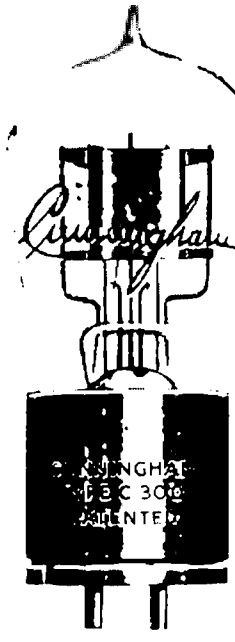
CUNNINGHAM VACUUM TUBES

For HOME RECEIVING SETS

CUNNINGHAM
C-300
GAS CONTENT
DETECTOR
$5.00



Amplifies as it Detects

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

THROUGHOUT the entire country today Cunningham Type C-300 Gas Content Detector Tube is recognized as the ideal tube for use in Home Receiving Sets.

For clear reception of Concerts, Market Reports, Stock Quotations, etc., sent out by radio, this tube cannot be excelled.

The one tube which gives the best results used with any type receiving set applicable to wave lengths of 100 and 3000 meters for both spark and C. W. Telegraph and Telephone, this Cunningham Detector Tube is being purchased everywhere by those operating Home Receiving Sets.

In addition to its remarkable detector properties, low B. battery, quietness in operation, it is a free and persistent oscillator for regenerative amplification and C. W. reception and functions without distortion of the received signals.

Many wonderful tributes have been paid this tube by those who have achieved the remarkable results that it always gives.

Your nearest dealer will gladly give you full information about this tube or write direct to us.

E. T. Cunningham

Trading as

AUDIOTRON MFG. COMPANY

248 First Street
San Francisco, Calif.

154 West Lake Street
Chicago, Illinois

Stop Those Hissing and "Frying" Noises, Now!
—with Burgess "B" Batteries

HISSING, rattling, "frying" noises! Did you know that most of them are due to noisy "B" batteries?

WHEN there is static and interference, why increase your troubles with a poor "B" battery? Did you know that there is at least one "B" battery which IS noiseless, yet can be used to the last milli-ampere?

THAT battery is the Burgess. You can receive broadcast without noises if you use only Burgess Batteries. And when you "Buy Burgess" you get high capacity and the lowest price in hours of service.

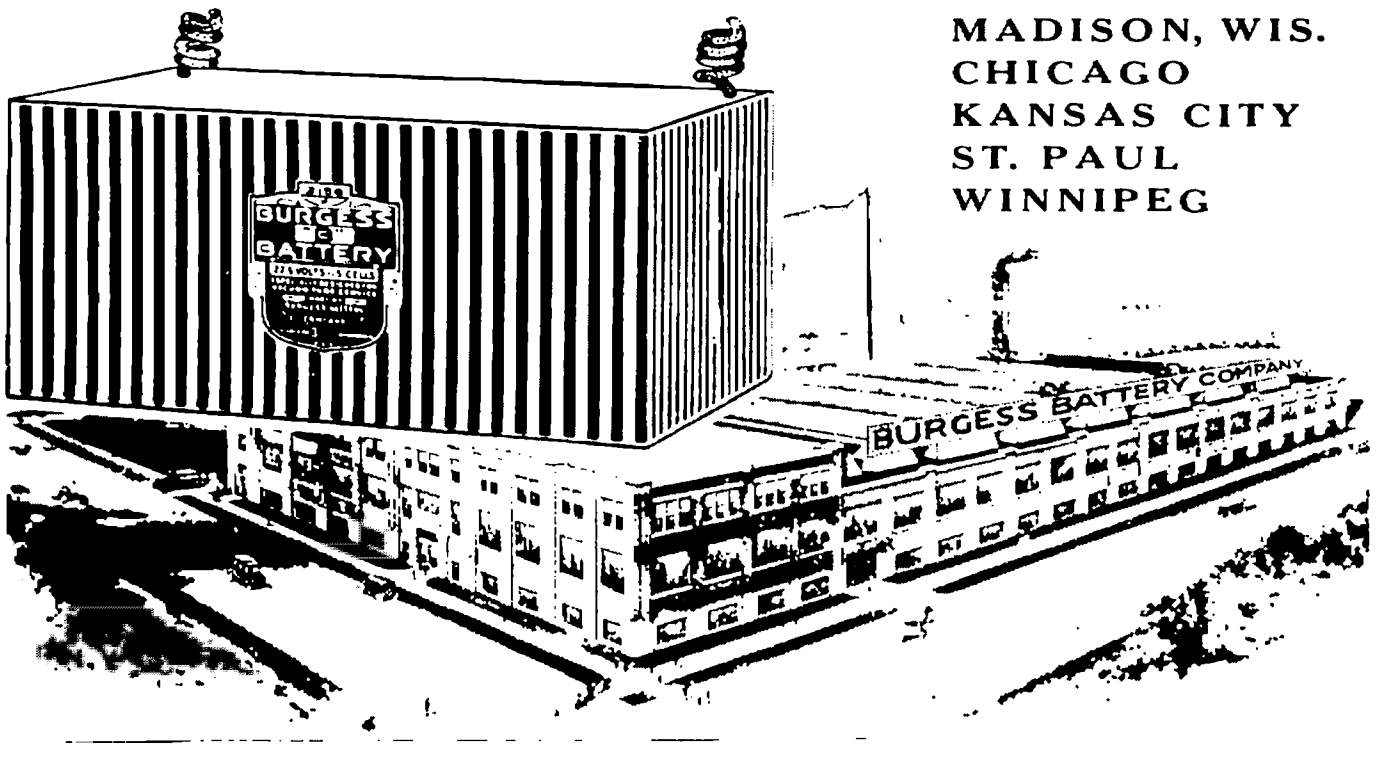
MULTI-STAGE radio frequency and audio frequency amplification is easily possible with the Burgess "B." Weak and distant audio frequency signals can be received with multi-stage amplifiers and Burgess "B" Batteries, because Burgess Batteries DO NOT drown out the signals.

THE Burgess "B" noiseless battery is the result of years of experimenting. Careful cell construction—individual insulation, moisture-proof separators and box, substantial triple seal. All under the constant supervision of Burgess Battery engineers in the big Burgess plant.

BURGESS "B" Batteries are sold by all reliable dealers in radio equipment. If you can't get the Burgess "B" from your dealer, write to—

BURGESS BATTERY COMPANY

MADISON, WIS.
CHICAGO
KANSAS CITY
ST. PAUL
WINNIPEG



RADIO

Established 1917 as Pacific Radio News

Volume IV *for* MARCH, 1922 *Number* 3

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RADIO is Published Monthly by the
Pacific Radio Publishing Co., Inc.,
Pacific Building, San Francisco, Calif.

ARTHUR H. HALLORAN, *Editor.*
LAWRENCE MOTT, *Associate Editor.*
GERALD M. BEST, *Technical Adviser.*
O. SCHUWENDT, *Engineering Draughtsman.*
H. W. DICKOW, *Advertising Manager.*
Branch Offices: 147 Sixth Ave., New York City;
1307 Hartford Bldg., Chicago; 18 Boylston St., Boston;
140 So. Oxford St., Los Angeles, Cal.

Advertising Forms Close on the First of the Month
Preceding Date of Issue

Issued Monthly, 20c a copy. Subscription price $2.00 per year in the U. S., $2.50 per year elsewhere. Instructions for change of address should be sent to the publisher two weeks before the date they are to go into effect. Both old and new addresses must always be given.

Entered as second-class matter at the Post Office at San Francisco, Calif., under the Act of March 3, 1879.

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Forecast of Contributions for April Issue

Hugh R. Sprado, whose article on interference elimination in this issue should be of benefit to many of our readers, will contribute two articles in April RADIO, one on "The Intermediate Circuit," and another on "Eliminating the Grid Battery."

Geo. F. Patrick of New Orleans has some good ideas for the amateur in an article on "Construction of a Wave Meter for Tuning C. W. Transmitters."

"Experiences of a Radio Engineer in China" will be the subject of an interesting article by Chas. R. Grubbs, who has recently returned to America from China, where he made a number of radio installations.

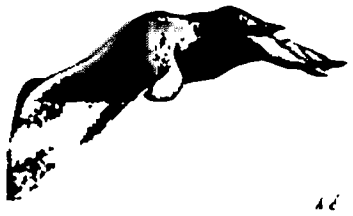
A helpful series of radio letters to salesmen by H. A. Eveleth, who is in charge of radio sales for the Electric Appliance Co. at San Francisco, will be revamped for publication as simple talks for the non-technical man, starting with the March issue.

The fiction feature will be an exciting tale of the adventures of a radio engineer in Alaska by Volney G. Mathison, well known author of the Samuel Jones Series.

The next installment of "The C. W. Manual," by J. B. Dow, will deal with "The Design and Construction of a 10-Watt C. W. Transmitter, I. C. W. Transmitter and Phone Set Using Direct Current."

"How to Design an Antenna for C. W. Transmission" will be treated in detail by Gerald M. Best, whose answers to questions on C. W. practice are proving valuable to many of our readers.





"Confucius has said:
The accomplishment
of great things
consists
In doing small things
Well"
Perfection of
detail
makes the
Grebe Receiver
What
it is-



The Grebe CR-5 Receiver

Dear Sir.

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Distributors of Reliable Radio Apparatus to Dealers, Schools, Colleges, Radio Clubs and Experimenters All Over the World!

"PITTSCO" SERVICE DISTRIBUTES "RADIO CORPORATION'S" PRODUCTS ALL OVER THE WORLD! TRY US AND SEE!

"PITTSCO" NOW HAS TWO STORES! BOTH CARRY "RADIO CORPORATION'S" COMPLETE LINE. ORDER TODAY!

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No. RORK Grebe, two stage with automatic filament control jacks	55.00
No. RORD Grebe, Det. and two stage with automatic fil. control jacks	75.00
No. 2634 Amrad, Det. and two stage in mahogany cabinet. Splendid value	47.50

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No. UV-712 Radio Corporation	7.00
No. QO Clapp-Eastham, semi-mounted	4.00
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No. 50 Chelsea, new type	4.50

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"Pittsco" No. 14 Hard drawn copper (80 ft. per lb.), per lb	.40
500 ft. special value at	2.25
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"Pittsco" 7 strand No. 20 phosphor bronze, per ft	.02
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"B" BATTERIES

No. 7623 Standard 22.5 Volts, small	1.50
No. 7625 Standard 22.5 Volts, large	2.65
No. 7600 Standard 22.5 Volts, variable 16½ to 22½ Volts	3.00
No. 7650 Standard 22.5 Volts, large, variable, 15 variations	3.50
No. 763 Eveready 22.5 volts small	2.25
No. 766 Eveready 22.5 volts large, 16½ to 22½ volts	3.00
No. 627 Ace, 45 volts, variable	3.50

COILS (Duo-lateral)

DL-25	$1.40	DL-300	1.75
DL-35	1.40	DL-400	1.80
DL-50	1.50	DL-500	2.00
DL-75	1.50	DL-600	2.15
DL-100	1.55	DL-750	2.35
DL-150	1.60	DL-1000	2.60
DL-200	1.65	DL-1250	3.00
DL-250	1.70	DL-1500	3.50

COIL MOUNTINGS

No. LC-100 DeForest 3 coil mounting with gears, reduced price	6.00
No. LC-101 DeForest 3 coil mounting with gears and wooden base	9.50
No. 400 Remler 3 coil mounting with base and extension handles	6.50

CONDENSERS (For CW work)

No. UC-1014 Radio Corp. .002 MF. 3000 volts	2.00
No. UC-1015 Radio Corp. .0003, .0004, .0005 MFD. 7500 volts	5.40
No. UC-1803 Radio Corp. .000025 MF. 10000 volts	5.00
No. UC-1806 Radio Corp. .002 MF. 6000 volts	7.00

CONDENSERS (Grid and plate types)

No. UC-570 Radio Corp. .0025 MF	$2.00
No. UC-569 Radio Corp. .001 MF	1.50
No. UC-568 Radio Corp. .0005 MF	1.35
No. UC-567 Radio Corp. .00025 MF	1.20
No. UX-548 Radio Corp. Condenser meg.	.50

CONDENSERS (Filter type)

No. UC-1631 Radio Corp. .5 MF 750 volts	1.35
No. UC-1632 Radio Corp. 1 MF 750 volts	1.85
No. UC-1634 Radio Corp. .5 MF 1750 volts	1.50
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C. W. INDUCTANCES

No. UL-1008 Radio Corporation	11.00
No. P-1 Acme	8.00

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No. UP-1016 Radio Corp. 750 watts	38.50
Acme 200 Watt 350-550 Volts Mtd	20.00
Acme 200 Watt 350-550 Volts unmtd.	16.00

FILTER REACTORS

No. UP-1626 160 Milliamperes	11.50
No. UP-1627 300 Milliamperes	15.75

GRID LEAKS (Radio Corporation)

No. UP-1719 For 5 Watt Tubes	1.10
No. UP-1718 For 50 Watt Tubes	1.65
No. UP-516 ½, 1, 1.5, 2 or 3 megohms ea. complete with mounting	1.25
Grid leaks only, each	.75

HOT WIRE METERS

No. P-1 Roller-Smith 0-2.5 Amperes, flush mtg. Special value at	4.75
No. UM-530 Radio Corp. 0-2.5 Amps	6.00
No. UM-533 Radio Corp. 0-5 Amps	6.25

JACKS (Radio type)

No. 61 Pacent open jack	.70
No. 62 Pacent closed jack	.85
No. 63 Pacent 2 circuit	1.00
No. 65 Pacent three spring Automatic filament control type	1.20
No. 66 Pacent five spring A. F. C.	1.50

LOUD SPEAKERS

No. R-3 Radio Magnavox, new type horn, very latest model	45.00
No. P-1 Vocaloud, station type	30.00
No. 400-W Federal Pleiophone	14.00

RECEIVING SETS (Crystal)

"Aeriola Jr.," Westinghouse, complete with Brandes "Superior" phones	25.00
"Radiola" DeForest, complete with Brandes "Superior" phones	25.00
Radio Service Type S-8 without phones, splendid value	7.50

MAGNETIC MODULATORS

No. UT-1634 ½ to 1½ Amperes	$9.50
No. UT-1357 1½ to 3½ Amperes	12.50
No. UT-1637 3½ to 5 Amperes	17.00

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No. UV-216 Radio Corp. "Kenotron" 20 Watt type for UV-202 tubes	7.50
No. UV-217 Radio Corp. "Kenotron" 150 Watt type for UV-203 tubes	26.50
No. P-1 DeForest 20 Watt Rectifying tube for use with 5 watt tubes	7.00

RECTIFYING DEVICES (for "A" Batteries)

No. P-1 Tungar, 5 ampere type, complete with bulb	28.00
No. P-2 Tungar, 2 ampere type with Bulb	18.00
No. P-3 FF Battery Booster, 5 amp. type	15.00

REGENERATIVE RECEIVERS

No. CR-3 Grebe "Relay-Special" 175-680 meters	65.00
No. CR-5 Grebe 175-3000 meters, "Super-special" complete set	80.00
No. CR-8 Grebe 175-1000 meters, complete set, latest "Relay-Special"	80.00
No. CR-9 Grebe 175-3000 meters, complete set with det. and 2 stage amplifier self contained, "A Masterpiece"	130.00
No. RA Westinghouse, 180-700 meters, very selective, mahogany cabinet	68.00
No. RC Westinghouse, RA receiver and DA Det. Amplifier combined in one cabinet, a splendid unit, compact	130.00

TELEPHONES

No. 56 Murdock 2000 ohm double	5.00
No. 56 Murdock 3000 ohm double	6.00
No. CW-834 Western Electric 2200 ohms	15.00
Brandes, "Superior" with new headband	8.00
Brandes "Trans-Atlantics" with new headband	12.00
Brandes "Navy Type" with new headband	14.00
Baldwins Type C	12.00
Baldwins Type E	13.00
Baldwins Type F	14.00
Baldwins Type C unit only	6.00
Federal A. and N. Type 2200 ohms	8.00
Federal A. and N. Type 3200 ohms	10.50

VACUUM TUBES

No. UV-200 Radiotron detector	5.00
No. UV-201 Radiotron amplifier	6.50
No. UV-202 Radiotron 5 watt	8.00
No. UV-203 Radiotron 50 watt	30.00
No. UV-204 Radiotron 250 watt	110.00

Note:—All Radiotrons sent postage and insurance prepaid anywhere in U. S. A. Send us your orders for Radiotrons.

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THE STANDARD PLAN

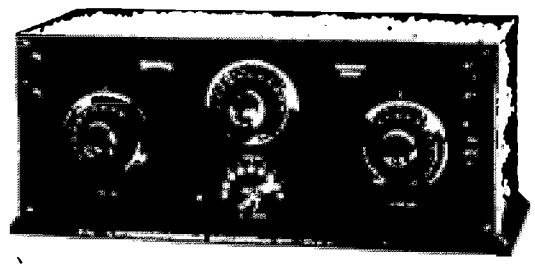
The Standard Plan allows the experimenter to incorporate his own ideas in completely assembled, machine made radio instruments.

There are two parts in the building of radio apparatus: First, the panel drilling, assembling, etc., and second, the actual wiring.

The first is essentially machine work. To be done properly it requires equipment which is not available to the amateur; but because it IS machine work it is really the less expensive part of the entire assembling.

The wiring, which is hand work, is the expensive part, and also the part which you can do just as well yourself.

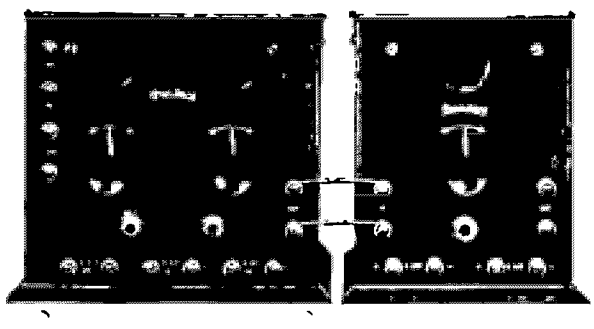
The Standard Plan gives you the opportunity to secure correctly machine assembled apparatus, and at the same time save the expensive wiring costs. Standard instruments come to you fully



Short Wave Regenerative Tuner, $47.00

This simple type of receiver is highly efficient and meets every requirement for the reception of spark, C. W. or telephone on all amateur, commercial and broadcasting wave lengths. It is extremely selective, produces greatly amplified signals and is unusually easy to adjust. High grade parts are used throughout and are mounted on a handsome Formica panel. This tuner comes to you completely assembled all but the wiring. And the price of only $47.00 represents a clear saving of $10.00 to $15.00 over what you would pay for a similar quality in a fully wired instrument.

Assembled—but Not Wired!



V. T. Control Panels

Standard Vacuum Tube Units are provided in the same style and quality as the handsome tuner shown above. Amplifier Units are provided in two styles, Commercial Type and Amateur Type. The Commercial Type incorporates Radio Corp. UV-712 transformers, and similar high quality parts. In the Amateur Type, tube receptacles and transformers of high efficiency but low in price are used. Both styles are alike in appearance. Read these prices, and let the Standard Plan save you money.

Commercial Type Tube Control	$15.00
Commercial Type Amplifier	22.00
Commercial Type Detector-Amplifier	37.00
Commercial Type Two-Stage Amplifier	40.00
Amateur Type Detector-Amplifier	32.00
Amateur Type Two-Stage Amplifier	34.00
Short-Wave Receiver with Detector	57.00

(Instruments supplied without cabinet for $3.00 less than above prices.)

The Standard Assembling Company does all the actual machine work in a splendidly equipped factory. Instruments and parts of commercial grade are used throughout, but the wiring is left for you to finish. Only in this way can you get high grade fully assembled apparatus at prices only slightly more than you would pay for the individual parts.

Any Standard instrument will be shipped to any part of the United States for inspection on receipt of one-third the purchase price. Examine it carefully. If satisfactory remit the balance. But if you are not fully convinced that it is the best value in radio today, return it and your deposit will be refunded, less carrying charges.

Take this opportunity to try the Standard Plan at our risk. Or send 2 cents for literature describing the complete line of Standard instruments—*Assembled but not wired!*

STANDARD ASSEMBLING CO.

19 Bridge Street
New York City

The Most Popular Radio Insulation

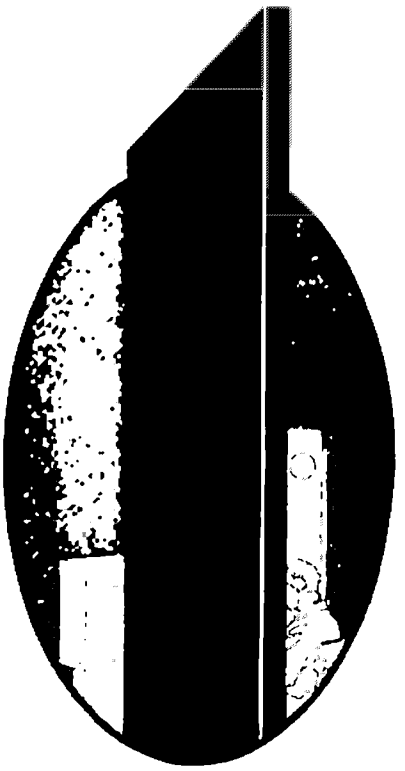
Week by week the amount of Formica used for radio insulation by amateur and commercial operators increases. It is the most popular material of its kind.

This great demand for Formica is due to its high dielectic strength, and the low power and hysteresis losses with high frequency currents where it is employed.

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Formica is approved by the United States Navy and the Signal Corps!

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Made from Anhydrous Redmanol Resins

SHEETS TUBES RODS

The MARVEL OF RADIO

Have You a Marvel In Your Home?

The "MARVEL" is the lowest priced complete crystal wireless telephone receiving outfit on the market having a wave-length range of 180 to 2600 meters. It sells complete all ready for installation for the small sum of $15.00. It can be set up by anyone all ready for operation in 20 minutes. Not one additional part to purchase. No previous knowledge of wireless necessary—no license, batteries or source of current whatever needed. This $15.00 "MARVEL" is the junior wireless telephone receiving set of other sets made by the Freed-Eisemann Radio Corporation, and selling up to $5,000.00. Although the junior as we say, it is made in the same workmanlike manner and of the same tested and proved material as the higher priced Freed-Eisemann apparatus.

The complete outfit, model 105, consists of a "MARVEL" highly efficient crystal receiver, mounted in a handsomely finished mission oak cabinet, 150 feet of solid copper wire for antenna, 25 feet of insulated wire, 5 porcelain insulators, a 1000 ohm telephone with leather covered headband and a telephone cord, antenna switch, ground clamp, extra "MARVEL" Radio crystal, code chart, abbreviation chart, and complete simple instructions for installation and operation. Nothing else needed **$15.00**

Model 110, same as above, but with a 2000 ohm double headset **$18.00**

The Marvel De Luxe with fine tuning attachment in handsome carrying case complete with double headset, Antenna equipment, etc.—no additional parts to buy. **$25.00**
As simple to operate as a phonograph.

List of Parts Specially Designed for Amateur and Experimental Use by F. E. Engineers, For Those Who Prefer the Highest Quality

Model 101	"Marvel" Radio Receiver, (without phones or antenna equipment), with one extra galena crystal	$10.00
Model 102	"Marvel" 1000 ohm telephone with leathered covered headband and cord	3.50
Model 106	"Marvel" Grid Condenser (capacity 0.0005 Mfd.)	.30
Model 107	"Marvel" Telephone Condenser (capacity 0.0025 Mfd.)	.30
Model 108	"Marvel" double-tested galena "Radiocrystal" cast in special F.E. Electrolytic metal	.40
Model 109	Unmounted tested galena crystal	25
Model 113	Freed-Eisemann double headset, (3000 ohms) with leather covered split headband and cord	9.00

TELEPHONE JACKS

Standard for all wireless apparatus. Especially designed for radio telephone equipment. Completely assembled. Nothing to adjust. Can be used on any panel up to ¼" thick. Solid silver contact points. Bakelite and hard rubber insulation. All parts heavily nickel plated and polished.

