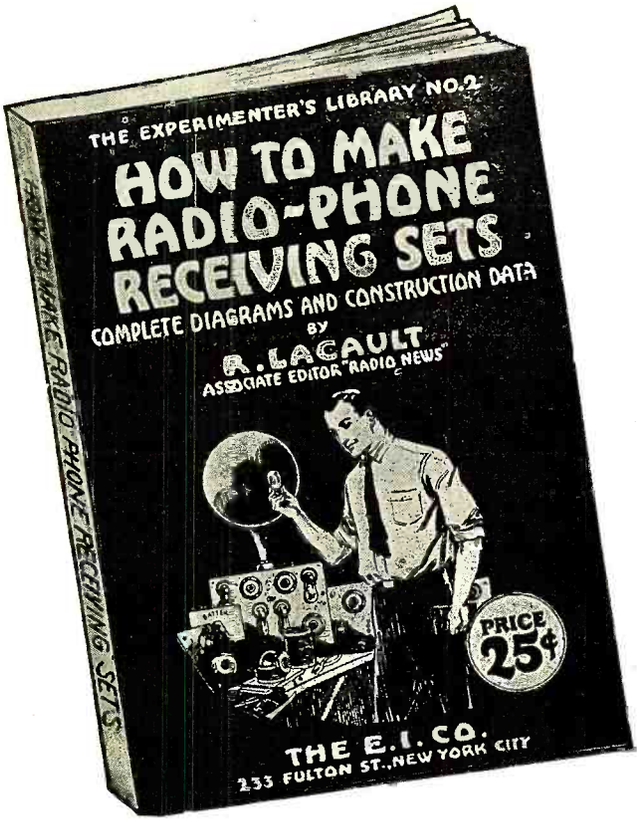

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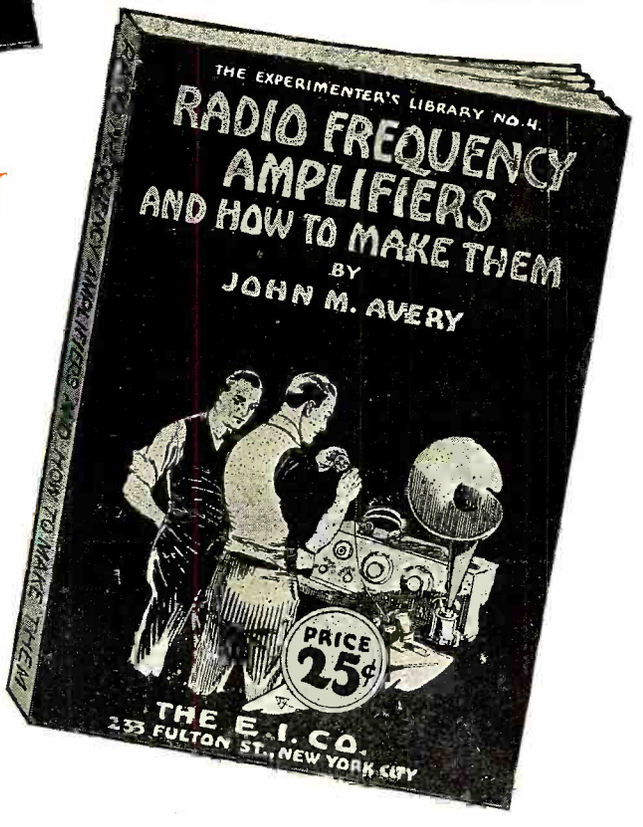

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