Model 116	"Marvel" single contact Jack	$0.75
Model 117	"Marvel" two contact Jack	1.00
Model 118	"Marvel" two circuit Jack (4 contacts)	1.25
Model 119	F.E. "Atlas" super compression safety strain insulators, guaranteed against breakage	.25
Model 120	Audio Frequency Amplifier Transformer. Especially designed to amplify radio telephone speech and music without distortion. Adapted for use with high impedance tubes. Each	7.50

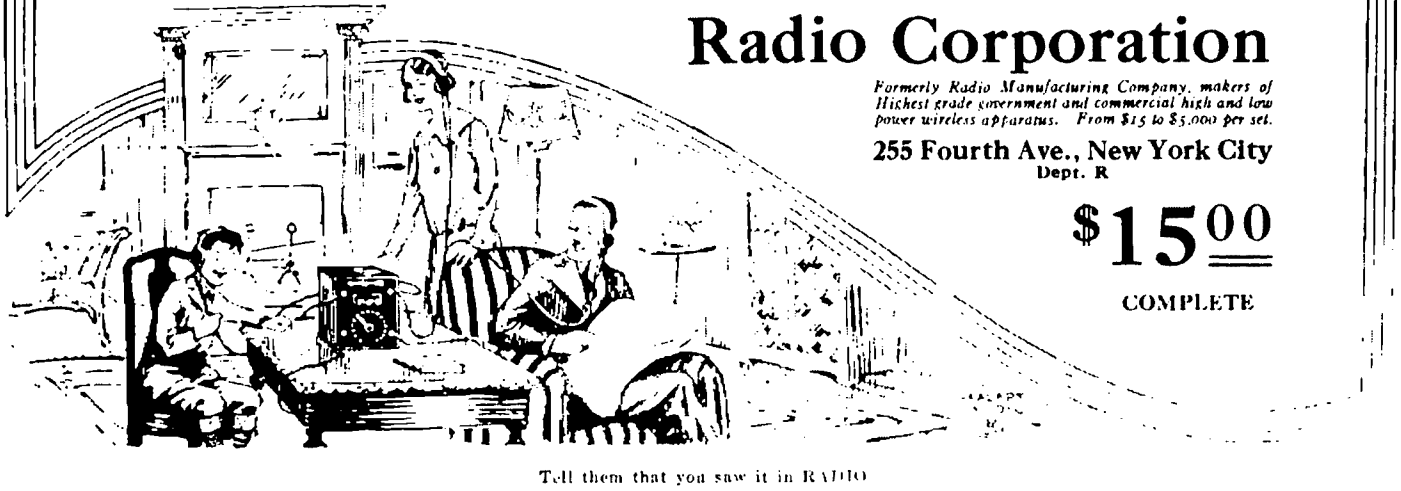
Unqualified Guarantee

"MARVEL" sets are absolutely guaranteed to equal or surpass in performance any outfits selling at double the price—a statement our engineers can prove by actual test. Ask any Marvel owner.

If your dealer has not received his supply as yet, send check or money order direct for immediate shipment. Book: "Wireless Telegraphy and Telephony Simply Explained," 154 pages, 156 engravings. **Postpaid** **$1.50**
Or 10c in stamps for our Catalog.

DEALERS: We have some interesting information for you on these nationally advertised "MARVEL" outfits. Write us today.

Built by the same engineers who designed apparatus now used by the U. S. Navy.



Freed-Eisemann Radio Corporation

Formerly Radio Manufacturing Company, makers of Highest grade government and commercial high and low power wireless apparatus. From $15 to $5,000 per set.

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COMPLETE

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DR. CHARLES D. HERROLD, E. E., R. E.

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—Let Him do Your Thinking for You.
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March, 1922 **RADIO** Vol. 4 No. 3

Radiotorial Comment

THE founders of our government in their wisdom provided for the encouragement of inventive genius by granting full protection to the inventor through letters patent. Much good has resulted from such protection, but some times by limiting the use of articles of general public utility, some harm has been caused. So the suggestion seems pertinent that the patent laws be modified so as to allow any responsible person to secure a license from the owners of a patent, in order that it be applied to the greatest public good. Thus can everyone, including the owner of the patent, gain the largest benefit from an invention.

TODAY'S applications of radio are based upon the patient, and oft unrewarded, work of scientists. Without the pioneer efforts of men who labor for the pure love of research, without hope of compensation other than the joy of discovery, radio would still be a mere scientific toy. Not the least of these agencies, so helpful to the advancement of radio, has been the U. S. Bureau of Standards. Looking backward for 20 years, what a great gap there would be in current knowledge of radio if it were not for the contributions of Austin, Kolster, Grover, Curtiss, Dellinger, Whittemore, Hull, Miller, and other devoted workers in this branch of government service. Such work as theirs should be encouraged, not alone by the heartfelt tribute of those who have benefited thereby, but also by substantial congressional appropriations for carrying forward these accomplishments. Every reader of RADIO can do his part to bring this about by urging his congressman to get behind such an appropriation.

TO many of our readers, the most interesting department is that devoted to Calls Heard. To realize that one's signals are reaching out gives a thrill and a satisfaction that is exceeded only by hearing some hitherto unheard distant signal. So an effort is being made to have this department really mean something. Hereafter the lists of Calls Heard will include stations 250 miles or more distant from the receiver. For it is little distinction to reach or receive shorter distances, but to be listed as a real DX worker is worth striving for. Our readers all over the country are invited to contribute regularly to this department.

WE are impelled—just at this time—to ask the great, and potentially useful, body of citizen radio to read and ponder on selfishness, jealousy and lust for power by a few. Having done so we would ask that those who have the *good* of citizen radio at heart—remember them. This, as in several ways it has indubitably been brought to our attention that *all three* are seriously at work in our ranks, and the time to crush these fatal weaknesses is—NOW!

We have but to look across the waters of the Atlantic ocean to poignantly realize the meaning of the term "chaos," it its fullest sense!

Selfishness, jealousy, and lust for power by a few brought about the Great War, and they are the direct causation of the present turmoil-worse-confounded that maintains in Europe!

Let us be frank with one another—for the good of the cause!

Citizen radio must *not* be a stamping ground for petty politics, wire pullings, and so forth! Cheap clap-trap and melodrama—all—on the part of a certain few who have attempted—and still are attempting—to arrogate unto themselves the right (?) of a dictatorship, a species of Kaiser'ism, in matters that concern only the *private rights* of each amateur radio operator—as an American citizen, of good standing.

There must NOT be any Association, Club, or Organization of *any* kind that in the least threatens the personal liberties of each individual in the field of amateur radio—nor must there be *any* body of men that say to the others: "Do thus-and-so!" "Prevent such-and-such!" "You MUST do this!" "You must NOT do that!"

All such attempts at the coercion of citizen radio is the cheapest sort of balderdash, and it would be laughable, were it not for the fact that there are many amateurs who—because of their residences being in the more remote districts—do not realize the dangerous tomfoolery that is going on, and that tends inevitably to disrupt, rather than to coordinate, amateur radio effort.

To citizen radio we have this to say: As licensed operators you have shown energy, individuality, resourcefulness and self-reliance! Study very carefully the proposals, orders, and what-not, of *any* group of men, giving due consideration to the *motives* behind the arguments that have been shoved at you, willy-nilly! BEWARE of the least attempt to usurp your rights as individuals! BEWARE of the element of Personal Domination! On that reef, families—and entire Nations—have been wrecked!

9DVA—1000 MILE RADIUS WITH 10 WATTS

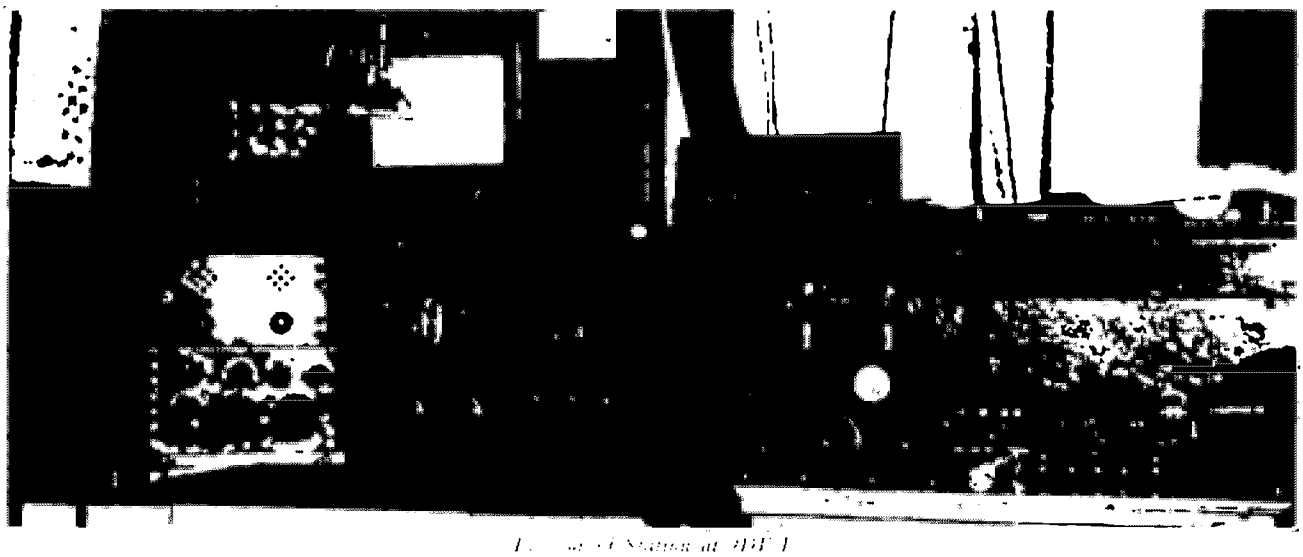
The effectiveness of continuous wave transmission with small power is well illustrated by 9DVA at Denver, Colorado, which has been heard by amateurs on both the Atlantic and Pacific Coasts. Mr. Wilson, the owner, has erected two steel towers at his home, 2316 East 12th Ave., Denver, Colorado. He employs a five-wire aerial, 50 ft. long and 50 ft. high.

Two 5-watt tubes are used for transmission, using a modified Hartley circuit. A normal radiation of 1.8 amperes is obtained when using 7½ volts on the filaments, and 350 volts on the plate with 90 milliamperes plate current. Plate current is supplied from a 350 volt d.c. Esco motor generator set controlled by the rheostat shown to the left of the generator. The complete transmitting equipment is shown on the small table at the right in the picture. The aerial switch appears between the transmitter and the long wave receiver on the table at the left. A useful feature is the Clapp-Eastham filament heating transformer to the right of the transmitter, thus doing away with any rheostats on the transmitter.

Three sets are used for receiving. The small set on the window-sill is a regenerative receiver for tuning spark signals. The long-wave set with honey-comb coils has a detector and two steps of amplification. The short wave set with the two-step audio-frequency amplifier in separate cabinet above is used solely for tuning continuous waves.



Antenna at 9DVA

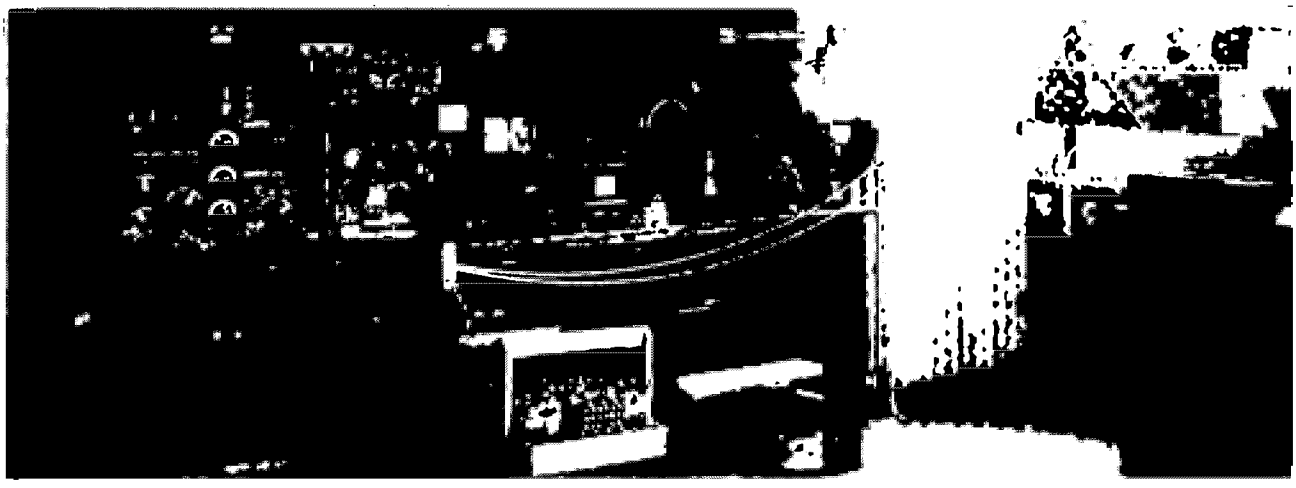


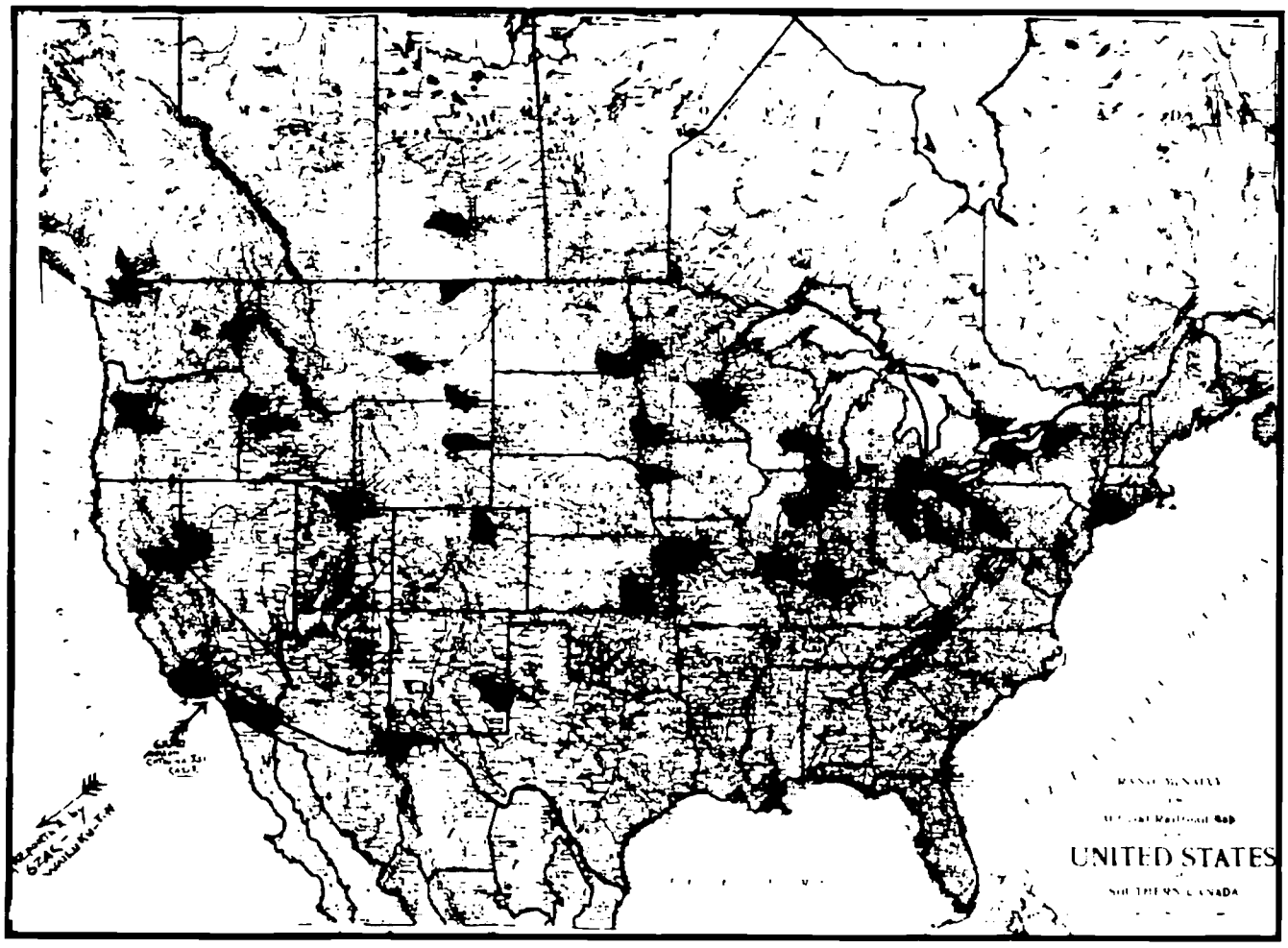
Transmitting Station at 9DVA

RADIO 7YJ

Radio 7YJ is the spark station installed by the physics department of the Oregon Agricultural College at Corvallis, Ore., in charge of Jacob Jordan. As it is frequently reported in distant lists of calls heard, a brief description will be of interest to many operators. The department plans to have a 100 watt C. W. and phone transmitter on the air before the close of 1922.

Continued on page 21





A Novel Method of Showing Stations Reached

By Lawrence Mott

ALWAYS with the idea uppermost in my mind—of trying to prove to the great amateur fraternity that low-powered C. W. or I. C. W. will easily and effectively cover most astonishing distances—I bethought me to have a map of the United States, that hangs in my operating room, photographed for a reproduction in these pages. Each flag denotes a station that I have either actually worked, or from whom I have, in my files, written proof that the operator has heard 6XAD. Lest there be some readers who did not see a description of my smallest of three transmitters in January RADIO, I say that this smaller transmitter used but four five-watt tubes for the making of the rather satisfactory records, as shown by the map.

Such work as I have done has not been with an intricate apparata, at all! Any amateur can possess such a transmitter as my smaller one, for no vast outlay. Of course, the ground, counterpoise and aerial systems have much to do with these records, and I am furthermore convinced that my location, on Catalina Island, out in the Pacific ocean, has also materially been of benefit, as I hear East coast stations every night that I am at my instruments!

I give, for interest's sake, the call letters, geographical location of the stations worked by me—marking these with an (x). The others have *conclusively reported hearing my signals.*

(N.B.—90 per cent of the stations are C. W. or I. C. W.)

2FP—Brooklyn, N. Y.
3JI—(Can)Toronto, Canada.
3JJ—Washington, D. C.
3ALN—Washington, D. C.
3BHW—Philadelphia, Pa.
3FS—Philadelphia(x).
3HJ—Haverford, Pa.
3AHR—Philadelphia, Pa.
5HK—Oklahoma City, Okla.
5ZA—Roswell, N. M.(x).
6ZAC—Hawaii.
6ZZ—Douglas, Arizona(x).
6AJR—Reno, Nevada.
6AWT—San Francisco(x).
7FI—Pullman, Washington.
7OS—Casper, Wyoming.
7ZU—Polytechnic, Montana(x).
7RN—Cashmere, Washington.
7FI—Pullman, Washington.
7YJ—Corvallis, Oregon(x).
8JL—Cleveland, Ohio(x).
8LX—Crafton, Pa.(x).
8EW—Crafton, Pa.
8JQ—Washington, Pa.
8BUM—Syracuse, N. Y.(x).
8BRL—Crafton, Pa.
8BDG—Cleveland, Ohio.
8AXI—Syracuse, N. Y.
8BMX—Buffalo, N. Y.
8KW—Buffalo, N. Y.
8KF—Buffalo, N. Y.
8ZAC—Barnesville, Ohio.
8ZG—Salem, Ohio.
9RC—Chicago, Ill.
9ZN—Chicago, Ill.(x).
9AJA—Chicago, Ill.(x).
KYW—Chicago, Ill. (The Westinghouse Station.)
9DTM—Denver, Colo.(x).
9DVA—Denver, Colo.(x).
9AMB—Denver, Colo.(x).
9BJI—Denver, Colo.
9AYU—Denver, Colo.
9AQR—Kansas City, Mo.(x).
9AOG—Lawrence, Kansas.
9LW—Wahpeton, North Dakota.
9BAD—Ellendale, North Dakota.
9AIG—Sioux Falls, South Dakota.
9BEX—Denver, Colo.
9ZAF—Denver, Colo.(x).
9JQ—St. Louis, Mo.
9FM—Kansas, City, Mo.
9ALG—Wichita, Kansas(x).
9NX—Wichita, Kansas(x).
(Can)9BD—Vancouver, B. C.
9DUZ—Ellendale, North Dakota.
9XM—Madison, Wisconsin.
9RPS—Wichita, Kansas.
9BEX—Denver, Colo.
9ASP—Kansas City, Mo.
9AU—Chicago, Ill.
9WD—Chicago, Ill.

I think that I have not overlooked any good friend who has either worked me or reported me, but I have some 500 postal cards, letters and telegrams; the matter of sorting them is not simple! A great many other calls have been worked by me, I know to my personal satisfaction, but as I have no written proof, I do not set them down. This for the reason that there be some who might challenge so formidable a list of DX work—on but 4 five-watt tubes, I. C. W., and I fain would have my proof by me!

Herewith a very small list of the hundreds of stations that I hear—the more distant ones *only:*

Continued on page 61

The C. W. Manual

Third Installment

By J. B. Dow, Ensign U. S. N.

EXPERIMENTAL PHONE CIRCUITS

The scope of the present chapter will be limited to the development of two simple radio-phone circuits with which the experimenter may study the principles of operation involved and, in general, the factors which govern the operation of oscillating vacuum tube circuits for transmitting purposes.

The Design and Construction of an Inexpensive One-eighth Watt Experimental Phone Set

In the development of the subject matter above, certain factors which are to govern the design, will be stated briefly as follows:

1. The apparatus must operate from a source of direct current having an e.m.f. not exceeding 110 volts.
2. In order that the apparatus may be constructed at a minimum of expense, one tube only will be used, and by virtue of the limiting e.m.f. for plate supply, the circuit must be designed to use the ordinary receiving tube as an oscillation generator.
3. The band of frequencies at which the circuit must operate will be restricted to those corresponding to wavelengths between 200 and 350 meters.
4. In order that flexibility, so necessary for experimental work, may be had, the design will be further limited to that of a laboratory *lash-up*. This will enable the author as well as the experimenter to confine his efforts to the circuit itself, and to the construction of the component parts, rather than to an array of mechanical details.
5. It is assumed that the apparatus herein considered will be used with an antenna having a capacity of 0.0004 to 0.0008 micro-farad.

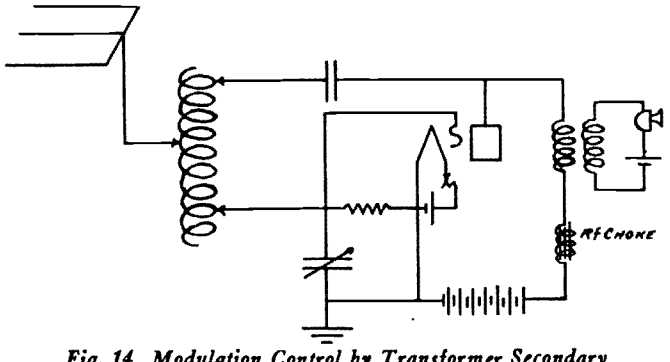


Fig. 14. Modulation Control by Transformer Secondary in Power Circuit

Two circuits are available for this purpose. See Fig. 14 and Fig. 23. The difference lies in the location of the modulation transformer in the circuit.

Let us consider first, the matter of high voltage supply to the plate. A voltage of 110 has been selected because it is a commercial value and in case it is not obtainable as such, it may be quite easily obtained from an arrangement of batteries. If its source is a generator, it may be necessary to smooth out the ripples by means of a filter circuit, though this will rarely be necessary. If noises are present in the received signals, a suitable filter circuit may be made for such a low power circuit as this, by constructing two coils each of 5000 turns of No. 36 D. C. C. magnet wire on a laminated soft iron core, having a 5/8 in. by 5/8 in. section and a length of 8 in., insulating each layer with thin white paper.

These coils should be inserted in series with each leg of the supply circuit and cross-connected by two paper dielectric telephone condensers having a capacity of 2 micro-farads each, as shown in Fig. 24.

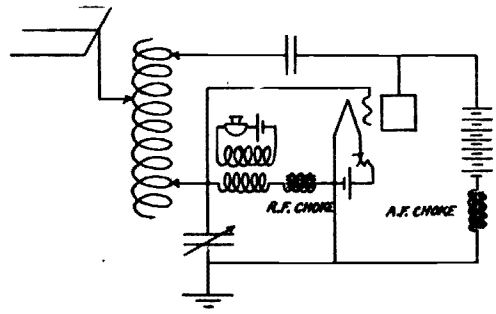


Fig. 23

The antenna inductance as well as the plate coupling coil and grid input coil will be constructed as a single coil of 40 turns of No. 14 bare copper wire on a Bakelite or Micarta tube 5 in. in diameter and 6 in. in length. This tube should, preferably, have a 1/8 in. wall, though a thinner wall may be used with equal success if care is taken. The tube should be mounted in a lathe, and a spiral groove having a pitch of 1/8 in. should be cut to within ½ in. of each end.

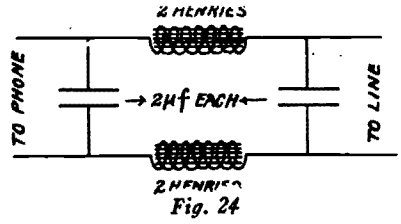


Fig. 24

This will net a 5 in. winding space into which it will be possible to wind the required 40 turns. Every other turn should be tapped as shown in Fig. 25, care being taken in soldering the taps, which may be made of strips of light shim brass, in order to prevent either solder or flux from short circuiting the turns. The taps should be soldered in place as the respective turns of wire are placed on the tube, and if care is exercised in this particular, no trouble from the sources mentioned should result.

As shown in Fig. 25, the radio-frequency choke coil consists of a 250 turn honey-comb.

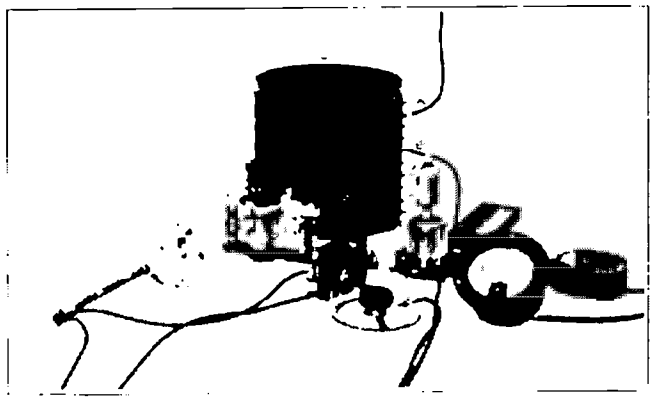


Fig. 25. View of 1/8 Watt Phone Circuit. This circuit utilizes a single receiving tube as an oscillator and can be operated entirely from five blocks of 22 volt B batteries in series for the plate supply and a 6 volt storage battery for heating the filament.

The condenser inserted in the circuit between the coupling tap and the plate of Fig. 14 is an ordinary paper dielectric telephone condenser having a capacity of ½ micro-farad. In a low voltage circuit like the one under consideration, a smaller capacity is not recommended.

The variable condenser of Fig. 25, is of the type commonly used with receiving equipment and should have a capacity of approximately 0.001 micro-farad.

The milliammeter with a scale reading to 30 milliamperes, the vacuum tube and its receptacle, and the filament rheostat are standard equipment needing no detailed description.

Fig. 26 gives the details of the modulation transformer.

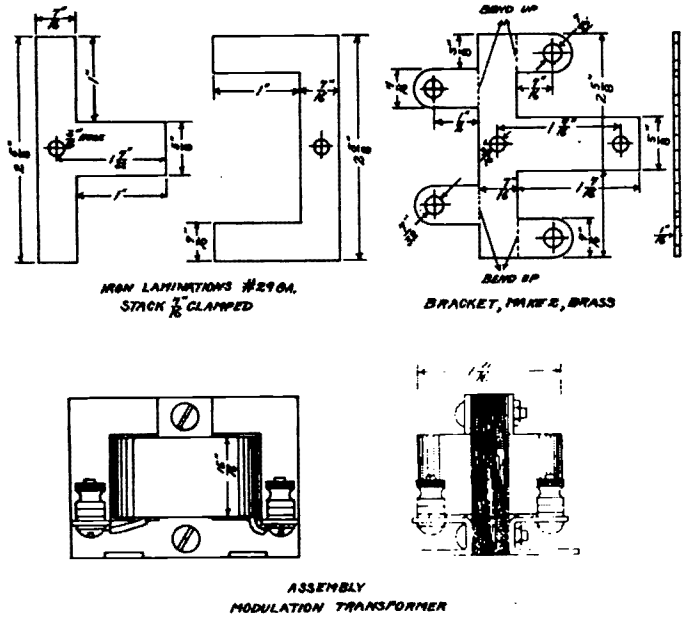


Fig. 26. Assembly of Modulation Transformer

Coil data: Primary, 150 turns of No. 28 enamel insulated wire in three layers. This should be wound upon a 15/16" mandrel and over 3 wraps of 5 mil fish paper. Secondary, 4000 turns No. 40 enamel insulated wire in 28 layers of 140 turns per layer. Layers should be insulated from each other with thin paper, and primary, from secondary, with three wraps of 5 mil fish paper. Whole coil should be impregnated in paraffin after winding. This will result in a coil 1 11/16 in. in diameter and 15/16 in. wide which will fit the core detailed in Fig. 26 above.

It will be observed by referring to Fig. 14 that a grid leak is placed in the circuit between the grid and filament. The use of a grid leak is imperative in transmitting circuits and care must be exercised in selecting the correct value. For Western Electric tubes of the type shown in Fig. 25, the grid leak resistance value should be approximately 10,000 ohms. Such resistances are easily obtained from stock at very little expense. In case the reader desires to construct one, the necessary details will be found in Fig. 27. Another alternative is to fill a glass tube 5 inches in length and having an inside diameter of 3/32 inch with pure lampblack, packing it lightly in the course of filling, and sealing the ends with brass plugs. The measured resistance of such a unit is approximately 10,000 ohms.

In Fig. 23, the resistance of the modulation transformer secondary is utilized as the grid leak.

By way of explanation to the experimenter who is operating a vacuum tube transmitter for the first time, it may be stated that more or less patience is required. A number of factors which influence the operation of such apparatus may not be in evidence physically. This will be found to be the case especially in a low power equipment. For example, the mere substitution of another tube for the one in use will turn what is apparently a failure, into success. The constants of the antenna seriously affect the operation of vacuum tube transmitters—particularly, the resistance. It is a good plan to study a transmitting circuit involving low powers by using an artificial antenna consisting of a small variable capacity and a resistance of 3 to 10 ohms, in series, across the antenna and ground connections.

Operation of the One-eighth Watt Phone Set

Place the artificial antenna circuit between the tap A, Fig. 25, and the ground connection (negative side of plate supply is grounded on this particular case) and cut out all resistance in dummy circuit. Manipulate filament rheostat until filament reaches correct temperature and cut in plate supply current. Select an arbitrary position for the plate tap B, Fig. 25, about half way between antenna tap and the lower connection to the variable inductance. The milliammeter will indicate a current of approximately 12 milliamperes flowing to the plate. Next, adjust the variable capacity and observe the pointer on the plate current milliammeter. It will show an increase or decrease in deflection when the limiting capacity is reached.

Oscillations will start on one side of this point of limiting capacity, depending upon the initial setting of the condenser. As this circuit contains no antenna ammeter, it will be necessary to resort to some other method of determining when the circuit is oscillating. If the circuit is oscillating properly and the antenna tap A, Fig. 25, is touched with the finger the milliammeter pointer will be displaced.

Assuming that the circuit is oscillating, we will next turn our attention to its adjustment. The "cut and try" method with a small previously calibrated receiving circuit may be used, but, the more expeditious and more accurate manner of tuning with a wavemeter should be used for best results. In this connection, any ordinary wavemeter having a current-squared meter or other equally sensitive indicating device may be employed. The procedure is not unlike that of tuning an ordinary spark transmitter, i. e., by coupling the loop of the wavemeter to the variable inductance C, Fig. 25, and adjusting A, B, and the variable capacity until the desired wavelength is obtained.

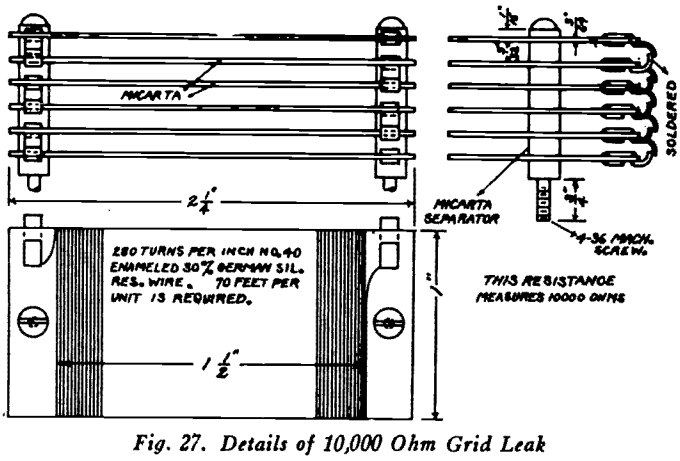


Fig. 27. Details of 10,000 Ohm Grid Leak

Up to the present time, we have been using the artificial antenna with practically no resistance in the circuit, and it may have been observed that as the resonance point was reached in the adjustment of the wavemeter, the circuit suddenly failed to oscillate. Gradually cut in resistance in the artificial circuit (two rheostats like the one shown in Fig. 25, in series may be used), and follow up this operation with a corresponding adjustment of the taps A, and B, and the variable capacity, and note that the wavemeter does not seriously influence the oscillating quality of the circuit as heretofore.

Study the circuit in this manner and when a sufficient knowledge of its operating characteristics is obtained and when good stable oscillations are produced with 6 to 10 ohms of resistance in the circuit, replace the artificial circuit with a regular antenna. (It must be remembered, here, that 6 to 10 ohms of resistance is the form recommended above, is equivalent of 10 to 15 ohms of high-frequency resistance.)

As previously stated, the upper limit of operating frequency is governed primarily by the resistance, and often, the failure of a given circuit to oscillate may be traced to some

object which introduces resistance into the circuit. Among these may be classed: leaky insulators, metal structures in the vicinity of the antenna, trees, and in fact anything that may introduce the condition of an imperfect dielectric in the vicinity of the antenna.

The use of a counterpoise is one of the best means of lowering the resistance of an antenna. The advantage of a low resistance antenna may be realized by a moment's thought to the following: The power circulating in the radiating system is, in general terms, equivalent to the product of the current squared times the resistance. Assuming in Fig. 14 that the resistance of the variable inductance plus that of the variable condenser is 2 ohms, and that of the antenna is 8 ohms, the total is 10 ohms. Now, assume that by using a counterpoise, the antenna resistance may be decreased to 4 ohms, the total will be 6 ohms. If the antenna current in the first case was 1 ampere, it would be approximately 1.7 ampere in the second. The result would be an output of 17.34 watts in the second case as compared to 10 in the first, and this, by halving the antenna resistance.

Up to the present time, the attention of the reader has been confined to a small assemblage of equipment constituting what might be termed a three mile set.

The Design and Construction of a Simple Inexpensive Five Watt Radio-Phone

Fig. 11 illustrates a circuit previously explained, wherein one 5 watt tube is used with a Hartley circuit as an oscillator, and another similar tube is used as a power modulator. This circuit will be used in the development of the 5 watt set, shown in Fig. 28, and, as will be seen by referring to this figure, several pieces of apparatus, the construction of which was explained heretofore, will be utilized.

This apparatus includes the variable inductance, the grid leak, modulation transformer, and the 250 turn honey-comb (in center of figure and back of the vacuum tube).

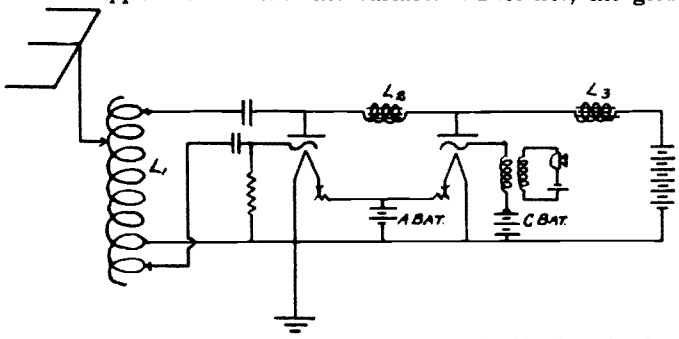


Fig. 11. Power Modulator Method of Control for Hartley Circuit

The factors governing the design of this experimental set may be stated as follows:

1. A source of direct current having an e.m.f. of 350 volts must be used. No details will be considered now as to the matter of obtaining this. It may, however, be obtained from a direct current generator, or from rectified alternating current in a manner to which the readers' attention will be called later.

2. The apparatus will be designed to operate at wavelengths between 200 and 375 meters.

3. It is assumed here, also, that the builder contemplates using this apparatus in connection with a small antenna, the limiting capacities of which will be found noted among the factors governing the design of the ⅛ watt set.

In view of the greater potential used in the operation of the 5 watt tubes, two ½ micro-farad paper dielectric telephone condensers must be used in series in the plate coupling lead to the variable inductance. It must be remembered that condensers of the type suggested above, are used to promote economy only. If, the constructor desires, he may use any other type of condenser capable of withstanding the impressed e.m.f. and having a capacity not less than 0.01 micro-farad.

The grid condenser upon which the grid leak resistance is mounted (Fig. 28) consists of three pieces of copper foil 2 by 3 in., separated by thin mica and mounted within a small wooden base.

The audio-frequency choke coil shown in the upper center of Fig. 28, is used to prevent fluctuations in the plate supply current at voice frequencies. It is necessary to use such a

Continued on page 60

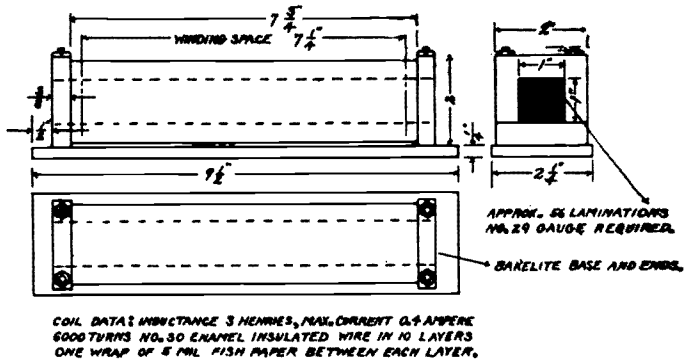


Fig. 29. Construction Details of Audio-Frequency Choke Coil



Fig. 28

The Care and Use of Electric Meters

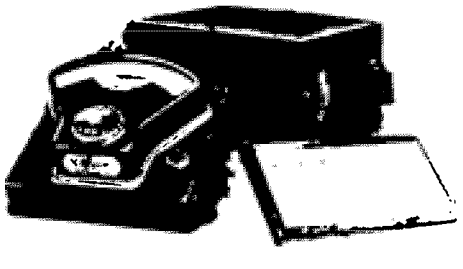
By D. B. McGown, Assistant Radio Inspector

OF all the instruments used around most radio stations, the meters usually receive the least care and attention, considering their quality and value, despite the fact that there are few parts which are so costly and serve their purpose with so little attention.

Meters may be divided into two general classes, portable, and switchboard types. The portable types are usually rugged and are mounted with convenient binding posts, or terminals, with suitable leads, which makes it easy to connect them into any circuit it is desired to measure, the whole being encased in a strong box or carrying case. The switchboard types, on the other hand, are made for mounting on or in a switchboard or instrument, and are designed for connection into a circuit permanently.

These types are divided into the numerous kinds which are used on every known voltage, and under all conceivable conditions, many of which would be entirely unknown to the average man trained in radio work only, and which have no place in a radio set of any kind. Generally, we are interested in the following classes when operating or using radio apparatus: Voltmeters, both d.c. and a.c.; ammeters, both d.c. and a.c.; wattmeters, usually a.c. only, and frequency meters.

Most voltmeters of ordinary type are instruments of high resistance, and may be connected across the line, and left permanently, while the measurements are being made. Such instruments are sensitive and delicate, and all operate on some more or less simple principle of applied electro-magnetism, usually in the form of a coil which is attracted or repelled by the current flowing thru it, due to the coil's being placed in the field of an electromagnet (with d.c. meters), or due to the attraction of a small mass of iron by a coil, one member or the other moving (with a.c. meters).



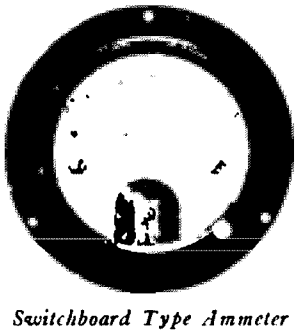
Portable Voltmeter

Ammeters may also be of either of the two above mentioned types, or they may be of some more complex design. In d.c. ammeters, owing to the heavy currents often used, it would be impossible to pass the whole line current thru the coil inside of the meter case without making the instrument hopelessly bulky and clumsy, as well as inaccurate, so a device called a shunt is used. This is merely a conductor of a certain fixed resistance connected in series with the line. When a current flows across this shunt there will be some drop in voltage, due to the resistance of the conductor. If a very sensitive voltmeter is connected across this shunt, we will get a *voltage* reading which is proportional to the *current* flowing in the shunt. This voltmeter is then calibrated by sending a known current thru the shunt, but is marked in *amperes* on the scale of the indicating voltmeter, and we have a complete instrument which will read amperes, wherever it is connected.

For alternating current we may use several methods. We may use the same scheme as that described above, but it is much simpler to use a transformer, of the type called a current transformer, for reasons which will be explained. If we have a wire carrying an alternating current of any frequency, we will have current generated in a coil, which is placed adjacent to, or around the wire. The amount of this current, or rather e.m.f. set up in the coil, will depend on two things—first the current flowing in the wire, and second on the number of turns in the coil. Now if we connect the output of this coil to a small a.c. voltmeter, and if it is calibrated, when so connected, as was described in the calibration of the d.c. meter, by setting up a current of known value in the wire, we have an alternating current ammeter.

Besides this there are the thermo-element and hot wire types of ammeters. The thermo-element type of meter is much used in radio work, and would be used more if it were not for its rather high cost, which is, however, well justified, owing to the peculiar and delicate construction of the instrument. If we pass any current thru a wire, or other conductor we set up heat therein, due to the resistance of the wire, or rather due to the electricity forcing itself thru the wire. This heat may be used in two ways.

In the case of the hot wire instrument, the heat causes the wire to expand or increase in length, this expansion increasing as the current increases, and being read directly in amperes. There are special means of magnifying this expansion, so that the result can be read directly on a scale, the meter being calibrated as described above. This heat may also be used to warm a thermo-junction, which consists of two small wires, or strips of dissimilar metals, with their ends joined together (usually copper-constantin, or similar metals). This thermo-junction (which together with the heating wire is usually called a thermo-element) generates a small amount of low voltage direct current. This again is proportional to the heat generated in the heating wire. If this system is calibrated, as described, we will have a thermo-element type of ammeter.



Switchboard Type Ammeter

These last described types of ammeters are used exclusively for the measurement of radio frequency currents, as they are not, if properly constructed, affected by the frequency of the current flowing in them. That is, they could be used on a current of ten million cycles frequency, just as well as they could be on direct current. The ordinary type of meter could not be used on high frequency, however, owing to the extremely high impedance the coils of the magnet would offer to current flow, and also due to the fact that, generally speaking, we cannot successfully use iron in any form on the higher frequencies.

The commercial types of hot wire ammeters are not, however, as dependable as the thermo-junction or thermo-element types, first because it is extremely hard to produce a metal of a material and shape that will have the same resistance at all frequencies, and second because these meters are affected

by every temperature change in the surrounding air. Calibration at radio frequencies would eliminate the first error, but it is practically impossible to eliminate the second. Furthermore, it is often necessary to use high resistance material for the heating element in meters of this type, which is objectionable in many cases. They have the advantages of simplicity, cheapness, and durability, together with a reasonable overload factor, which tends to prevent their burning out.

The thermo-element type of meter is the best, so far produced, for the measurement of alternating current having frequency values up to and over several million cycles per second. These meters are accurate, of low resistance, and are not affected by the temperature of the surrounding air. They are also very quick acting, and where the proper method of damping is used, will come to their maximum reading in negligible time, while it may, and usually does, take several seconds for a hot wire ammeter to come up to the full scale reading. They are not as simple as the hot wire type, and are more expensive, first because of the greater number of parts, and also because of the more delicate and sensitive adjustments required. The greatest care should be taken *never to overload them beyond their capacity,* as this will result in almost every case in a burned out meter, as they cannot be designed to work on heavy overloads. Their chief claim to use and popularity is that they are accurate on all frequencies, within reasonable limits, and on d.c. as well as a.c.

Wattmeters are, generally speaking, combinations of the volt and ammeter systems; that is, they have two coils, one of which is connected in series with the load (called the current coil) and the other across the line (called the potential coil). These meters are only used on d.c. and low frequency a.c. circuits, it being obviously impossible to use them on radio frequencies. In using them, the chief points to remember are to connect them so that they are of the right polarity (both on d.c. and a.c., as they give the effect of polarity on a.c.), and not to get the terminals connected opposite to the normal connection scheme, i. e., not to connect the current coil across the line, or the potential coil in series with the line, the first blowing the fuses, and possibly burning out the meter, and the second opening the circuit. Besides this type of wattmeter, we have the ordinary recording wattmeter, which is used to measure the total amount of power drawn on a line. These meters are simply small motors, made without iron, and so designed that their potential coils act as the fields, and the current coil causes the armature to rotate, which turns a recording dial. The Sangamometer as used on battery charging panels is a recording wattmeter, of a special type, fitted with a scale marked in ampere-hours.

Frequency meters of the ordinary type are usually fitted with vibrating "reeds." A small electromagnet is so arranged that there are a number of steel reeds held between the poles. These reeds are loaded with lead, or other material, so that they have a definite period of mechanical vibration. When the electromagnet is supplied with alternating current, a varying, or alternating magnetic field is produced, which will vary exactly in accordance with the alternations of the supply line, and if the alternations happen to be of the same frequency as the mechanical period of the reeds, they will also vibrate. Actually, the row of reeds is loaded in such a manner that all the periods are different, so a variation proportional to the limits of the adjustment of vibration of the reeds can be obtained. For example, if the frequency is 520 cycles, the reeds marked 510 and 530 cycles will vibrate only slightly, while that with the 520 cycle period will vibrate rapidly. This can be easily seen, and read, from a scale provided for the purpose. The chief precautions to be taken with frequency meters are not to connect them to lines carrying too high voltages, which might burn out the coils, or damage the reeds, and not to damage the reeds themselves. The frequency meters are all arranged to be connected directly across the supply line, and but little attention is required by the meters themselves.

Any and all of the meters described should have the best of care that it is possible to give them. A number of "don'ts" have been listed, as the descriptions proceeded, but there are several other points which are worthy of serious attention. Great care should be taken never to jar or pound a meter, or subject it to a sudden shock, as this is very likely to do serious damage to the working parts. The small coils, bearings, springs, and other small portions of the meters' mechanism are as delicate as those in a high grade watch, and should have as good care, altho unfortunately they do not always get it. Many meters are sealed by the manufacturers, when assembled, and should not be opened again unless absolutely necessary. Many people think that these seals are put on the meters to keep the purchaser from looking at the insides of the instrument, but such is not the case. The seals are put there to protect the user from defective or broken parts, and if a broken or burned out meter is returned with the seals unbroken, the maker usually will and does assume all responsibility for the repairs which are often made free, provided the maker finds the fault is his, and not due to misuse. If a meter is sealed, it is usually made air and dust proof by the same action, and for this alone, if for no other reason, the seals should be left intact, whenever possible.

Very few attempts to repair meters should be made by persons unskilled in the art. The delicate inner working elements of a meter should never be tampered with by anyone but a competent meter-man, or in case of emergency, by a skilled watchmaker. It is usually a hopeless job for one unskilled in meter work to try any repairs, unless they are of obviously simple nature, like re-soldering of leads, or lugs, or the like, and even then, it is generally a ticklish piece of work, due to the absence of proper tools and appliances. If a meter is damaged, it will in almost all cases be cheaper and better to return it to the factory or to a specialist for repair than to attempt to do so with the ordinary tools on hand. The few instances where it is possible to do the job at home are so rare that it is practically a fixed rule, and a very safe one, not to try any repairs at all.

Above all, meters should never be overloaded. The folly of this is apparent. In the first place, it is a useless and silly practice, as if a meter is overloaded it will simply swing beyond the maximum scale reading and hit the "peg," making any kind of readings impossible. Furthermore, it is very liable to burn out the meter, or seriously damage the moving parts, and it is almost certain to ruin the calibration, which is almost the most valuable part of the meter.

When connecting to an unknown or unmeasured circuit proper precautions should be taken to see that the line voltage is not greater than the maximum reading of the meter. All direct current meters should be carefully checked up before turning the current on them, to make sure the correct polarity of the line and meters are connected. Meters with external shunts should be connected so that they will not read "reversed," and furthermore, the leads from the shunt to the instrument should always be those supplied by the maker, as the meters are calibrated with these same leads in the circuit. The same refers to thermo-element meters, with external elements.

All high voltage d.c. voltmeters are provided with external resistance coils, and these *must* be connected in series with the indicating element, or the latter will be burned out. Some types of wattmeters are provided with similar resistances, usually in the form of multipliers (which give twice, or three times the normal scale reading), which must be connected in circuit for proper results.

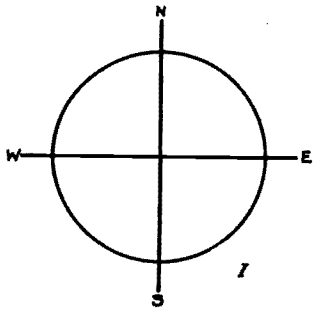
Above all, common sense and intelligent care are required for the use of ordinary electric meters, and if a reasonable "dose" of each is taken, together with realization that a sensitive meter is one of the finest mechanical and electrical appliances produced, there should be but little trouble with electric meters in ordinary service in a radio station.

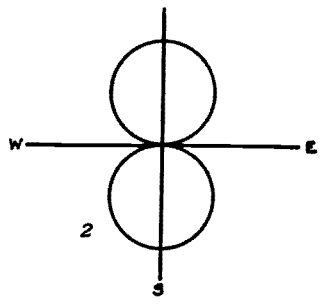
Directive Reception and Interference Elimination

By Hugh R. Sprado

THE coming of radio frequency amplification for short waves has brought with it innumerable advantages, among the most important of which is reception by means of loops. A certain manufacturer speaking of radio frequency amplification, says: "This is the most important advance made since the introduction of the vacuum tube." The experimenter will realize the significance of this statement more and more, as he works towards the elimination of interference. Before the advent of radio frequency amplification, the elimination of interference usually meant a decrease in signal strength of the station with whom communication was desired. Now, however, radio frequency amplification allows any desired amount of selectivity providing we gain through radio frequency amplication what we lose through selectivity.

As loop reception is the first step toward the elimination of interference, the writer will describe a system that has





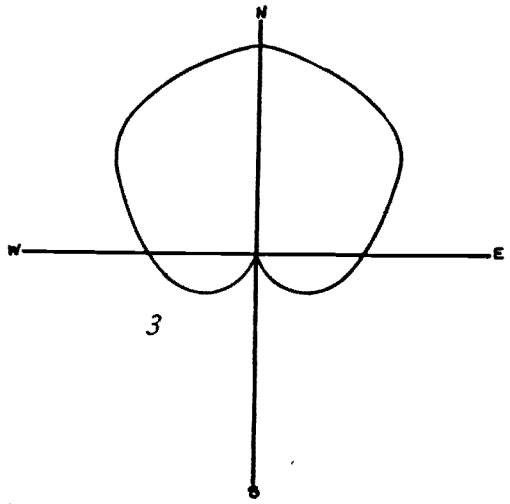


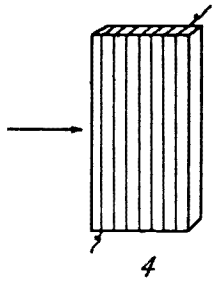
Fig. 1. Antenna Receiver *Fig. 2. Loop Receiver*
Fig. 3. Antenna-Loop "Barrage" Receiver

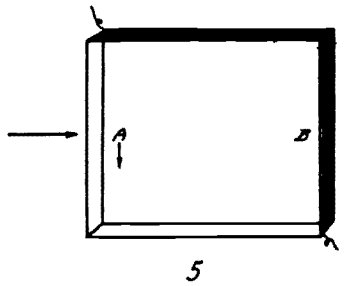
many advantages over the use of open antennæ or loops alone, a system whereby any station can be tuned out completely providing this station is not in direct line with the station desired. Under certain conditions, a strong interfering station may be entirely eliminated and a weaker station on exactly the same wavelength can be read as clearly as though the interfering station were not operating.

Fig. 1 shows diagramatically the directive properties of an open antenna. As shown, the open antenna receives equally well from all directions, that is, it is non-directional. Fig. 2 shows the directional properties of a loop antenna. It will be noted that the loop receives equally well from only two directions. The reason for this is as follows: Suppose we have a loop so placed, Fig. 4, that an oncoming wave strikes the plane of the loop, cutting all the turns at the same instant. The e.m.f. induced in the end turns will be equal, but 180 degrees out of phase. In other words the induced forces will buck each other with the result that no current flows in the loop.

However, if we were to turn the loop 90 degrees one way or the other, the plane of the loop would be in line with the direction of the traveling wave, Fig. 5. The wave would first cut the turns on side A inducing a downward current, then cutting side B and inducing a current upward in that side. As these two currents would be in phase, there would be energy flowing in the loop. If we turned the loop through 180 degrees there would still be energy in the loop, but in the opposite direction. The following system depends upon this reversal of current in the loop for its operation.

Fig. 6 gives a schematic circuit of the "antenna-loop barrage" system. It consists essentially of an antenna and ground system, a variable condenser shunting the antenna and ground, a coupler having primary winding L and secondary winding L_1, and a double pole double throw switch





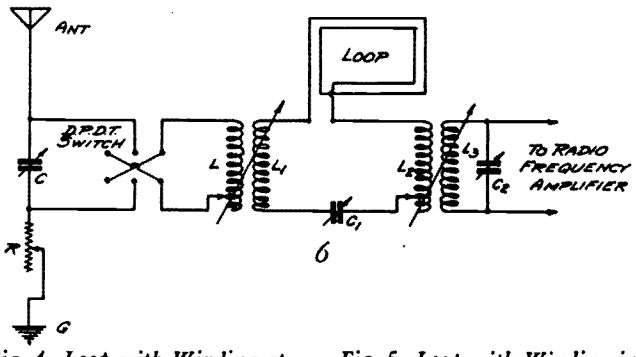


Fig. 4. Loop with Winding at Right Angles to Direction of Wave Travel. No Signal.

Fig. 5. Loop with Winding in Line with Direction of Wave Travel.

Fig. 6. "Antenna-Loop Barrage" Receiver

for reversing the primary coil L. The loop is connected in series with the secondary of the first coupler, the primary of the regular receiver coupler and a variable condenser C_1. This forms the loop tuning circuit. The secondary L_3 of the second coupler is connected to a radio frequency amplifier of two or three stages, depending upon the distance to be covered.

The operation of the circuit is as follows: Let us assume that the current in the antenna circuit at any instant is in the downward direction. At the same instant we will assume that the current in the loop circuit is as shown in Fig. 7. A downward current in the primary coil L will induce an upward current in the secondary coil L_1 as shown in Fig. 8. It will readily be seen that the current in the loop circuit will then be in phase with the energy induced by the antenna circuit and the two currents will be additive. This condition is only true when the signal is in the direction shown by the arrow.

Should another signal from the opposite direction cut the loop and antenna, the current in the loop would be reversed, while the current in the antenna would still be in the same direction or downward. When this is the case, the current flowing in the loop circuit will be exactly 180 degrees out of phase with the current induced from the antenna circuit. The two currents, if equal, will neutralize each other and no signal will be heard. The directional properties of such a circuit are shown in Fig. 3.

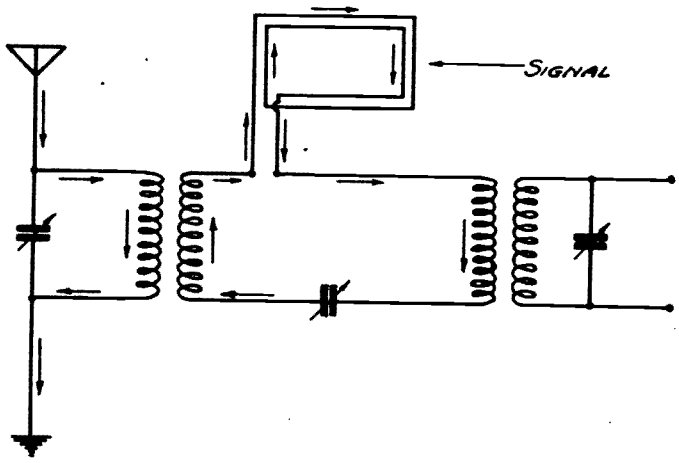


Fig. 7. Direction of Current Flow in Circuit When Antenna and Loop Circuits are Additive

By studying Fig. 3 it will be found that any signal can be "barraged" out, providing it is not in the direction of the desired signal. In the elimination or reduction of interference, the advantages of this circuit are obvious.

The adjustment of this "barrage" is comparatively simple. To tune in a desired signal, the double pole double throw switch is opened and with the loop circuit tuned to the desired wavelength, the loop is revolved until the station wanted is at a maximum. The antenna circuit is now connected into operation by closing the switch, first to one side and then the other, at the same time tuning with the antenna condenser. The antenna variocoupler should be adjusted to fairly tight coupling during this adjustment. When the antenna approaches resonance, it will be noted that with the switch on one side the signals become louder, and with the switch on the other side they become weaker. The switch should be thrown to the side where signals become weaker and the antenna circuit and coupling variometer adjusted until the signal is completely cut out. When this has been accomplished, the switch should be thrown to the other position and it will be found that signals are at a maximum and the "barrage" is in balance.

Any signal, static or arc mush coming from the direction opposite to that of the station being copied will be entirely eliminated. Should the interference come from some angle slightly off the zero balance, this can also be eliminated by revolving the loop until the interference is "barraged" out, without greatly diminishing the strength of the desired signal.

It is important that the energy in the antenna be the same amount as the energy in the loop circuit. If this is not the case a true balance cannot be obtained. It is advisable to make the open antenna large enough to supply more energy than the loop and then balance the two currents by means of a variable resistance in the antenna circuit. This added resistance also has the advantage of broadening the tuning of the antenna circuit, thereby covering a wider band of wavelengths to "barrage" out.

The operator will find numerous combinations of loop positions and coupling adjustments that will practically eliminate any source of interference. This requires practice and a thorough knowledge of the circuit and its operation.

For greatest selectivity, the circuit shown in Fig. 6 is recommended; however, very good results as far as directional effect is concerned, can be obtained by using the simplified circuit shown in Fig. 9. In this circuit a regular regenerative receiver can be employed, the only change necessary being an arrangement whereby the loop may be connected directly in the secondary circuit of the receiver. Although radio frequency amplification is required when great distances are to be covered, a regenerative detector and two stages of audio frequency amplification can be used with fair results for short distance work; that is, not over fifty miles.

As previously stated, there are numerous additional methods of obtaining extreme selectivity in receiving work, but they all depend upon the "loop antenna barrage" for their first step toward the elimination of interference.

In conclusion, a few actual results in interference elimination on long waves may be of interest to the reader. In one instance it was possible to completely "barrage" out one station radiating 500 amperes only 20 miles away and clearly copy another station 5000 miles away using identically the same wavelength. Another instance was the copying of this same station, 5000 miles west, while static coming from the east was so severe that wearing the telephones was unbearable. By use of the "antenna-loop barrage" this static was completely eliminated and the distant signal brought in clear and distinct with double the intensity. Still another instance was that of barraging out two nearby high power stations lying at different angles and at the same time copying a medium power station 2000 miles away. All these results were obtained in daylight and in the tropics.

The secret at the bottom of all these phenomenal results was the use of radio frequency amplification to regain the energy lost through selective tuning.

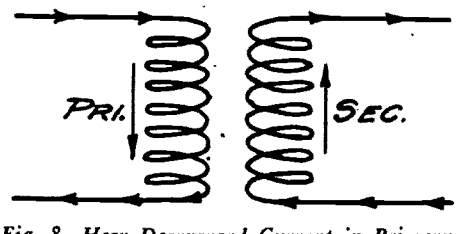


Fig. 8. How Downward Current in Primary Induces Upward Current in Secondary

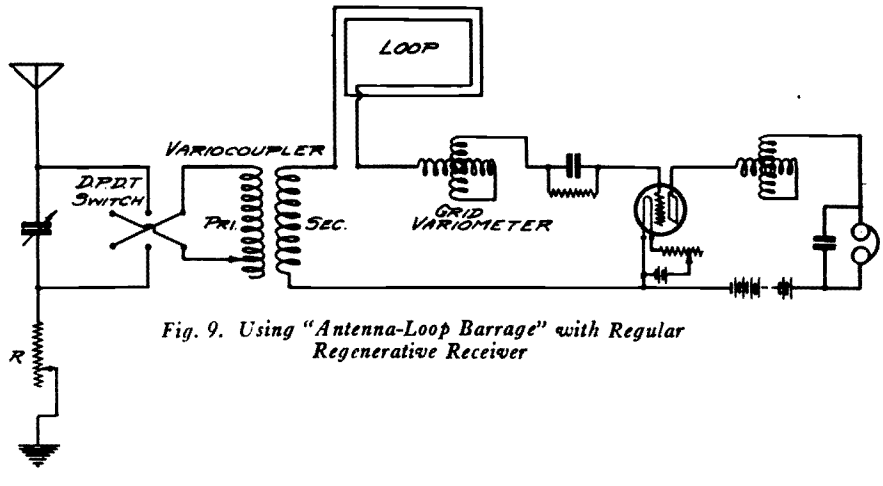


Fig. 9. Using "Antenna-Loop Barrage" with Regular Regenerative Receiver

A "Stand-By" and "Tuned" Continuous Wave Receiver

By R. E. Lake

THE reception of continuous waves is accompained in many cases by equally strong signals from transmitting stations using damped waves. A simple method of lessening this interference is to use a very loose coupling between an aerial circuit and a closed oscillatory circuit slightly mistuned. The distance between the circuits may be about 3 ft., in which case the spark interference is almost entirely eliminated. The strength of the continuous wave signals is of course lessened at the same time, but not enough to seriously affect them.

In Fig. 1 is shown two circuits, A and B, separated by 1 ft. The circuit B is an ordinary simple regenerative circuit which, by tightening the coupling between the aperiodic coil L_1, may be set into self-oscillation at a frequency mainly determined by the position of the variable tapping from L_1 and the value of the condenser C_1. The plate oscillatory circuit consists of an aperiodic coil whose natural wavelength should be less than that of the smallest wavelength to be received on the circuit.

Detector action is obtained by means of the condenser C_3 shunted by a resistance of about 2 megohms. This resistance may conveniently consist of several scratches on a piece of rough ebonite or bakelite filled with graphite by rubbing an ordinary lead pencil across the grooves until a resistance

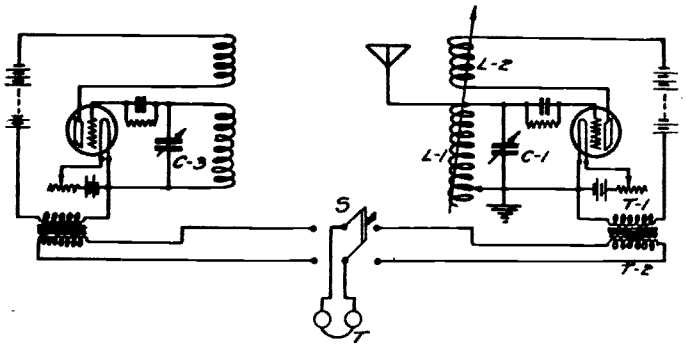


Fig. 1

tester connected across the terminals indicates the correct resistance. Instead of a pair of high resistance receivers in the plate circuit, a step down telephone transformer T_1, T_2 may be used, the high resistance winding of which may have a value of, say, 10,000 ohms. The low resistance winding T_2 should have a resistance equal to the resistance of the 'phones. It should be of heavier wire than the winding T_1 which latter may have about five times as many turns as T_2. The switch S when swung over to the right brings the telephones into the circuit B.

The circuit A is a similar one except that no aerial or earth connections are made to it. The coupling between L_4 and L_3 is variable and the vacuum tube is used to rectify and produce regenerative action or self-oscillation.

When the phones are connected in the B circuit, the latter of itself is capable of receiving continuous waves. The coupling between L_2 and L_1 is tightened until the tube starts oscillating. On touching the aerial, a sharp click is heard in T. If L_1 is variable by taps, a sharp click should be heard on moving the switch blade over them. Since these effects are not produced when the tube is not oscillating they may be used as indications of its oscillating.

When receiving continuous waves, the circuit B is made to oscillate at a frequency slightly different from that of the incoming waves by a suitable adjustment of L_1 and C_1. The beats produced will be rectified by the tube and will give signals in T. This circuit has at least two disadvantages. The first is that the strength of the local oscillations in B are not smoothly variable. A certain amplitude (greater than that of the incoming waves) gives the best results. The second is that since we have mistuned our local circuit, the aerial circuit will be slightly out of tune with the incoming waves. This results in a weakening of the incoming oscillations which, however, retain their frequency and force their way into the circuit. The higher the beat note received, the greater will have been the mistuning of the aerial circuit and consequently the greater the opposition to the incoming waves. This effect lessens the strength of weak signals considerably and explains why the lower beat notes are the loudest on this type of circuit, whereas the most pleasing frequency is about 1,000 cycles per second. When the aerial circuit is perfectly in tune with the incoming signals, the local oscillations will have the same frequency as the incoming ones and no beats will be produced.

Continuous wave signals are easily picked up on this type of circuit which is, therefore, convenient for use when standing by or searching. Once the station has been picked up we may eliminate interference by using the "tuned" circuit brought into operation by moving S to the left. The circuit B is first adjusted for no beats with the incoming signals. The filament current (or the plate voltage) is then decreased until the tube ceases to oscillate of its own accord, the coupling between L_2 and L_1 might be loosened if desired. The tube is now acting in a regenerative manner and is strengthening the incoming signals. These are then induced in the circuit A which is in a state of self oscillation. Interfering spark signals are lost in the coupling, but the continuous oscillations interact with those of A and cause beats which are audible in T.

A rapid method of adjusting these circuits is as follows: Switch S to the right, increase the filament current of A until the circuit oscillates, tune C_2 till signals are heard, tune to the silent point of these signals so that the latter will be heard if C_1 be varied either way. Switch S over to the left, see that the circuit A is oscillating of its own accord, tune C_2 until a beat note is heard due to the oscillations of B. Decrease filament current of B until the circuit ceases to oscillate, the loud beat note in T due to B will cease, but by careful adjustment of C_2 the incoming oscillations will produce audible signals. The circuit A should be removed as far as possible from B, without reducing the signals in T too much. If, while signals are being heard in T, the condenser C_1 is slightly turned either way, the strength of signals in T will decrease (owing to the mistuning of B), but the frequency of the beat note will remain the same since it depends on the local frequency of A.

The same disadvantages which applied to the B circuit alone still apply to the loose coupled arrangement of A and B with the telephones in the B circuit. A considerable amount of spark interference may, however, be successfully eliminated. Moreover by suitably adjusting the coupling between L_2 and L_1 the incoming oscillations may be considerably strengthened by regenerative action. The signals in T will be weaker if advantage of this effect is not taken.

Having adjusted the tuned arrangement, change back the phones to the B circuit. Very loud signals will now be heard —probably twice as loud as those heard on the B circuit alone, and three or four times as loud as when the switch was thrown over to the right. The action of the circuit is now as follows: The B circuit is now accurately tuned to

the incoming frequency and no loss is experienced through mistuning, also the oscillations are reinforced through the regenerative action of the coupling between L_2 and L_1, the degree of this coupling being just less than that required to set the circuit in oscillation. The A circuit which is oscillating at a frequency slightly different than that of the incoming waves, induces oscillations in B which, acting on the oscillations already existing there, produce audible beats. The circuit B is not as receptive to local oscillations from A as it might be, but this is no disadvantage since the amplitude of the induced oscillations forced into the circuit may be adjusted to any value by varying the distance between the circuit A and B.

In the above circuits if high resistance telephones are used the use of the step-down transformers may be dispensed with. There is no objections to lighting the filaments of both tubes from the same battery.

In Fig. 2 is shown a circuit intended for use as a general receiving circuit for damped or undamped waves. It has particular advantage in that it does not radiate continuous waves while receiving this class of signals from outside.

With the two circuits of Fig. 1 used in conjunction there is practically no radiation of continuous waves when receiving since the B circuit does not generate oscillations. With the circuit of Fig. 2 there is no radiation. Continuous waves

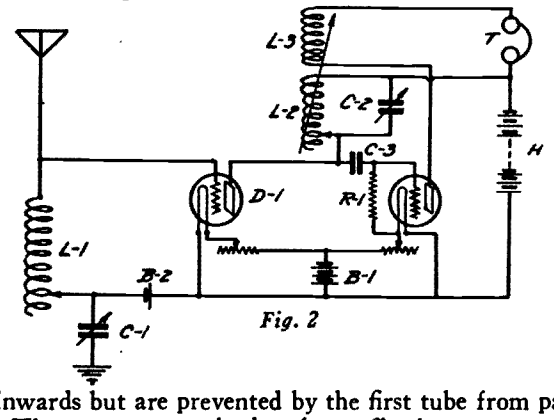


Fig. 2

pass inwards but are prevented by the first tube from passing out. The arrangement is therefore, effective as a trap.

The circuit consists of two vacuum tubes, the first one used merely as a radio frequency amplifier and the second as a combined amplifier, heterodyne and detector. The aerial circuit is shown directly connected to the grid and the filament of the first tube, in the grid circuit of which is a small dry cell, B_2, connected so that the grid is made negative and therefore prevented from taking a prohibitive current. Magnified oscillations are set up in the plate circuit of the first tube which consists of the plate P, the oscillatory circuit L_2, C_2, the battery H and the filament. Oscillating potentials are set up across L_2 and are communicated to the grid of the second valve through the condenser C_3 of about 0.0003 m.f.d. A resistance R_1 of about 2 megohms is connected across the grid and filament and serves the usual purpose of the grid leak. If connected across C_3 (the usual position) the plate battery would affect the grid potential. This form of connection is applicable to many similar circuits.

In the plate circuit of the second tube is a small aperiodic coil L_3, a pair of high resistance telephones, and the battery H. The coil L_3 is coupled to the inductance L_2 so that coupling may be smoothly variable. By tightening the coupling, the circuits may be made to oscillate continuously at a frequency determined by the values of L_2 and C_2. These oscillations will not be communicated to the aerial circuit as has been explained above.

When standing by for spark signals the capacity of C_2 is adjusted to zero and the value of L_2 is kept fairly low with loose coupling between it and L_3. All tuning is now done on the aerial circuit. The coil L_2 is then aperiodic and responds to all waves which are then rectified by the second tube.

When continuous waves are to be received, the aerial tuning inductance is varied and search is made on the condenser C_2 which varies the frequency of the local oscillations which are to interfere with the magnified incoming oscillations passing through L_2. The coupling between L_2 and L_3 is of course tightened sufficiently to cause the second tube to oscillate of its own accord.

The inductances used may be usual single layer coils, bank wound coils, or the tapped honey comb coils now on the market. If the latter are used it must be borne in mind that the coil L_1 is not to be placed in inductive relation with L_2. The size of inductances used will obviously vary with the wavelength desired to be received.

A NEW TELEPHONE INVENTION, THE "SUPERPHONE"

By MAJOR GENERAL GEORGE O. SQUIER
Chief Signal Officer of the Army

A new telephone invention, the "Superphone," has been developed under the direction of R. D. Duncan, Jr., chief engineer of the Signal Corps Research Laboratory, Bureau of Standards, assisted by S. Isler, assistant radio engineer, and is described in Information Bulletin No. 12 of the Signal Corps. It is based on the original invention of "wired wireless" or "line radio" invented about ten years ago by the writer.

The new device consists of a small portable set of instruments which may be installed in any office or residence in a few minutes and connected directly to existing telephone lines, and conversations carried on in the usual way. It will only be necessary for the subscribers to close a switch or press a button to connect in the superphone in place of the ordinary phone.

This superphone provides a means for absolute secrecy of communication without any chance of the conversation being overheard, interrupted or broken into on the line by anyone else. It is obvious that this invention will prove of the greatest value for military purposes in case of war where secrecy in communication is absolutely necessary, but it may also prove of great utility for ordinary commercial purposes where important business houses, such as banks, brokers, etc., may desire to have private channels for confidential communication with their branch offices or with any business establishment and insure secrecy of the conversations carried on.

The principles involved in this invention are those of "wired wireless" by which high frequency alternating currents are employed which are modulated at the transmitting end by speaking into an ordinary microphone and detected at the other end by the usual radio instrumentalities which finally passes on to an ordinary telephone receiver. The speaker, however, or the listener in, is not concerned with any of the additional instruments; they are installed and properly adjusted once for all, and the people carrying on the conversation have no more bother than in the use of the usual telephone system.

Another advantage of this method of telephone communication is that it makes multiplex telephony possible. Quite a large number of secret telephone conversations may be carried on simultaneously over the same line without interferring with each other.

The transmission of speech by the utilization of this invention is even clearer than ordinary telephonic speech. The power required for carrying on conversations over even considerable distances is of the order of one-tenth of a watt, which is about 1/500th of the power required to light an ordinary electric lamp.

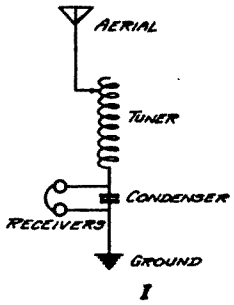
This novel development is only one of the many which are coming to light almost daily in the application of the broad principles of "wired wireless" or "line radio."

Crystal Detectors

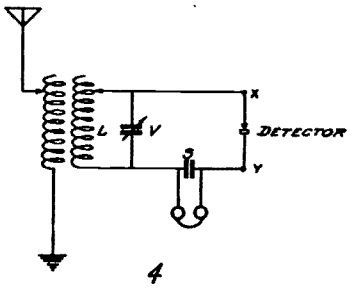
By B. F. McNamee

BEFORE taking up the subject of detectors, it will be well to consider the nature of the current in the receiving aerial. Let us take a 200 meter "spark" signal to illustrate. Each time that a spark occurs at the sending station, a group of waves is sent out, causing current to flow up and down the receiving aerial several times, gradually decreasing in strength until it finally dies out.

It is plain that there are two frequencies involved here. The "high" frequency refers to the rate at which the waves strike the aerial, causing the oscillating current. In the case of 200 meters, this frequency is 1,500,000 cycles per second. The other frequency is called the "group" or "spark" frequency and refers to the number of groups of waves in one second, which is of course the same as the number of sparks per second at the transmitting station. This number is generally between 100 and 1000.



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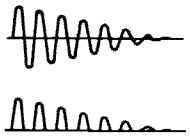


Fig. 1
Fig. 2

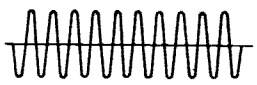


Fig. 4
Fig. 5

If a pair of telephone receivers is connected as shown in Fig. 1 and the 200 meter signal tuned in, there will be no sound for two reasons. The first is that the high inductance of the windings of the receivers offers an enormous resistance to the high frequency current so that the amount flowing could have no appreciable effect on the diaphragms. The second reason is that even if it were possible to move the receiver diaphragms in and out at a rate of 1,500,000 times per second, there would be no resultant sound, since the highest note that most people can hear is about 20,000 vibrations per second, and for good reception the notes should be much lower. If each group of oscillations is made to cause a single movement of the diaphragm, a good sound results.

It has been found that some minerals conduct electricity much better in one direction than in the opposite. This rectifying action is generally improved when one of the contacts to the mineral consists of a fine point resting very lightly. The action is usually confined to "sensitive" spots on the crystal, which can be found only by trial. Fig. 3 shows a common type of crystal detector. The mineral employed is galena, a compound of lead and sulphur.

Fig. 2 shows how a detector can be used to produce one movement of the receiver diaphragms for each group of waves. Above is shown one group of the received high frequency current. B shows what happens if a detector of the rectifying type is placed in the circuit. There are several current impulses, but they are all in the same direction, the current in the other direction being stopped by the crystal. These impulses serve as a series of small charges to condenser S in Fig. 4, which then discharges a single impulse through the receivers. Thus, if there are 250 groups of waves per second, there will be 250 movements of the receiver diaphragms per second or a note about as high as middle C.

A convenient test in locating a sensitive spot on the crystal can be arranged by connecting a buzzer to a battery through a push button. A wire is connected from one of the buzzer contacts to one of the detector terminals. When the buzzer is turned on, it will be heard in the receivers when a sensitive spot is found.

A detector of the rectifying type such as described above will not work on undamped waves (Fig. 5). Since these

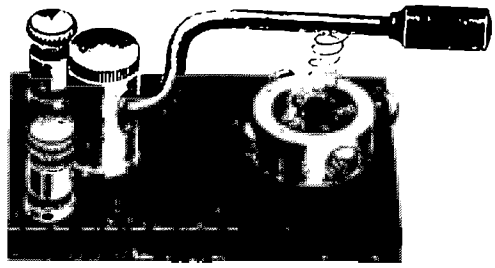


Fig. 3—Crystal Detector

waves produce in the receiving aerial currents of constant strength and not broken into groups, there will be no musical note in the receivers when a crystal detector is used. Undamped waves may be received if the crystal detector in Fig. 4 is replaced by a "tikker." This is a mechanical device for rapidly opening and closing the circuit between the points X and Y. It usually consists of fine spring wire resting lightly against the surface of a revolving metal pulley. The circuit from wire to pulley will rapidly make and break.

Condenser S should be considerably larger than the tuning condenser V. When the tikker contacts are apart so that the circuit is open between X and Y, the circuit LV is tuned to the signal, thus giving condenser V a maximum charge. When the tikker contacts close, condenser S is connected across condenser V, from which it is charged. Condenser S now discharges through the receivers, and the process is repeated. It is evident that the tikker can also be used for spark signals, although it will spoil the clear note.

RADIO 7YJ

Continued from page 10

The transmitter consists of a 1 kw. Thordarson transformer, a .01 mf. Dubelier condenser, and a synchronous gap secured by a 9 in. disk with eight 1 in. electrodes driven by an induction motor. With a 10 in. coupling this gives 5 amperes radiation from the aerial. A counterpoise on the roof, 30 ft. below the aerial, assists in producing this radiation. The oscillation transformer primary is made up of heavy 2 in. brass strip and the secondary of ½ in. brass strip.

The receiving set on the left, constructed by Mr. Jordan, was originally designed for wavelengths from 200 to 16,000 meters. The set on the right is an army C. W. transmitter and receiver, type BC 32A. The small set on top is a Grebe CR 3A.

The tray on the floor is a "B" battery made of 5 oz. bottles. The plates are old automobile storage battery plates cut into strips. The only cost for this 100 volt battery was $7.00 for bottles.

A LIST OF STATIONS HEARD AND WORKED BY 7YJ

6AFB, (6AJF), (6AV), (6CV), (6EB), (6FI), 6IK, 6OC, (6XAD), (6XAC), 6XG, 6ZX, 6ZB, and Avalon phone.
(7BH), (7BK), 7BU, 7HScw, (7GO)cw, (7MF), (7YA), (7YL), (7YS), 7PZ, (7ZJ), (7ZE), (7ZU).
9AB calling 9BE on cw, 9AX heard without aerial, 9AVV, 9AMBcw, 9BD, 9DTHcw, 9JQ, 9NXcw, 9OOC, 9WU, 9YA.

Scratchi Comes Ashore for a Trip

Decoded from the Walsirwinese

By David P. Gibbons

To EDITOR "RADIO" (which dispel pleasure by the month to all bugs and bugesses who have forwarded free coupon with proper sum):

DEAREST SIR:—

Since hearing from you before several little things have passed me by which I desire to place in front of you for illumination. For some reason or no other the Magnastocks Corporation which employ by Cousin Scratchi donate him generous vacation on beach, and in order to modulate high living cost I impose him to share my hilly apartment on Ashbury Street. When he arrive he bear along considerable excessive baggage such as motorgenerator, type 106 receiving box, transformer, complete battery and so forth, which he inform me he have picked up at special bargain. I inspect to find makers title-plates and numbers but do not, and Scratchi think perhaps these drop off on uphill route from ferry. Mightbe you think likewise, Mr. Editor? I am interest to know if any more such bargains are to be grabbed at, but Scratchi say "No, these are everything. Old scow-maru are now quite outside of commission."

"What position will you again assume when entirely refreshed?" I demand him in cousinly speech.

"I would highly enjoy a brief space of enlistment in glorious navy," flareback Scratchi.

"But all navies are now pointing toward grand scrappy pile," I project.

"Maybe pointing towards with full speed astern," quip Scratchi, "but such ticktacks chops no ice with me, as I aspire to regain rapid discharge, and then with envious supply of high navy grade vacuum tubes I shall make fingersnaps at all sparking and arking clutter from hence on."

"How do you arrive at that conclusion?" I confuse.

"I shall become good-standing member of the I. C. W. W., which are motely organization of picnic hams and lady friends," Scratchi obscure and peruse further, "these Continuous Workers are highly opposite to the Won't Workers, which are chiefly composed with soupbone and catmeat style of members and entirely devoid of juicy hams."

"What are object of such combine?" I query.

"Oh, many such," report my cousin, "but main one are to discover which member most fancy liar. For instant, one member compose communication like these, 'Last night I pick up Moscow on one piece of radium crystal so loud I can hear him on one foot away from fones which are disconnected from aerial with A and B batteries shunted in serious.' Then other member take floor away from him thusly, 'Last night I catch KICZ which are four days out from Frisco. He come in so strong on my loud-mouth hitchup I can hear operator scratch his head over abstraction!' He forgot to inform that KICZ always return himself back to Golden Gates after four days out. This continue until referee count ten o'clock."

"Are not very model station necessary to mingle up with such classy progressors?" I quip.

"Truly so," are response from my cousin, "but I hope to possess latest advanced model. I now pursue carefully special offerings in aft section of radio magazines, and have arrived at far end of wits to make buying decision. I enjoy so clever word pictures of the Pyramid Receptor, Type 14AD92, with micrometer binding posts, that I nearly neglect the Greenee short waving set, Type EZ2C, with rubber-tired ticklers and finished in shining walnuts. On next page writing expert have quite exhausted Hon. Webster's bridgeless volume, so he introduce Dr. Wu Zee, who shake magical stick while dispensing following Chinee adverbs, 'You can fool all the people quickly if you can sling the Durham slickly.' On other page the Glee Frost Company set out glib details of most modest radiophone fitout which only cost 2 or 3 hundred cash dollars, excluding tubes, batteries and everything."

"Why not employ very simple serkit which you have perfectioned and have expert insert it in small, neat set?" I propose. "All you must purchase for such are one vary condenser, one honey coil with rheostat and socket."

Scratchi agree to this as he have exalted this up-hook most unbelievingly, and we move along down to Market Street radio dealers to inquire for cost prices and etceteras. We reached there in short time after several skippings from under tintype jumpabouts which Mister Ford issue in wholesale quality when not otherly engaged in pepping up some stockbroke railroad. We make converse with very superior clerical gent who are safe behind glassy counter and he jot down what we desire. He add these up and it show twelve dollars. We then require how much cost it would become to put same in small box, six inch in all directions. He rapidly jot down 13 additional dollars, which he explains are for labor, time, roomrent, income tax and so forth. We leave him and approach some Mission Street radio places and collide with result very similar if not more so. My cousin Scratchi and self have by then exchanged our pep for pip and decide to oblivion such foolish misconstruction idea and we corrugate deeply how Hon. Mister Postmaster can secure himself husky marines to protect mail orders from upsticking bandits, while poor bug can obtain no such armored guard to go forth with him when radio shopping. I require intelligence on this angle, Mr. Editor. Mightbe you have some?

While wending gloomy footsteps towards our homely shack I inquire of my cousin how soon he figure to join up with the I. C. W. W. order.

"Never at all," he respond peevily. "Instead of it I desire to join the Q Cluck Canners and distribute tarfeather overcoats to highbounding wireless magnates."

When we arrive back home again Scratchi make hasty connection of my aerial to old type 106, and plug in motorgenerator to chandelier lamp. He then adjust potentiometer around the rumdum crystal and as buzzer have stripped gear he lean elbow on key while he hunt sensive spot with flowery oriental language.

He are still hunting, Mr. Editor, and hoping you are likewise, I remain,

Your Affected Reader,

HILOLI NOGO.

RADIO AUTOMOBILE GUIDE

Raymond F. Yates, a New York inventor, has produced a radio device which promises to eliminate the use of guide books, sign posts and road maps. High frequency electric current is made to pass through a wire running along the road. This current sets up an electromagnetic field and the passing car has attached to its hood a coil which cuts through this field. The current produced in the coil is amplified with a radio vacuum tube and from this point it passes to an instrument on the dash. The wire at the side of the road carries a definite signal and each road equipped with the system will be characterized by a certain signal. For instance, the wire along the road between New York and Albany may be emitting two dots and one dash. A car passing along this road would pick up the signal and the two dots and one dash would appear in red on the face of the instrument which has become known as a directometer.

The Small Person

By Lawrence Mott

HE was a queer sort of an elderly little man—a very *little* man, structurally speaking—not much over five feet in height, and narrow in proportion.

The other passengers of the first class, voyaging on the great liner from New York to Southampton, could make nothing of him, and—as is often the case under similar circumstances—proceeded to ridicule, at first covertly, and then because the Small Person—for so he was dubbed by popular acclaim—made no offer of self defense—open chuckles were in order when the strange little figure appeared on deck, an odd-shaped cap pulled well down over large ears, an old-fashioned muffler tight-wrapped about the thin neck, and a sort of a "duster" coat falling to his heels and flapping about his scrawny legs as he walked—with very droll effect.

The Small Person was sensitive of his personal appearance, and although he kept a bold front, the soul of him writhed in hushed pain.

"I can't help the way God fashioned me!" he would mutter to himself, pathetically. "And it seems kind o' hard to be made fun of *all* the time! 'Milk of Human Kindness'—huh! A helluvalot there is—*not!* The cow that gave it dried up long ago! Gosh, but I wish I had a little nerve!"

He kept—for the above reasons—entirely to himself, usually curled up in the sun behind a ventilator on the boat deck, his sparse-blue eyes roving the endless distances of eternally rolling waters, his thin hands tucked in his sleeves, fuzzy cap jammed over ears. A strange, Small Person—to be sure.

One morning he ventured to look in the radio room, and the operator on watch grinned cheerily.

"Come on in, Uncle! Chilly wind today!"

The *"Uncle"* rasped, but the Small Person hoisted himself over the brass-bound sill and sat himself gingerly on the settee within.

"A radio Op's life is not what it's dolled up to be—not by a long shot! People seem to think that all we have to do is to sit here and do nothin'!"

"Well—that's about right isn't it?" queried the Small Person gently, and the operator looked at him hard, wondering whether this odd specimen of humanity was making fun of him. But so guileless were the blue eyes that no one could accuse the mind, whose windows they were, of any levity whatsoever.

"Yes, but the doing *nothing* becomes tiresome! Time signals—weather reports—a few messages—press—watch on and off, reading trashy bunk between times—that's what it amounts to."

"Why don't you do something else, then?"

Again the operator studied the Small Person carefully, but could find nothing at which to take umbrage.

"Oh—I dunno. Sort o' get used to it, I suppose. Want to have a look 'round? I'm standing double watches, as the other operator's had some kind of a stroke—weak as a cat—off his head most of the time since yesterday. Doctor's got him in the sick bay. Great life—isn't it?"

"That's too bad. Why—er, yes, I don't mind lookin' 'round."

So—and in the most simple language at his command—the somewhat self-important operator condescended to explain, very cursorily, the workings of the bright-glistening radio apparata, while the Small Person listened deferentially, with expressionless face.

"Come in again—whenever you're up here," said the youth, "and mind that the wind doesn't blow you away!"

Again the soul of the Small Person writhed, as the wind literally blew him aft—for it was freshening fast from the nor'east.

By 8 bells that night it was blowing hard, and the huge vessel rolled ponderously to unusual degrees. The decks were dangerously wet and slippery, and the wind easily bit through the stoutest of over-clothing.

The Small Person did not like the loneliness of his cabin. Gregarious was he, when he could not see the sun, or the moon and the stars—and the beauties of nature that these revealed to him. At such times he preferred nature to the society of his kind. But when weather conditions shut off his supply of the Creator's handiwork he was lonely, and crept—mouse-like—among men.



"Outside—all of you! I'm running this show from now on."

He attempted the music room, but a ponderous female was being firmly held on the piano stool by two men—whom, he thought, should have had better sense—and the noises that she made, in efforts toward song, drove him forth.

So it was that he edged his way in the smoking room, and slipped in an as obscure corner as possible.

No one paid any attention to him—which was a relief in itself. Even the steward in whose particular tip-territory he had projected himself, merely gave the table top before him a con-

Continued on page 42

How to Make a Good Radio Receiver

By D. B. McGown, Assistant Radio Inspector

COUNTLESS and endless descriptions of radio apparatus, showing circuits, complete instruments, and what not, are published for the guidance(?) of the growing radio amateur. Many, possibly most, of these descriptions and instructions are very good, but they are not always complete, or specific enough to give the "dope" on the actual building of the apparatus. Or, again, the instrument or apparatus may be perfectly well suited to certain requirements, or the peculiar requirements of a certain station, but are almost useless for another. Or, as is very often the case, a complete machine shop, with many fancy tools, is required to perform some operation, so that instead of making it, the amateur finds it cheaper to buy the set ready-made. In this, and succeeding articles, apparatus will be described, that while not necessarily new, will be of such design that it is possible to duplicate it with a very modest equipment of tools, altho the proverbial "hammer and saw" will not suffice.

We will first consider the construction of a good receiver. This instrument is almost an exact duplicate of a popular type now offered for sale by several enterprising firms, and no credit is claimed by, or due, the writer for any originality in its operation or design. The instrument will receive on all wavelengths from about 175 to 2,500 meters, with an average antenna, and with a larger, or smaller one, its range will be increased, or decreased correspondingly. The circuit used is the so-called "single-coil" one, which is not quite as selective as some others, but is very sensitive, and is especially valuable if used for receiving C. W. signals.

The following material will be needed for the construction of the instrument:

1 bakelite panel 3/16x6x15".
1 4" dia. cardboard, or bakelite tube 7" long.
8 binding posts, of type to suit builder.
2 instrument dials.
1 filament rheostat.
1 tube socket.
1 grid condenser (.00025, approx.) may be made up.
1 bridging condenser (.005 approx.) may be made up.
1 small switch, with two arms.
10 switch-points.
1 3¼" variometer ball.
2 ft. brass strip ⅛x¾".
1 ft. 3/16" brass rod.
Wire for connections, a few small screws, nuts, etc.
1 lb. No. 22 DCC wire.

The circuit of the receiver is shown in Fig. 1. We have the antenna connected, thru the condenser C_1 to the inductance L, which is varied by the two bladed switch, and connected thence to the ground. Rough tuning is accomplished by varying the switch, and fine tuning is accomplished by the use of the antenna condenser C_1. Two blades are provided on the switch, to short circuit the two adjacent sections of the inductance L. This seemingly strange procedure is actually very useful, as it gives the effect of a "dead end" switch, without the complications necessary for its use, as, by short-circuiting, it throws the natural period of the unused coils so far out of resonance with the wavelength of the incoming signal and of the coils in use for reception, that no effect of any kind can be noted from their proximity. The grid of the vacuum tube is also connected to the antenna circuit, thru the condenser C_2, which is shunted by a grid-leak of proper value.

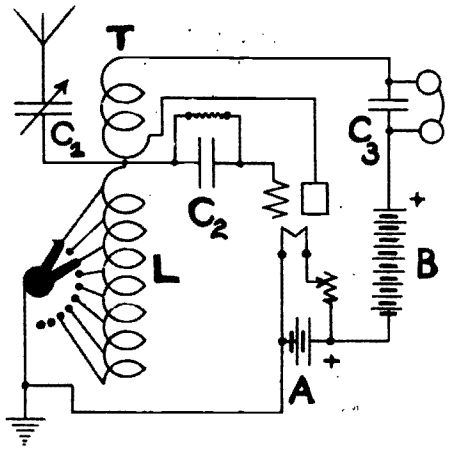


Fig. 1. Receiver Circuit

Oscillation is accomplished by the tickler T, which is mounted within the inductance L, as shown in Fig. 2. Here we have the long tube, wound with wire, which represents the inductance L, and the ball at the right end, marked "tickler." This ball may be rotated, so its coupling with L may be varied from maximum to minimum, and thus, by careful manipulation, either plain detection, regeneration, or oscillation of the vacuum tube may be obtained at will.

A front view of the receiver, as mounted after its completion, by the author, is shown in Fig. 3, and a rear view is shown in Fig. 4, which shows the arrangement of the ball tickler.

The main inductance L is wound, as shown in Fig. 2, after certain necessary mechanical operations have been performed. First four small brass brackets are made up of the brass strip, and the tube L is mounted so that about 1½ in. clearance is left between it and the panel. A quarter inch hole is drilled 1¼ in. from the right hand end of the tube. Then another is drilled at the same distance from the end on the opposite side of the tube. Small strips of brass are fitted to these sides of the tube, with a 3/16 in. hole over the ¼ in. one, and screws are passed thru the tube, into holes provided for the purpose in the strips, to secure them to the tube.

Starting ¼ in. from the right hand end, wind 20 turns of No. 22 wire, which will take nearly ¾ in., skip a space of ½ in., and wind 20 more turns, as shown in Fig. 2. Leave a space of ⅜ in. or a little less, and wind the main inductance. This is wound in "three layer banked" winding, which is done as follows: Start and wind two turns on the tube; now at the point where the third turn starts, bend the wire over a little, and wind the third turn on top, and in the space between the first

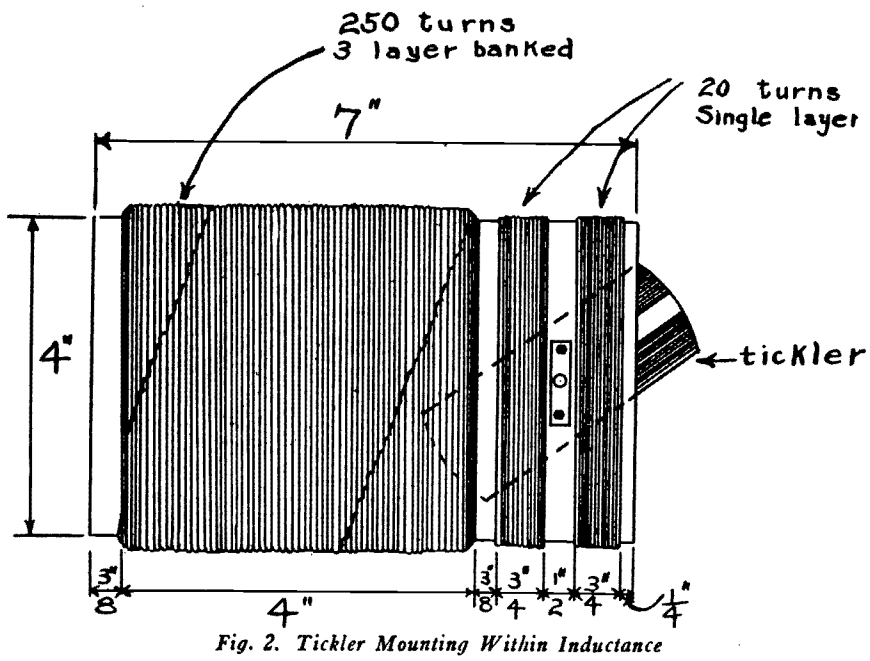


Fig. 2. Tickler Mounting Within Inductance

two. When this turn is completed, hold the wire already wound with one hand, and bend the wire so the next turn, number 4, will be down on the tube. Wind turn 5 on top of 4, between it, and 2, and wind turn 6 on top of 5 and 3. Then drop to the bottom again, and continue the winding, as described, turn 8 resting between 7 and 4, and turn 9 between 8 and 5, after which the same process is repeated, until the tube is wound. The winding order, and the position of the separate wires is shown in Fig. 5.

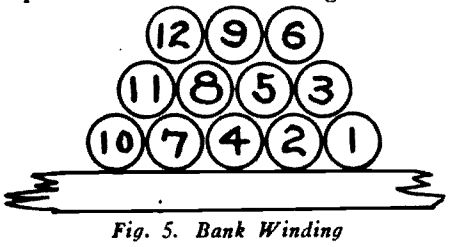


Fig. 5. Bank Winding

While winding it will be found difficult to hold the wire in place, unless great care is used, and, in any case, it will be necessary to coat the wire with something after winding, to hold it in place. Shellac may be used for this purpose, but common collodion, as sold by druggists, will be found much more suitable. It should be applied with a small brush, after each "bank" is wound, and its rapid drying qualities will hold the wire in place securely, and almost instantly. If no collodion is available, small pieces of celluloid may be cut up, and dissolved in acetone, which will make a varnish nearly as good. (Caution: Keep naked flames and lights away, as all these substances are extremely inflammable).

The tickler, as shown in Fig. 6, may be a wooden variometer rotor, or "ball," if obtainable. However, a piece of common cardboard tubing will answer nicely, and will probably be easier to obtain. The dimensions of the ball are given in Fig. 6, and should be wound, as shown, and mounted inside of the inductance coil, the brass strips acting as bearings, and the 3/6 in. brass rods acting as journals, as well as conductors from the tickler to the tube circuit. If a cardboard tube is used, there should be a couple of more turns wound on each half winding, to make up for the looser coupling between the coils, due to the smaller diameter necessary for the cardboard tube.

The grid condenser C_2 may be purchased, or can be easily made by the builder. The capacity is not critical, and may be made variable, if desired. A fixed capacity may be made by taking two sheets of copper, or tinfoil, ½ by ¾ in., and separating them by a sheet of mica about .001 in. thickness, and clamping them between two pieces of bakelite. A bridging condenser may be made by taking a dozen of such pieces of foil, and mica, and making them up in similar manner, which may be used as condenser C_3 in Fig. 1.

Taps should be taken off the inductance L, and connected to the ten point switch. Only 8 points are taken off the inductance, leaving two dead taps on the panel to accommodate the extra, or short-circuiting switch lever. The first tap will be taken off at the end of the first 20 turns, and the second tap at the end of the other single layered coil, or at turn 40. The remaining 6 taps may be taken off at equidistant points along the bank wound coil, or they may be, and preferably are, taken off in about the following order, considering the start of the banked winding as turn 41: Turn 60, 90, 130, 180, 220 and 250. The exact points need not be

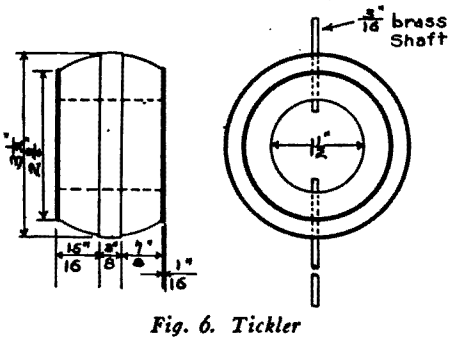


Fig. 6. Tickler

marked, as the "overlap" is enough so that no difference will be made if these exact numbers are missed. It is best to wind the coil completely, first, and then mark the points to be tapped, and then either carefully scrape the different turns, and solder a lead to them, or lift each wire to be tapped with a sharp point, as a scriber, and scrape and solder each wire where lifted. These taps are brought to the respective switch points and soldered thereto.

The mounting of the coil, tube socket, switches, condensers, etc., are left to the design of the maker. The antenna tuning condenser C_1 should not have a maximum capacity of more than .0005, and may be mounted within the tuner itself, and on the same panel, or, a ready-mounted "table" type condenser may be used. If tuning for much C. W. is contemplated, it is desirable, and advantageous, to cover the panel behind the condenser and tickler dial with thin sheet metal, which should be grounded, taking care *not* to ground the condenser or tickler shaft to or thru the shielding.

The sizes and dimensions, etc., given herein are not exact, and can be varied without seriously affecting the operation of the instrument. A smaller coil may be used, or a single layer coil could be substituted for the winding L, if it is not desired to go to the trouble of bank winding the complete coil, altho the wavelength range will be greatly reduced, probably to a maximum of about 800 or 900 meters. A common "variocoupler" of the type designed for the ordinary two-variometer regenerative set may be used, with the same circuit shown, and good results obtained with it, within the limits of wavelength, which will not be very large. It may be neces-

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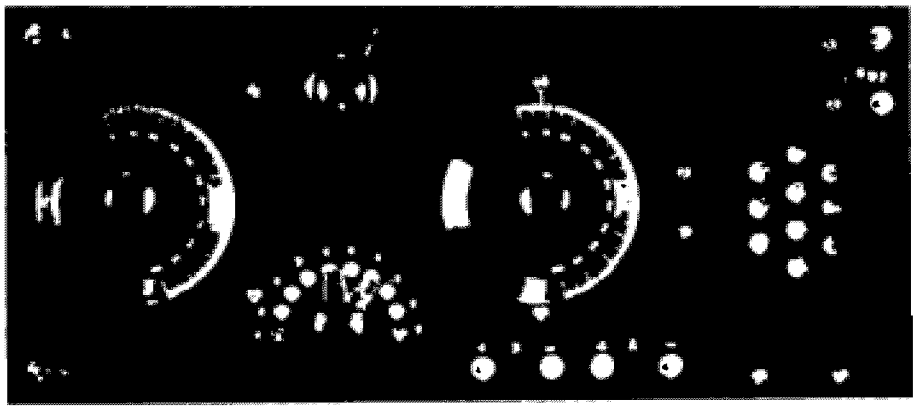


Fig. 3. Front View of Completed Instrument

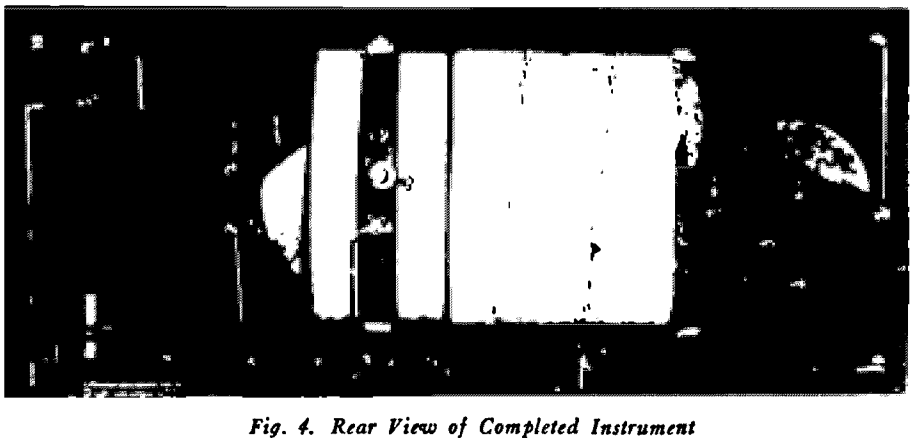


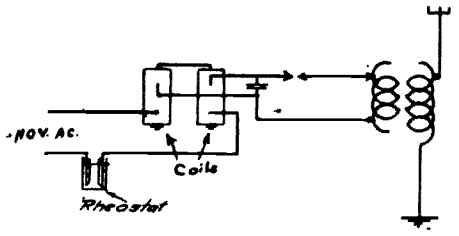
Fig. 4. Rear View of Completed Instrument

Use That Old Spark Coil!

By Chas. Dalziel

IN spite of the commercial-amateur sets that pop up now and then, most beginners still possess a Ford coil transmitter for local work, as the H. C. L. of high tension transformers is still above the average amateur, especially if he has blown himself for a good receiver. It is for him that this article is written.

By using the simple hook-up shown herewith 1½ to 2 in. sparks may be secured from two Ford coils, thus greatly increasing the range, as the average coil gives only a half inch when going full blast on a storage battery. As the hook-up is self explanatory, a brief account will be given as to the precautions necessary to get the best results.



Spark Coil Hook-up

Connect the end contacts of the regular Ford coil together by means of binding posts soldered on all the contacts. The current is supplied to the top front contacts, while the high tension is taken from the top back contacts, where it is used as in any standard set. An oscillation transformer is absolutely necessary as the whole set must be insulated for ½ in. to ground, the one bad feature of the set, but it can be done. But be careful when operating, so as not to get a kick out of the key.

The set will work on 40 to 70 volts, 5 to 8 amps. If you don't possess the d.c. voltage but have 110 volts a.c. handy, just get an ordinary fruit jar and two metal strips 1 in. wide by 6 in. long, so as to nearly touch the bottom. Connect the rheostat in series, as in the figure. Fill the jar to the rim with a weak solution of some electrolyte, add more until the vibrator contacts show some current, disconnect the oscillatory circuit leads and place the spark gap across the high tension binding posts. Adjust the vibrator contacts until the spark jumps at least ½ in. Be very careful as the contacts will burn out if they should get an excessive amperage. If the set does not show much pep add more electrolyte (this can be made by dissolving any salt or acid in water). Stir well before adding more. It will be well to practice on an old pair of contacts as the ones used for sending must be in first class order.

As to the contacts, the regular Ford KW points will do, but Fordson tractor points are much better, and not much more expensive. They will stand up much longer without excessive heating and are much heavier.

Both vibrators must be kept going at once, contrary to general opinion, in order to get the most efficient results. This keeps the set running smoother, and will be much more conservative on vibrator contacts, as the two buck against each other and thus split the amperage, so as to keep it above the safety mark. If you fail to note this part you will be liable to see your contacts get red hot in no time. Keep them always square to each other, and about 1/32 in. from the core.

If you have only one coil at hand, the range may be increased by using the same hook-up with one coil in series with the 110 volt mains with the rheostat and other essentials as in the diagram. In this case the high tension will be taken off the top two binding posts. The middle one is the hot one.

An oscillation transformer is not absolutely essential to the one coil set, but will be found to give much better results, especially as to sharp tuning. One is liable to get in bad with the radio inspector if the wave is not sharp or pure. I have had good success with both sets, reaching ten miles with one coil, on a crystal detector. The report was very QSA on two coils.

A HOME-MADE C. W. TRANSMITTER

C. C. Brown of Manton, Calif., submits the accompanying pictures of his continuous wave transmitting set, built up by himself, including the motor-generator set. He employs the Heising circuit and obtains a normal radiation of 1.1 amperes.

The generator was made from a 220 volt d.c. 1700 r.p.m. motor by rewinding the fields for 500 volts and running at 3450 r.p.m. It is direct connected to a motor and gives 100 watts output at 500 volts.

The inductance is wound on a 4½ in. grooved tube with 50 turns of No. 14 bare copper wire. It is tapped every 5 turns, the taps being connected to a switch on the front of the panel.

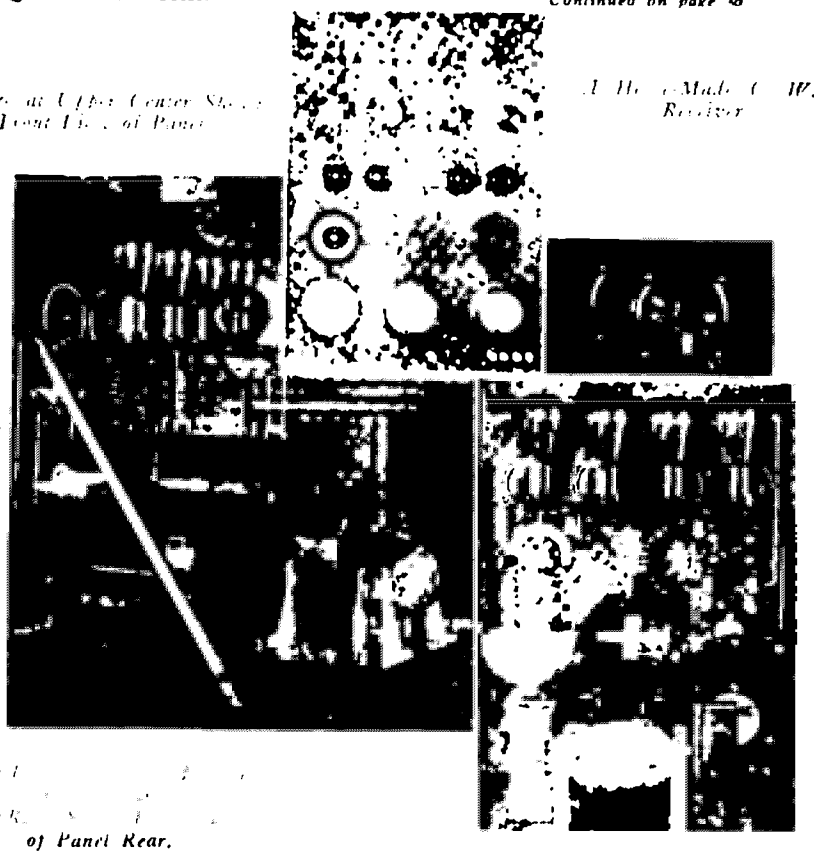
The filter seen at the rear of the panel is also home-made. Each choke coil has 2 lbs. of No. 24 D. C. C. wound on a 1 in. square laminated core. The condensers are 1 mf. Western Electric Bus-bar type wiring is used thruout the station. The meters were placed at the bottom of the panel so as to make connections as short as possible.

The receiving set at this station employs a regenerative variometer for short waves and honey-comb coils for long waves. It has a three stage power amplifier with both a Magnavox and Baldwin phones.

Continued on page 40

Pictur[illegible] Upper Corner Shows Front View of Panel

[illegible] Made C. W. Receiver



Lower [illegible]

Lower [illegible] of Panel Rear.

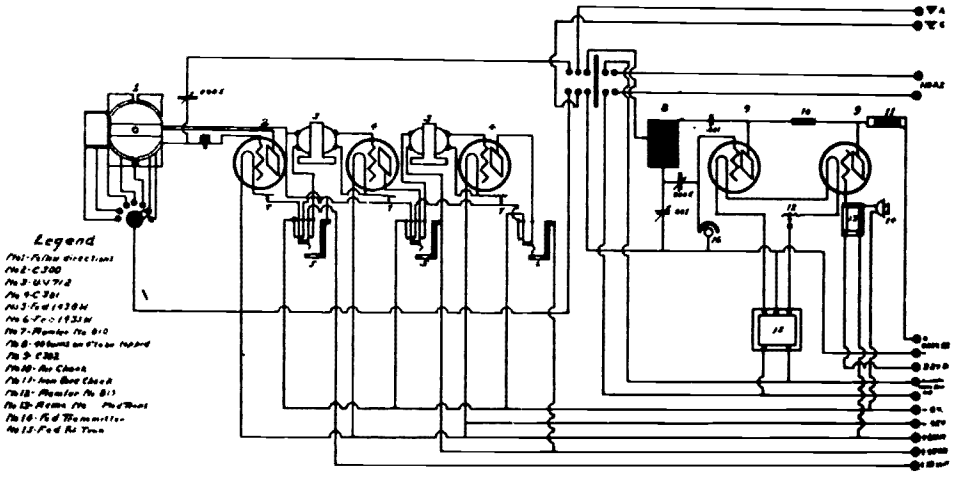
The Design and Building of a C. W. Set

By E. A. Ames

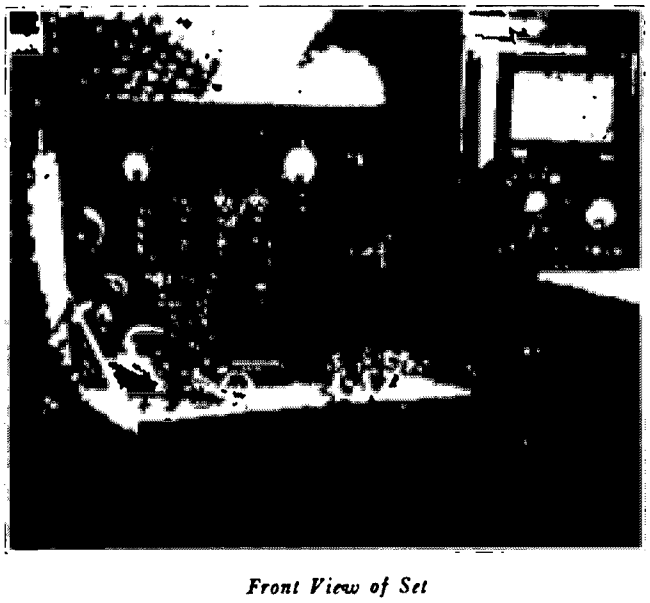
Instructor of Manual Training in the Fullerton Union High School, at Fullerton, California

ABOUT one year ago, because of the insistent demand of our students, we decided to let them build radio sets as manual training projects. This was one of the best moves that we have ever made as we have interested boys whom we had failed to reach by any other means. With the reaching of this decision I started to design a C. W. set, both receiving and sending, incorporated in a desk that would be an attraction in one's library or living room and be of value as a manual training project. It can be built complete for about $250, exclusive of labor cost, but inclusive of the motor generator set.

Before I reached a decision as to the hook-up, I had interesting conferences with Mr. Noonan, of the Western Radio Electric Co., and with the data and good advice received from him, I built the set which developed into the one illustrated and described in this article.



Wiring Diagram of Set



Front View of Set

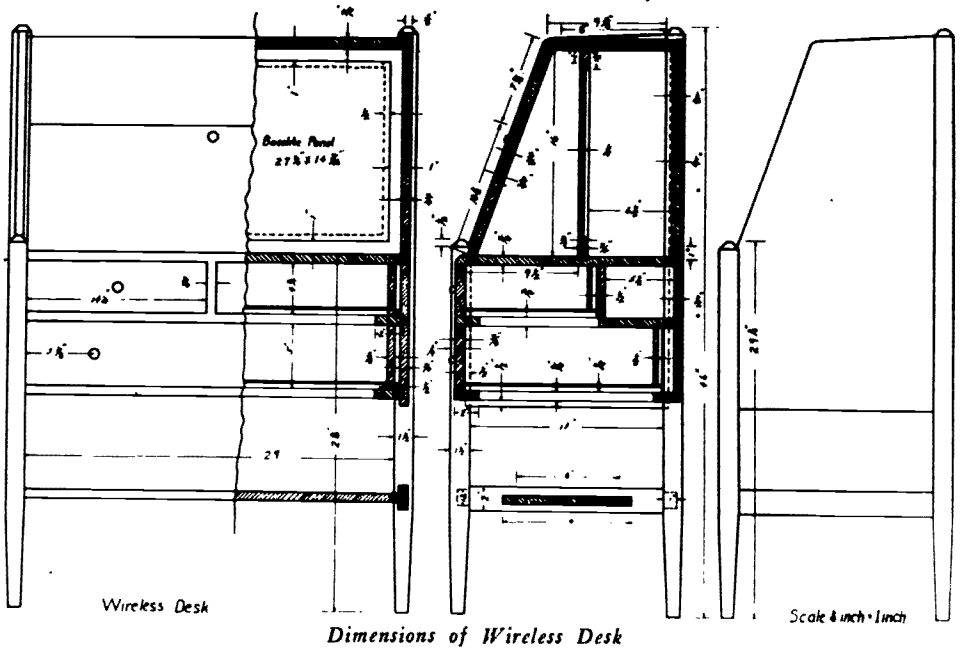


Rear View of Set

The tuning element consists of an especially built variometer having very close spacing between stators and rotor. One stator has 36 turns tapped every 6th turn; the other 36 turns tapped center and end. On the high wave side of this variometer we fasten a three inch tube that has been bank wound four layers deep, 20 turns to the layer, tapped center and outside end. The inside end of this coil is soldered to the high wave end of the stator winding, making one continuous inductance. The rotor has 18 turns on each side. All windings should be of No. 22 d. c. c. magnet wire. Do not use more shellac than is necessary to hold the winding in place.

A wiring diagram of the entire set is shown herewith. The rotor is used

Continued on page 56



Dimensions of Wireless Desk

Why, the Cage Antenna?

By J. B. Dow, Ensign U. S. N.

A NUMBER of experimenters have come forward from time to time in the past with spontaneous outbursts of pretentious literature aimed to encourage the use of cage antenna systems as a means of promoting greater efficiency, increased range, etc., *ad-infinitum*. These outbursts have come from experimenters, young and old, and many readers, amazed at the wonders of the "new" type of antenna, have discarded the more efficient flat top in favor of the most artistic cage.

Ah! gentle reader, aren't they artistic, and isn't that the reason our Navy Department adopted them for their potent dreadnaughts? Wrong, decidedly so, and in matter of explanation, let us drop back a few years. Some will recall, others (including the author) must resort to history. Marconi in his early experiments found that by suspending a single vertical wire in the air and connecting it to an induction coil et cetera, he could send signals which could be received at a distance with no intervening wires, upon a similar vertical wire connected to an arrangement of apparatus which he called a receiver. He also found that the higher the point of the suspension for this vertical wire, the greater the distance he could transmit signals. But he soon reached a limit, for even in those days yon trees were not so high.

He found further, that by using two or more vertical wires instead of one, a greater range could be covered. These vertical so *found themselves* arranged around the peripheries of hoops spaced at intervals. Hence, the cage antenna.

For quite some time the cage reigned supreme until it was discovered that the effectiveness of an antenna system was dependent upon the height of the center of capacity, the capacity, and the resistance. This brought forth other types including the flat top which, because of superior performance, soon placed practically all the others into the discard, so where directional qualities are either desirable or not looked upon with disfavor the flat top aerial has held its place in the field of good engineering.

As radio engineering progressed thru the first decade of its history under the able guidance of Marriott, Lowenstein, Hertz, Austin, Pickard, Stone, Kennelly and a host of others, and its scope of utility increased, other influences began to bear. Not the least important of these influences were those of the tacticians who sought to develop the military usefulness of radio.

The cage antenna came back, not as a more efficient device, for the story goes quite the contrary. Some thoughtful tactician discovered that a single shell from the gun of an enemy could cut down all wires in a flat top antenna. He also discovered that if one wire of the ordinary flat top antenna was severed, the ends would surely fall, grounding the remaining portion of the antenna in the rigging or on deck. Yes! the cage came back to its own as a military expedient to overcome the first difficulty because of its physical make-up and the second by virtue of the "hoops" placed at intervals along the cage.

WHY IS IT?

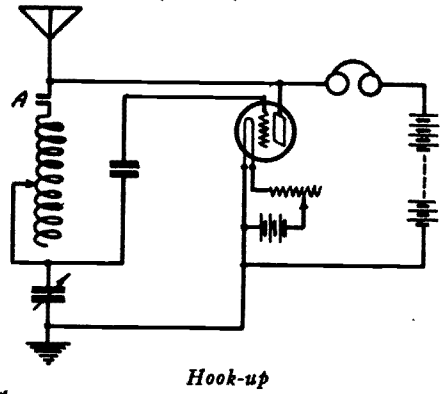
Why is it that every U. S. Navy arc station has to fizz and spit and ding and dong and clong and bang and buzz and hiss and beller and wail and pant and rant and howl and yowl and grate and grind and puff and bump and click and clang and shug and moan and hoot and toot and crash and grunt and gasp and groan and whistle and wheeze and squawk and blow and jar and jerk and rant and jingle and twang and clack and rumble and jangle and ring and clatter and yelp and howl and hum and snarl and puff and growl and thump and boom and clash and jolt and jostle and shake and screetch and snort and snarl and slam and throb and crink and quiver and rumble and roar and rattle and yell and shriek like hell on every wavelength from ten meters up to infinity, and then can't get their traffic through?

A VICTIM.

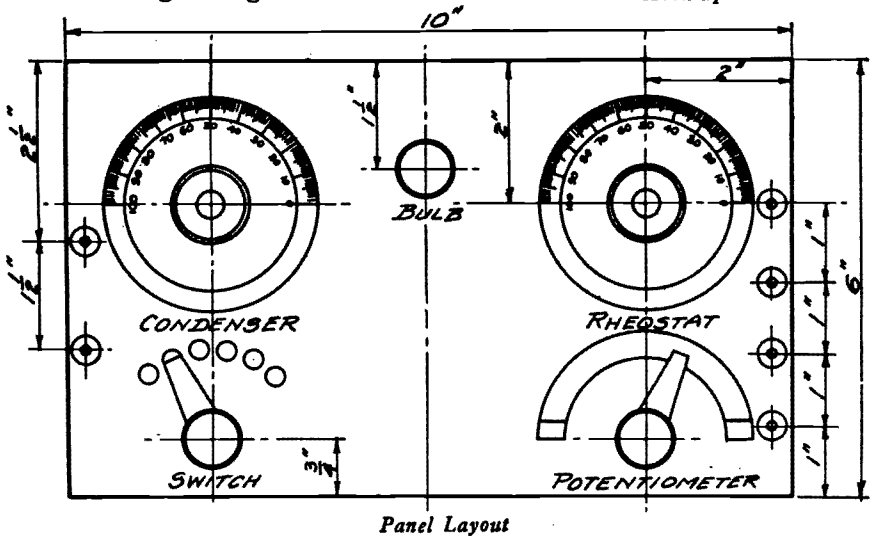
SHORT AND LONG WAVE RECEIVING SET

By CHAS. L. BARKER

The average amateur does not have the money necessary to buy or build the equipment for a set that regenerates, oscillates and detects over the entire range of 175 to 25,000 meters. The set which I am describing has been built and it is very efficient for arc and spark on long and short waves. As to fone music, 2XB, KDKA, WJZ, KYW, 6WV, 9ZAF, 3ZA, 9XM and others have been copied here in Iowa with only detector. For long waves European stations come in QSA with only one step.



Hook-up



Panel Layout

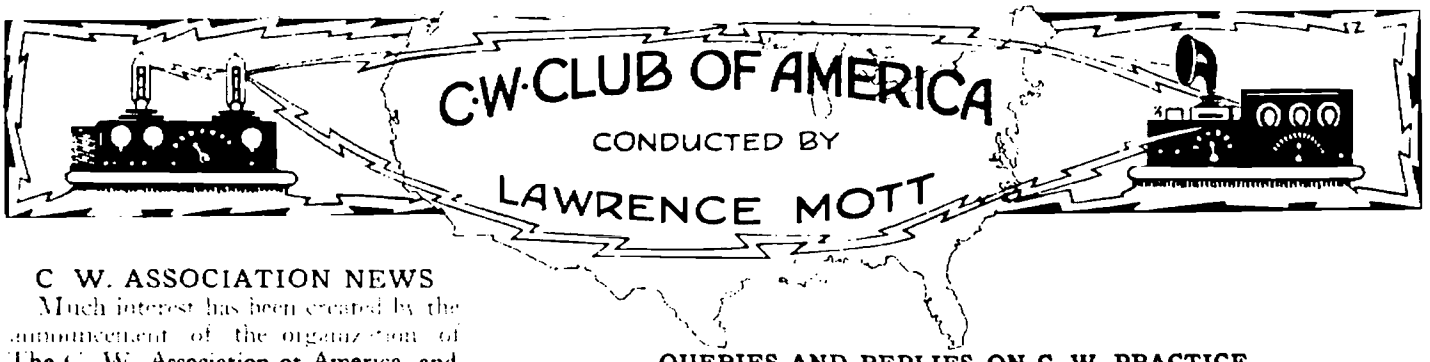
The following is a list of material needed:

1 Formica panel 6x10x3/16. 2 dials and knobs.
1 Formica tube 3½x4. 1 rheostat.
1 23 or 43 plate condenser. 1 bulb and socket.
1 switch, 1½ inch radius. 6 binding posts.
1 potentiometer with switch. 6 switch points.
1 grid condenser.
1 honeycomb coil plug for panel mounting.
1 honeycomb plug for terminals connected on back.
1 Remler tapped honeycomb coil.

The main inductance is composed of 72 turns on No. 22 S. C. C. wire wound on the Formica tube and tapper at the 20, 35, 50, 58 65, 72 turns.

As shown in the hook-up the panel mounting coil plug is connected in the circuit at A. In using long waves the big honeycomb coil is inserted and for short waves the plug with the terminals connected on the back is used.

The remainder of the details are so simple that no explanations are necessary.



C W. ASSOCIATION NEWS

Much interest has been created by the announcement of the organization of The C. W. Association of America, and many applications for membership have already been received by Secretary G. G. Griffeth. The board of managers have drafted a complete constitution and by-laws and are selecting vice-presidents for each of the nine radio districts. J. B. Dow, 6ZAC, is acting vice-president for Hawaii, and E. T. Jones, radio inspector for the U. S. Shipping Board at New Orleans, is vice-president for New Orleans.

The other officers are: President, Lawrence Mott, 6XAD, Avalon, Calif.; secretary, G. G. Griffeth, 6AA, 625 Sheldon Bldg., San Francisco, and treasurer, H. O. de la Montanya, 6AUL, Oakland, Calif. The board of managers is made up of A. H. Babcock, 6ZAF, G. M. Best, 6JX, L. B. Benjamin, 6XAQ, W. W. Lindsay Jr., 6ALE, J. J. Karr, 6ZA, and H. L. Gooding, 6ZZ.

The objects of the club are "the advancement of the theory and practice of radio communication by means of continuous waves. Among the means to this end shall be the encouragement of experiment and investigation by mutual exchange of experience and assistance. Furthermore it is intended to provide a medium whereby the government can be assured a reserve personnel thoroughly trained in radio communication should national emergency require."

Any person who is interested in or connected with the study or application of radio communication is eligible for membership. The initiation fee is $2.50, the dues are $3.00 per year. Among other advantages, members are entitled to service from the association's advisory engineering staff without charge, this staff consisting of G. M. Best, chairman; A. H. Babcock, R. C. Tavers and Ralph Heintz.

Lawrence Mott,

Reference your letter January second please accept congratulations on your most remarkable achievement on transmitting across the continent with but twenty watts power on wavelength of two hundred ten meters. Astonishing results like these compel all radio engineers to seriously modify their views in regard to radio transmission and foreshadow in the near future great developments both in pure radio and in long radio messages.

GEORGE O. SQUIER,
Major-Gen. Chief Signal Officer,
U. S. Army.

QUERIES AND REPLIES ON C. W. PRACTICE

By Gerald M. Best

Questions submitted for answer in this department should be typewritten or in ink, written on one side of the paper. All answers of general interest will be published. Readers are invited to use this service without charge, except that 25 cents per question should be forwarded when personal answer by mail is wanted.

Question: Please publish a regenerative circuit with detector and two stage amplifier, using filament control jacks.

W. B., Redding, Cal.

Answer: The circuit requested is shown in Fig. 1.

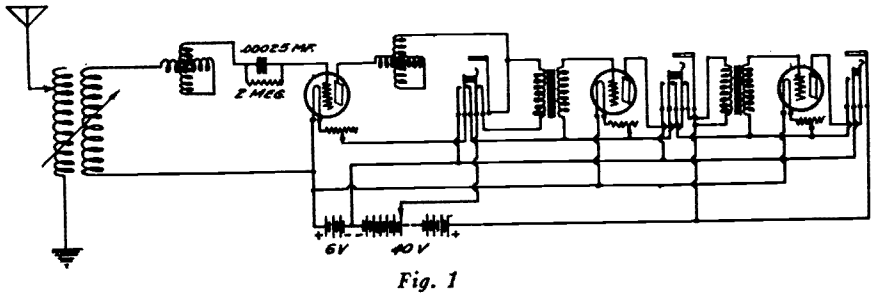


Fig. 1

Question: I am sending you a drawing of my 50w C. W. set. I cannot get it to work. I have tested out all parts and found them working. When the tube is connected to the set, it doesn't light. Please tell me what is wrong.

P. B., Quincy, Calif.

Answer: Your circuit appears to be correct, but your sketch does not show the apparatus very clearly. If possible, the plate voltage should be kept off the antenna circuit, and Fig. 3 shows a method of accomplishing this. If your tube is O. K. when tested, and yet doesn't light when placed in the set, you have trouble in your wiring, and the best method of detecting the trouble is to start at the source of filament supply and by means of your a.c. voltmeter check each wire in the circuit until you find the defect.

Question: Will you please tell me where I can buy a book on the construction and operation of radiophones or plans for making same?

B. L. T., Exeter, Cal.

Answer: The Radio Corporation has recently published a very good book on this subject. It may be purchased for 25 cents, either direct from the publisher, or from your nearest radio supply house.

Question: D. D. M. requests the dimensions and winding data for a C. W. power transformer to supply two 50 watt tubes, using the Hartley self rectifying circuit as was illustrated in December RADIO. Also the data on 3 millihenry chokes for the plate circuits or his two transmitting tubes.

Answer: Based on the assumption that core iron is available, a core of the di-

Continued on page 50

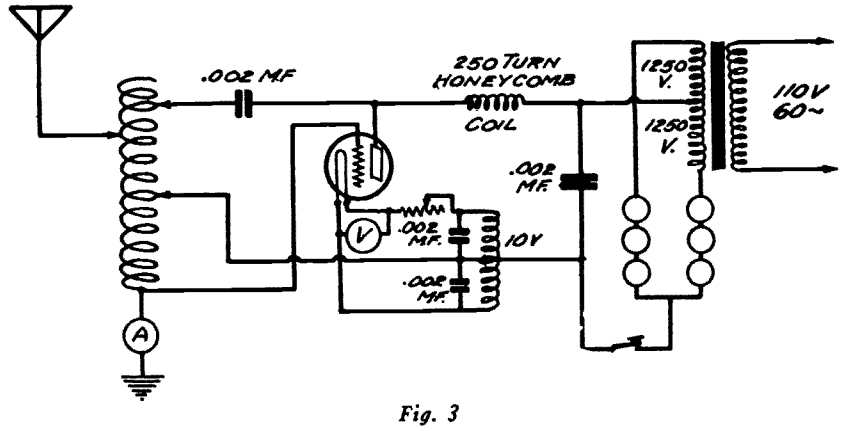


Fig. 3

Numerous Stations Heard by 6ZAC, Hawaii

So much interest has been created by the reception of radio signals by Clifford J. Dow, 6ZAC, at Wailuku, Maui, Hawaii, as reported in February RADIO that additional logs are here reproduced. Inadvertent omission was made of a number of reports including 6ZAF at Berkeley, Calif., and 6ZB at San Diego, Calif, 5ZA at Roswell, N. M., also reports that the log of messages quoted from 5QA are recognizable as having been transmitted from 5ZA.

Further logs received from Mr. Dow follow:

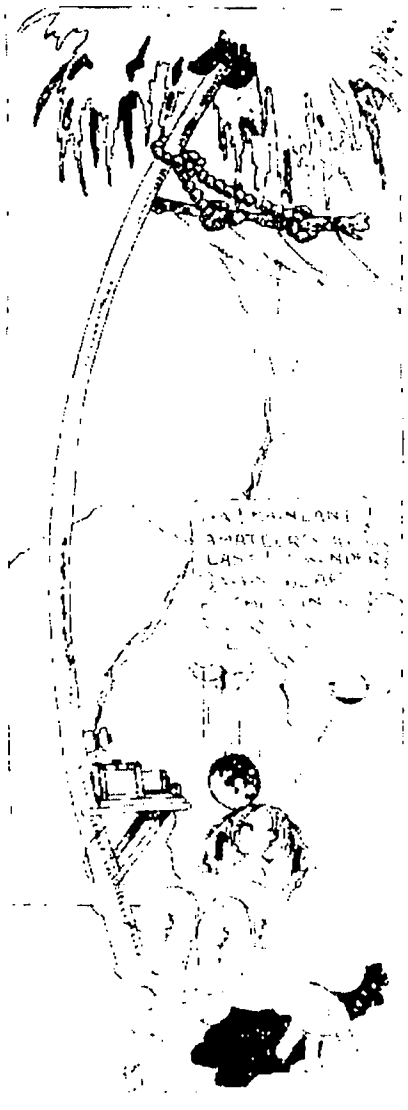
January 5, 1922.

6:30 p.m.—6ZZ de 6ZR.
7:37 p.m.—CL8 de 6ZAD.
7:39 p.m.—7MF de SC3.
7:40 p.m.—7MF de SC3.
7:42 p.m.—7PD de 7YA.
9:58 p.m.—9YAE de 7YA.
9:59 p.m.—7YA de 7ZJ. "QSQ pse."
10:01 p.m.—9YAE de 7ZJ.
10:05 p.m.—7ZJ de 7YA. "QSQ 9YAE."
10:06 p.m.—9YAE de 7ZJ.
10:08 p.m.—9YAE de 7ZJ. "QRA? QRA Mumford Bros., Vancouver, Wash. QRA?"
10:15 p.m.—9YAE de 7ZJ. "Ship QRM. Park OK. I am in Vancouver, Wash. Pse QTA ur QRA OM K."
10:22 p.m.—9YAE de 7ZJ. "Where did you say you were located? Rest OK. U very QSA when QRK but QSS very slowly."
10:24 p.m.—7ZJ de 9YAE. "9YAE is Lemars . . . (QSS) . . ."
10:25 p.m.—9YAE de 7ZJ. "R U very QSA now OM. Well if I had a msg wud try one but will C U at schedule." (NPM arc in on 'em.)
10:27 p.m.—7YA de 7ZJ. "Tnx OM."
11:35 p.m.—7ZP de 9YAE. "Rpt GA Roseau to end in msg rpt GA Roseau and end."
10:45 p.m.—7YA de 7ZJ.
10:46 p.m.—7ZJ de 7YA. "OK Nil."
10:47 p.m.—7YA de 7ZJ. "Nil GN."
10:49 p.m.—CQ de 9YAE.
10:50 p.m.—7YA de 9YAE. "U say while ago QSQ 8ZP?" (9YAE QSS slowly.)
10:57 p.m.—9YAE is arranging for a test on a different aerial, 7YA to QRX for him.
11:04 p.m.—7YA de 9YAE (Very QSA nw). "Could you hear me?"
11:04 p.m.—9YAE de 7YA. "GM 73." (Unsaid if heard him or not.)
11:07 p.m.—CQ de 9YAE.
11:08 p.m.—9YAE de 7ZJ. "GM 73."
7ZJ de 9YAE. (Very QRZ now, can just hr him in.)
9YAE de 7ZJ. "Sorry ship QRM. You very QSA tho'."
11:11 p.m.—7ZJ de 9YAE. "R Very QSA OM. Did you say you heard me often?"
11:13 p.m.—9YAE de 7ZJ. "Tnx OM 73."
7ZJ de 9YAE. "R 73 was glad to work you. C. U. again CUL."
11:15 p.m.—9YAE de 7ZJ. "QRD Hay, GM."
7ZJ de 9YAE. "GM. dit dit dit dah dit dah."
11:16 p.m.—CQ de 9YAE.
11:19 p.m.—CQ de 7ZJ. (Too many CQ's for me, so G. N.)

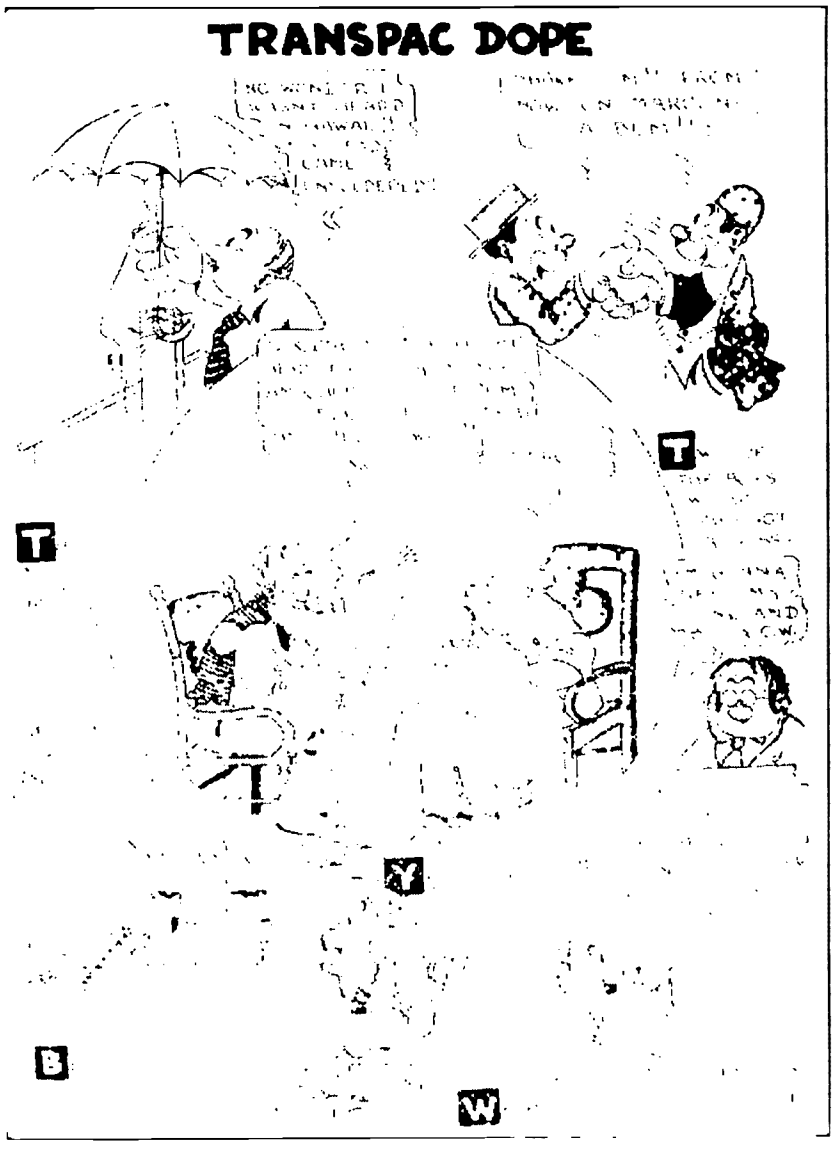
January 6, 1922.

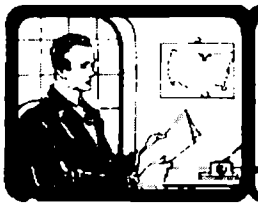
6:00 p.m.—4CB de 7ZT.
6:15 p.m.—Phone just finished "Over the Waves." Music fairly QSA, and very distinct, but 7ZJ in most of the time.
6:19 p.m.—Phone just finished "I want to go to the Land Where the Sweet Daddies Grow!" (Very pathetic.) (Did not get the announcements of either of the above, but recognized them in playing.)
6:20 p.m.—"Hello—Hello—" (Fone talking now, but talks too fast and can't understand it all. Following are few excerpts I was able to scribble down from speech): " . . . 7YA of Boise, Idaho . . . The Country that God forgot . . . I enjoyed the nice concert also . . . (Saying Hello to a bunch of stations, presumably in QSL to their letters) . . . Pittsburg . . . Hello . . . Modesto, Calif. Hello . . . Santa Clara . . . Hello Dr. . . . Petaluma . . . Hello Mr. Carter, Sacramento, Hello Carter, how's everything in Sac. . . ." (Unable to ascertain what station transmitting.)
6:28 p.m.—4CB de 7ZJ. "R Nr 2. QRU K."
6:32 p.m.—4CB de 7ZJ. "Yes, glad to work u. QSQ 7ZT on 375. Best 73's."
6:34 p.m.—? de 6ZAF. (Just got him signing off.)
6:37 p.m.—8AQF de XFI (CW).
6:40 p.m.—7ZJ de 6ZAF.
6:41 p.m.—5IF de 5XU. "Agn please, O. M. QRM bad here K."
6:42 p.m.—4II de XF1 (That's XF-One.)
6:47 p.m.—1BKQ de XF1.
6:51 p.m.—1BKQ de XF1.
6:53 p.m.—CQ de 5ZZ (Low pitched rotary, very QRZ).
7:03 p.m.—CQ de XF1.
8:07 p.m.—9UU de XF1.
8:12 p.m.—9OX de XF1.
8:15 p.m.—9XI de NOF (ICW?). "R Tnx. QRA NSF Washington, D. C. QTC?"
8:16 p.m.—9XI de NOF. "QRA Washington, D. C. NSF QRU NSF QTC?"
8:18 p.m.—9XI de NOF. "73 G. M. LC."
8:22 p.m.—5ZZ de 5XU. "1421 Laura Ave., Wichita, Mich. Now HW?"

Continued on page 49



Ye Skeptics' Mental Vision of Hawaii Hearing the Mainland





With THE U-S-Radio Inspector

CONDUCTED BY MAJOR J.F. DILLON

A MONTHLY DEPARTMENT OF INFORMATION FOR OUR READERS



Questions and Answers

Question: What is the largest antenna system that is allowed for work on 200 meter wavelengths?

K. L. B., S. F., Cal.

Answer: In general, an inverted L antenna of four wires should never exceed 120 feet, over all, including flat-top, lead-in, and ground lead. A T type antenna may have a slightly longer length of the flat-top, but a total length, as computed as a total of the parts mentioned above, should be 120 feet, or less. In most cases, however, much better results will be obtained by using a smaller antenna, and adding inductance in the secondary of the oscillation transformer, than by using a very large antenna, and very few turns in the secondary. For maximum efficiency the total length should not exceed 80 to 90 feet, overall.

Question: May two brothers obtain two licenses and two call letters for the same station, and use their own call letters when working?

T. Y. O., Elko, Nevada.

Answer: It is not the policy to issue two licenses to one station for the same class of service. If two brothers wish to operate a station, they both must have operator's licenses, and the station license may be made out in the name of one brother, or in the name of both, if they make application for the same, when the license is applied for. The different operators may indicate their operation by adopting a personal "sign," of two letters, which will indicate who is operating.

Question: What advantage has a "cage" antenna over one of ordinary type?

Y. I. L., Oakland.

Answer: Generally, there is no advantage, except that the cage, so-called, is easier to construct than the flat-top type, and may be, if properly constructed, better, and stronger, and able to withstand windstorms better. The type used by the Naval Stations is simply built up in its present form to act as an additional protection in battle. If a cage antenna is damaged by gunfire, it will have to be shot away, or have all wires cut before it would drop to the deck, while with the ordinary type, the cutting of one wire will render the antenna useless, due to its immediate grounding, when the loose wire hits the steel deck. A cage antenna, due to the number of "hoops" does not allow the wire to drop in this manner, unless all wires are severed.

Question: Is the filament current counted as "power input" when figuring the power supplied to a C.W. transmitter?

H. K. L.

Answer: According to general custom, the filament current is not counted as the power supplied to a tube set, altho strictly speaking this is incorrect. If the over-all efficiency of the set is to be included, the filament current should be included.

Question: May amateurs operate on a wavelength below 200 meters, and can they play music if this does not interfere with others, on, say 150 meters?

Answer: Amateurs may transmit on wavelengths below 200 meters. They may not, however, play music, or broadcast concerts, etc.; this class of work can only be handled by a limited commercial station, on a specially assigned wavelength.

NOTES FROM THE RADIO INSPECTOR

Ship operators who have been disconnecting the regular receiving equipment of their stations on show board and installing miscellaneous private apparatus are cautioned to discontinue that practice and to conform to the regulation which reads:

"The apparatus shall not be altered or modified in respect of any of the particulars mentioned in the schedule submitted with the application, except with the approval of the Secretary of Commerce."

Hence, before any change effecting the installation is made, except in an emergency, the Radio Inspector should be consulted and his approval obtained.

Under date of January 11th, the Assistant Secretary of Commerce authorized the insertion of the following on all general and restricted amateur radio station licenses:

"This station is not licensed to broadcast weather reports, market reports, music, concerts, speeches, news or similar information or entertainment." Signed by C. H. Huston, Assistant Secretary of Commerce.

All licenses issued from the radio inspector's office in the future will contain that insertion and the operators of all amateur stations should govern themselves accordingly.

The Bureau of Navigation suggests the following general idea of what may be considered "broadcasting" as it relates to radio communication:

"The transmission by radio telegraph or radio telephone of any message, communication or signal for the information, entertainment or instruction of the public, not sent to or intended for the use of any particular party or radio station."

Limited use can be made of phonograph records for testing purposes only, in stations licensed for experimental use, where such tests are solely for the scientific development of radio apparatus.

Because of the rapid development of radio broadcasting during the last three months, the value of such service to the public and the limitation of wavelengths which can be assigned for this service, it has been found necessary to take precautions to protect the broadcasting service from interference.

It was decided first to regulate broadcasting by the larger stations by requiring special authority to do so on special wavelengths.

It later became apparent that some restriction must be placed on amateur stations, and the privilege of amateur broadcasting was temporarily withdrawn pending the adoption of a plan which would be acceptable to the amateurs engaged in radio telegraphic communication.

Two plans have been suggested. First, the use of 200 meters between certain hours each day; second, the use of the wavelength of 175 or 225 meters for broadcasting only.

If the second plan is agreed upon with the wavelength of 175 meters, this authority could be given in the ordinary amateur licenses.

The use of 225 meters will require special licenses.

The bureau would like to have any practical suggestions from radio inspectors and amateurs which will be helpful in reaching a satisfactory solution of this question.

THE VALUE OF CO-OPERATION

By J. F. DILLON

Is the mutual assistance and co-operation of citizen operators and the radio inspectors of the Department of Commerce essential to the effective co-ordination of amateur communication in the United States? Is so, how can it best be effected in order that the operators of amateur stations may derive the maximum return from their investment of time and money, in pleasure and experimental knowledge?

From the view point of the inspector, the experience of the past several years would seem to justify an affirmative answer to the first question, beyond any possible doubt, for without the active co-operation and assistance of that splendid body of young men constituting the advanced amateur class, the maintenance of and semblance of order or decorum in the ether would be exceedingly remote and discouraging, to say the least.

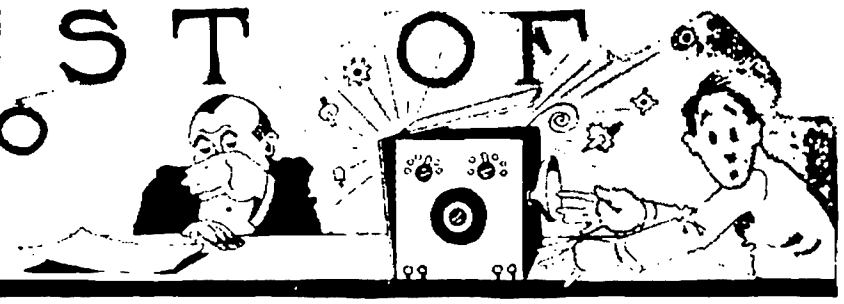
The writer became a confirmed convert to the co-operative plan soon after entering the radio service, in 1912. Upon assuming supervision of the Eighth District with headquarters at Cleveland, Ohio, I found the amateur situation in a chaotic condition from which it seemed impossible to rescue it. About the second day of my incumbency several young gentlemen from the amateur ranks called at the office, and after discussing the general situation, proffered their assistance in adjusting matters. Briefly, within a few days the perspective was changed from one of gloom and discouragement to hopeful cheerfulness, and I may say that the warm friendship resulting from our pleasant association and intercourse has endured through the passing years.

However important the understanding between the inspectors and the amateurs may be regarded, co-operation of operators themselves is equally important and essential. If polite courtesy is regarded as indispensable in the transaction of ordinary commercial business, it is doubly so in the conduct of amateur or radio communications. So intimate is now the connection between all radio communities and centers of activity, that the scientific progress of one group is sure to reflect more or less on the other; also, any serious infraction of the traffic rules in force must affect every receiving station within the range, in direct proportion to the strength of the interfering signals.

The problem of organizing the operators of the various communities into clubs for mutual help and co-operation must, necessarily, be solved by the citizens who are chiefly concerned. It ought not be difficult, however, to convince any intelligent person that such co-operation is vitally essential to the welfare and progress of amateur communication in their zone. The authors of the existing regulations contemplated the co-operation of all amateurs, for they stated clearly that "It is not the intention of the Dept. of Commerce to continue in force the license of any person who maliciously interferes with the communications of other operators, nor those who refuse to larger group, whose motto was to Let George recognize the rights of others to the ether circuit."

Continued on page 47

DIGEST OF RECENT RADIO PATENTS



Prepared by White, Prost & Evans, Patent Attorneys, San Francisco, who have been particularly active in the radio field for many years, and from whom may be obtained further information regarding any of the patents listed below.

Cornelius D. Ehret, Pat. No. 1,400,591; Dec. 20, 1921. Electrical wave transmission.

A wireless telephone transmitting system is described, in which there are radiations only when the telephone transmitter m is actuated by sound waves. This is effected by interposing an oscillating tube O between the antenna R and the telephone circuit, which tube receives all its energy by way of the telephone circuit; that is, there are no batteries in the plate circuits of the oscillator. The result is that no oscillations can be produced except when the telephone circuit is active. The oscillator O is made to produce waves of a frequency suitable for radiation, and these waves have amplitudes varying in accordance with the sound waves transmitted by the telephone m. Amplification if desired may be had between the telephone circuit and the oscillator O, or between this oscillator and the antenna circuit.

P. C. Hewitt, Pat. No. 1,402,931; Jan. 10, 1922.

A scheme is described for producing oscillating current of controllable frequency and variations in amplitude, by means of a tube 1 having unidirectional conducting properties. This tube has a voltage impressed upon it by the source 11, and has connected across it a circuit 16, 17, 18 having capacity and inductance. By varying the constants of the circuits various effects may be obtained. The main control however is effected by electrically influencing the path of current flow in the tube by the aid of one or more conducting tubes 8 or 9 interposed in the path. The potentials impressed on these may be varied by variable resistors 23 and 25. Signaling may be effected by a microphone inductively coupled across both tubes 8 and 9.

P. C. Hewitt, Pat. No. 1,402,933; Jan. 10, 1922. Method of and apparatus for controlling electric current.

A relay or amplifier is described, using a gas, vacuum or vapor device having anode 2 and cathode 3. Supplementafy electrodes 11 and 12 are used operated from their own source 13. By influencing the flow of current through the tube, as by electromagnets 17 and 18, the current flowing in the circuit connecting electrodes 11 and 12 is correspondingly influenced. The variation in the magnetic field may be produced by a microphone 20; and the telephone 14 reproduces the variations in the sound waves influencing the microphone.

Harold Jorgenson, Pat. No. 1,402,235; Jan. 3, 1922. Oscillation generator.

A three-electrode device is described, in which these electrodes are constructed and arranged to secure high voltage amplification and comparatively high efficiency. To insure these results, the patent states that the grid 1 must be located as close to the filament 2 as it is possible to do so; the anode 3 must be spaced relatively far from the filament; the grid 1 must have a relatively large conductive surface compared to its open surface; and the impedance of the entire device should be of the same order of magnitude as the impedance of the external consumption circuit.

André E. Blondel, Pat. No. 1,400,517; Dec. 20, 1921. Recording apparatus for radio-telegraphic signals.

Reception of signals from antenna A by a vibrating galvanometer G is obtained, by mechanically tuning the period of vibration of the conductor of galvanometer G so as to be equal to that of the groups of received waves. The electrical circuit R', L', and C' are also tuned to this frequency. For beat reception, a heterodyne H may be provided in proximity to the galvanometer. In order that the damping of the received signals be reduced to a low value for the best operation of the galvanometer, the output circuit C, R, L, of the detector D should have low resistance.

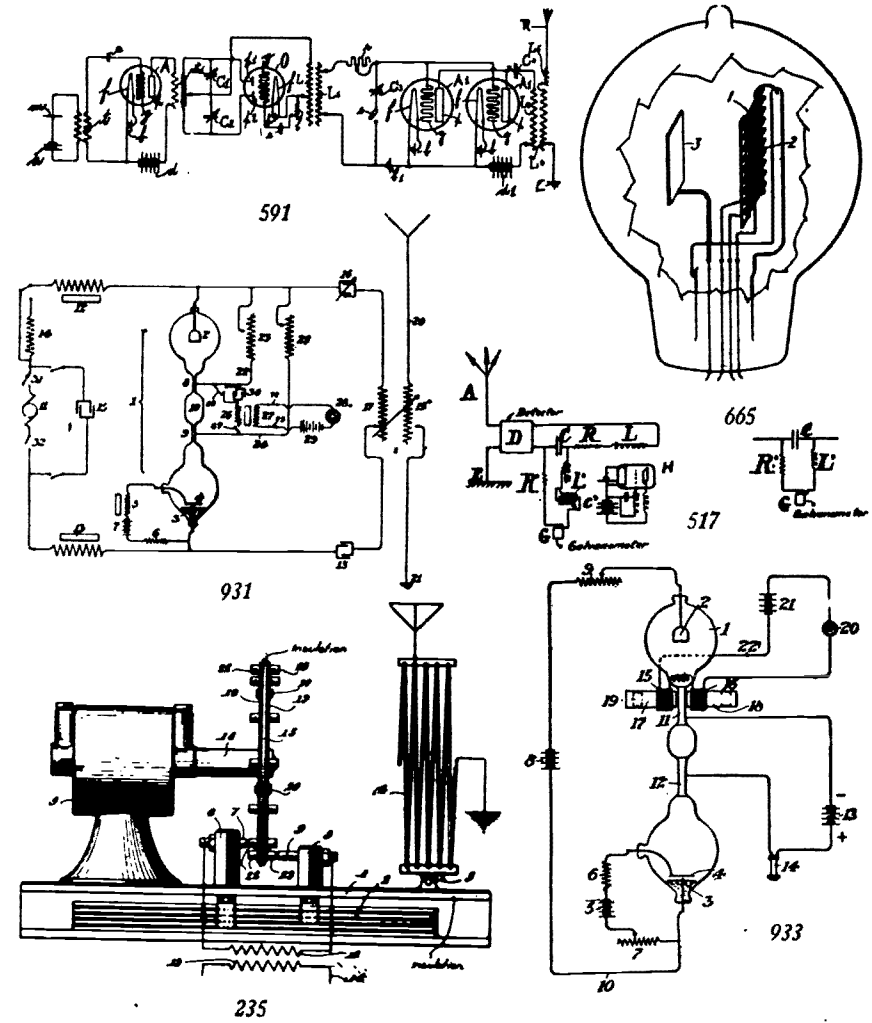
Harold D. Arnold, Pat. No. 1,398,665; Nov. 29, 1921. Thermionic amplifier.

A spark set is described, in which the rotary disc 15 carries two conducting segments 18 and 19 which are in series to form the primary coil for the coil 4. This latter coil is adjustable on pivot 5 and is adapted to be connected to an antenna circuit. The segments 18 and 19 also carry the spark electrodes 22 and 23 which pass between the stationary electrodes 7 and 9 as the motor 3 rotates. The patent states that due to this arrangement, the apparatus may be very compactly arranged.

Ernst F. W. Alexanderson, Pat. No. 1,400,847; Dec. 20, 1921. System of radio communication.

A system is described for maintaining the frequency of the radio waves transmitted from antenna 1 so nearly constant that the reception of these waves by the heterodyne system may be recognized as a musical tone of fairly constant pitch. This is secured by maintaining the speed of alternator 3 constant, by proper control of the driving motor 9. This motor is fed from mains 10 in which are interposed the coils 12. These coils are wound on iron cores 11 which have other windings 13 fed from a direct current source

Continued on page 51



MONTHLY BROADCAST OF RADIO NEWS

One out of every six homes in Pittsburg, Pa., is reported to have a radio receiving set.

The new radio regulations of the Canadian Government are expected to allow amateurs to use a wavelength of 200 meters for spark and 250 meters for continuous wave transmission.

To make it harder for bootleggers and other criminals, Sheriff Matt Starwich of Seattle, Wash., will soon be able, with the use of radio phones, to direct his men in armed automobiles as far as a hundred miles away. An electrical expert has installed two sets of phones on two automobiles, with one phone in Starwich's office. The cost will be approximately $2000, which, Starwich says, will be saved in greater efficiency and telegram bills.

Tests substituting automatic wireless signals for SOS signals have been so successful that it is predicted that the familiar SOS soon may disappear. The tests, which have been entirely satisfactory within a radius of 100 miles, are now being made over longer distances. The principle is an automatic signal with a four second beat repeated three times instead of using the old Morse code. The beat when given on a sinking ship rings an alarm bell on vessels within reach in such a way that it is really an automatic alarm. The important advantage over the SOS is that it won't enter other signal combinations and cause confusion. Ten English vessels are already equipped with the new alarm and twenty-five more are being fitted. The vessels are in different fleets in order to conduct experiments in the widest possible range. Two stations—North Foreland and Niton on the Isle of Wight— will be fitted up with the alarm systems.

Washington housewives now get "tips on the food market" by radiophone from the Department of Agriculture. The service consists of information secured by "listening in" on a general grist of market produce news broadcasted by wireless all over the country. Local papers print pictures of women "wising up" in their kitchens before starting out for the grocery and the butcher shop.

The information available concerns the prices charged by wholesalers to retailers so that the consumer who has her own radio installation knows whether the prices charged her are exorbitant or otherwise. Installations must be supplied by those who want the service.

The exchange of news between Oregon Agricultural College, and the University of Oregon in the future will be made by wireless. Steps have been taken to connect all the colleges on the coast using the Pacific Intercollegiate News Service by means of the wireless. O. A. C., University of Oregon, Stanford, and the University of California now have radio outfits.

OBITUARY



Arno A. Kluge

Died, in Los Angeles, on New Year's Eve, 1921, Arno A. Kluge, at the age of 23 years. It is with deep regret that we chronicle the passing of so promising a young man at such an early age. Born at Ravenna, Neb., where he had his early schooling, finishing high school in 1916, when he removed to Lincoln in the same state for the purpose of attending the university. He had two years of that work, during which he also served as instructor in the Signal Corps of the U. S. for drafted men from Nov., 1917, to July, 1918. In Jan. of the latter year he had his first break-down, and came on to Los Angeles in Sept., disabled by paralysis. In March, 1919, after a stay of five weeks in the hospital, he came home in a helpless condition and was always thereafter confined to his chair when about the house.

Wanting to do something for himself, he engaged in the sale of radio apparatus, often assembling sets for his customers, and built up quite a trade. He also did typewriting and wrote articles for the magazines. He had a wireless telephone, and his concerts, under the call 6XN, which had become a regular thing, will be missed greatly by his many friends.

Ellery W. Stone, formerly general manager Atlantic-Pacific Radio Supplies Co., B. F. McNamee, formerly chief engineer Moorhead Laboratories, and Edward M. Sargent, formerly chief engineer for the A.-P. Co., have resigned their connections with the Atlantic-Pacific Radio Supplies Co. and the Moorhead Laboratories. Mr. Stone is now making an extended trip through the Orient where he will do some radio work in China. Mr. McNamee is now engineer with the Roentgen Appliance Co., and Mr. Sargent has joined the Western Radio Electric Co. at Los Angeles.

Wireless telephone instruments will be installed on a number of important German express trains, and receiving instruments will be placed in hotels and embassies, according to an announcement made recently. Experiments conducted in a moving freight car have shown that the wireless system works well, the men engaged in the testing of the instruments being able to hold conversations with friends in Berlin. The tests were made under the observation of engineers, military attaches and the diplomatic representatives of the United States and Sweden. It is said that in three weeks it will be possible for travelers on express trains to reserve hotel accommodations by radio.

Ethereal music, sermons, vaudeville, lectures and personal advertising and other non-official radio broadcasting when on its way to eager listeners must vibrate at a wavelength of 360 meters. The daily weather reports, crop and market reports and other official and semi-official announcements have been given exclusive right of way on the radio wavelength, 485 meters.

This action of the Bureau of Navigation of the Department of Commerce, the government agency that has control over radio communication and which issues regulations governing radio operators and the use of radio apparatus on ships and on land, will shortly be officially announced.

The increase in popularity of broadcasting, commercially and governmentally, has caused alloting of these ether waves to these uses.

The recent Paris conference on international radio communication decided that radio telephony should be limited to wavelengths above 1550 meters and below 330 meters and W. D. Terrell, chief of the radio inspection work of the Department of Commerce, says that if this provision is incorporated in a convention adopted by the United States it will probably be necessary to change the wavelengths authorized for broadcasting.

Market reports of the Department of Agriculture are now being sent out from eight post office department wireless stations at Cincinnati, Omaha, North Platte, Neb., Rosch Springs, Wyo., Elko, Nev., and Reno, Nev. From these stations the information is sent out in dots and dashes. In addition to these there are also thirteen state and private stations which are authorized to send out this crop and weather information. Missouri state market officials have just installed a wireless telephone transmitting outfit at Jefferson City, Mo.

Licenses to use the 485 wavelength for broadcasting will be granted only when approved by the government officials in charge of distributing weather and crop reports.

The right to use the 360 meter wavelength is being granted to all stations that wish to send entertainment or other matter broadcast. In many localities this promises to cause ether mix-ups. Operators will be forced to get together and parcel out sending time in order that those listening in may receive their messages.

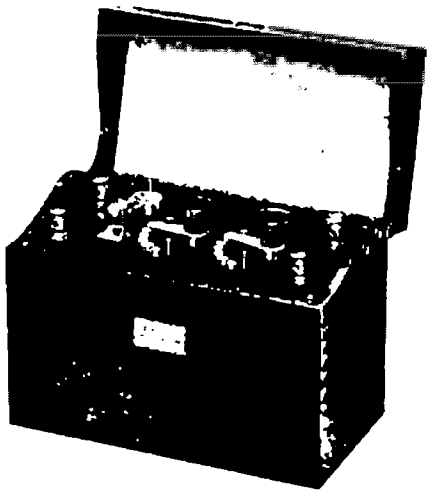
NEW APPARATUS AND SUPPLIES FROM THE RADIO MANUFACTURERS



LEMCO RADIO SET

The Lee Electric and Manufacturing Co., of San Francisco, has recently placed upon the market a self-contained crystal receiving set designed specially for the reception of radio concerts. The set is practical in every way and very attractive.

The panel upon which all the controls are mounted is of grade M Formica. The assembled panel and coil is mounted within a dust-proof, handsome mahogany finished cabinet, The cabinet is equipped with eyelets on each side, through which lead-in wires and phone cords may be inserted. This permits the cover of the cabinet to be closed while



the set is in use and wires need not be disconnected while the set is not being used. Wires can be connected or disconnected very readily.

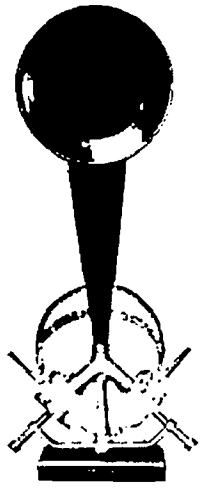
Hinges on the side of the cabinet hold the cover in an upright position. The instruction card placed within the cover is plainly visible to the operator. The detector is equipped with a sensitive mounted Radiocite mineral. The lever of the detector proper passes through a spring ball which is set in a spring clip. This gives a universal joint which permits the cat-whisker to be very easily adjusted on all points of the mineral and at the same time holds rugged enough to prevent being jarred out of adjustment.

The character of the set would appeal to those who would enjoy radio music, or desire to receive radio signals without great expense. The set is made as nearly perfect as mechanical skill will permit. With the average size antenna this set will respond to wavelengths up to 900 meters. The manufacturer also furnishes the equipment for the complete installation of the set if desired.

Acme Apparatus Company, Cambridge, Mass., in its Bulletin R, has issued a 20-page radio catalog featuring Acme transformers for all radio purposes—amplifying, spark, C. W. power, and modulation. Details are also given of the Acme amplifier and detector, anti-light blinker, choke coils, condensers, and grid coils.

A NEW LOUD-SPEAKER

A new loud-speaker, appropriately called the "Adapt-O-Phone," has just been placed on the market by J. Thos. Rhamstine, Detroit, maker of radio products. The Adapt-O-Phone uses the regular head set, the receivers being held in position against the manifold by setscrews and protected from injury by soft rubber sleeves. By using both receivers the fullest audibility is obtained, the sounds being rounded out and amplified by the horn



Adapt-O-Phone

so as to give clear, undistorted tones.

As may be noted from the picture, the Adapt-O-Phone is attractive in appearance. The base is of mahogany, the manifold is heavily plated and polished, and the horn is japanned. With the increasing custom of sending out concerts, bulletins, sermons and other messages of general interest, the need of a satisfactory, low-priced loud speaker is wide-spread, and the Adapt-O-Phone should meet with great popularity.

NEW RADIO CATALOGS

Bulletin No. 101 from the Radio Service Laboratories, Asbury Park, N. J., is devoted to Radio Frequency Transformers. This information is of value to those interested in distortionless radio frequency amplification.

RADIO TRADE NOTES

For some time past John Firth & Co., Inc., New York City, have been exclusive distributors for the famous Seibt Condensers, Capacity Meters and other precision instruments. They have now purchased all the patent rights in this Seibt line. Firco Radio products are well known to all dealers and their engineers have developed every one of their products to attain the greatest possible efficiency.

The Electric Appliance Co., 807 Mission St., San Francisco, an old-established electrical jobber, has added a radio department, in charge of H. A. Eveleth.

A new radiophone broadcasting service has been established by J. C. Hobrecht of Sacramento, Calif., on the building of the Sacramento Bee, which furnishes the news for the press service. The station was opened with a musical program from the Victor artsits and was reported as being heard as far away as Alberta, Canada. George Tett, who has charge of the radio department of J. C. Hobrecht Electrical Co., operates this new station, which broadcasts daily from 5:30 to 6:30 p.m. and on Wednesday and Saturday nights from 8 to 9 p.m.

L. B. Benjamin, president of the Southern California Radio Association, has been appointed to represent RADIO in his vicinity.

The F. E. Newbery Electric Co. of San Francisco are employing rather a novel stunt in demonstrating the wireless music received in their store by using the scientific tone chamber of the Sonora Phonograph in combination with a Baldwin phone. The quality of the music is improved immeasurably thereby. Those who are anxious to get the best results would do well to try this feature.

BOOK REVIEWS

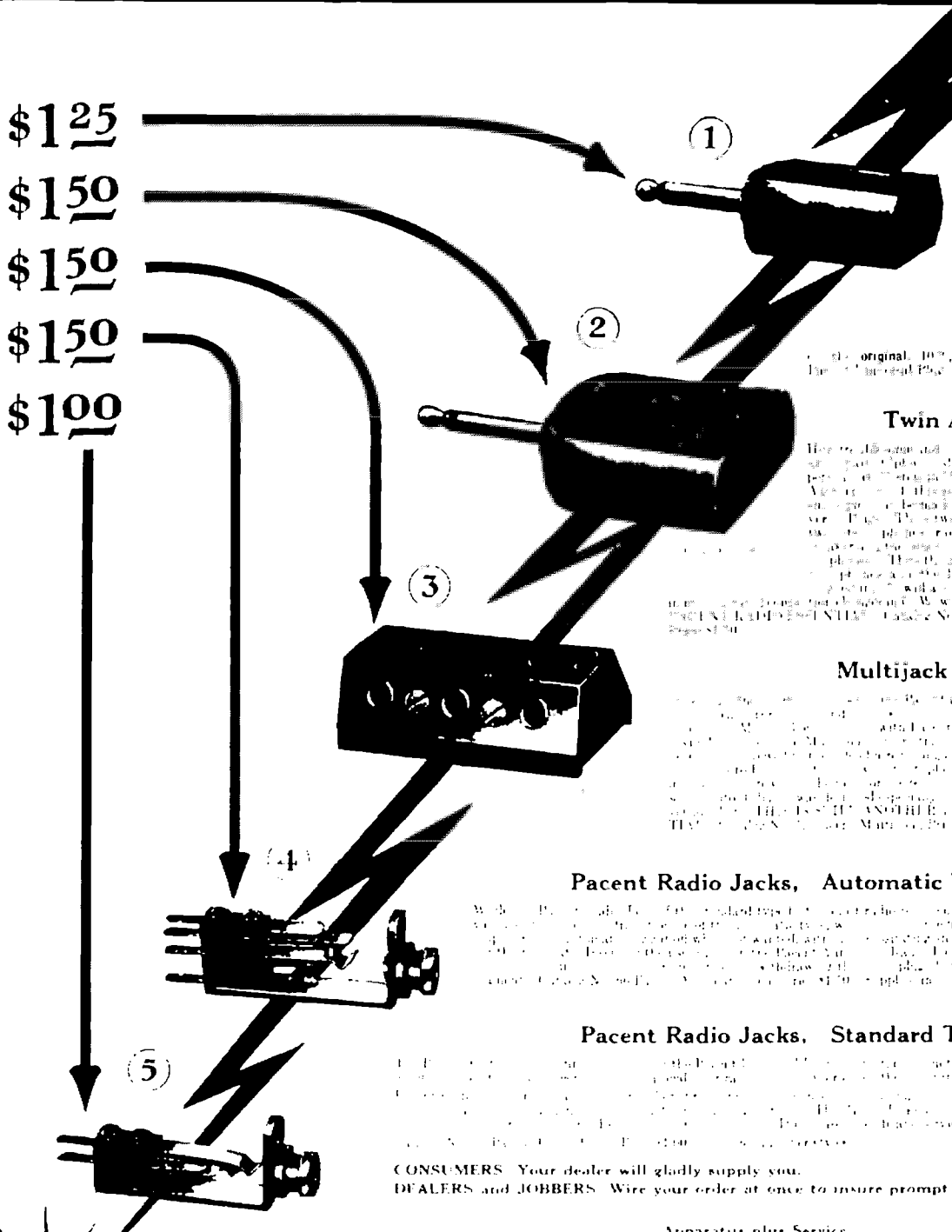
"PRINCIPLES OF RADIO COMMUNICATION"—By J. H. Morecroft, assisted by A. Pinto and W. A. Curry; 935 pages, 6 by 9; 788 illustrations. Published by John Wiley & Sons, New York City, and for sale by RADIO, San Francisco. Price, $7.50.

This is a textbook of instruction for the college student and the radio engineer and is unqualifiedly the best comprehensive text yet published. It considers the theory and practice of radio communication from the standpoint of the electron theory so as to give an excellent visualization of what is actually taking place in radio circuits. The author is associate professor of electrical engineering at Columbia University. Starting with a general review of alternating current theory underlying radio operation, he next discusses resistance, inductance and capacity in detail, illustrating his points with many experimental curves and oscillograms. Then follows an explanation of radio wave motion, written so as to be intelligible to the non-mathematician. The laws of oscillating circuits are fully developed. The theory of electron emission and the vacuum tube is treated in detail; damped and continuous wave teleg-

Continued on page 62



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Twin Adapter

Multijack

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Pacent Radio Jacks, Standard Types

CONSUMERS Your dealer will gladly supply you.
DEALERS and JOBBERS Wire your order at once to insure prompt delivery.

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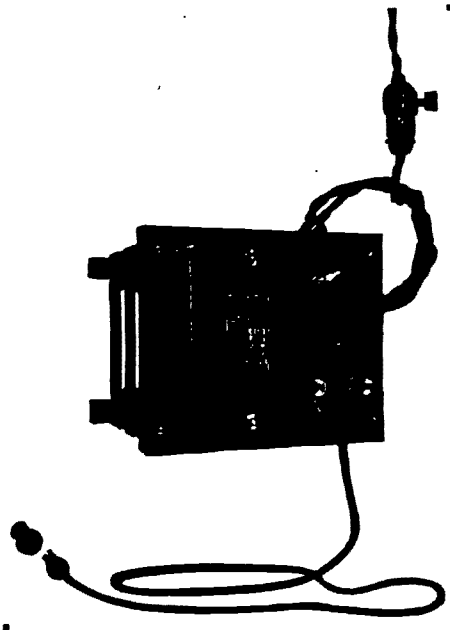
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WESTERN RADIO ELECTRIC CO.

637 South Hope Street
Los Angeles

274 Twelfth Street
Oakland

Operating Kinema Theater Radiophone—Los Angeles

CALLS HEARD



Readers are invited to send in lists of calls heard from stations distant 250 miles or more from their own station.

BY 7LR, 426 ELLSWORTH ST., ALBANY, ORE.

7bc, 7ch, 7kj, 7ln, 7ma, (fone), 7mh, 7mw, 7mi, 7mu, 7nn, 7nl, 7re, 7sv, 7tb, 7th, 7ts, 7xf, (fone), 7xc, (fone), 7yi, (fone, sp and cw), 7ya, 7ys, 7yg, 7st, 7sm, 7aai, 6ah, 6af, 6aa, 6ar, 6eb, 6gr, 6ht, 6hf, 6if, 6iw, 6lw, 6mi, 6nn, 6nw, 6ta, 6tf, 6tt, 6tn, 6oh, 6rc, 6uu, 6lv, 6tw, 6wj, 6so, 6wv, (fone), 6jw, (cw), 6ale, (cw), 6xad, (cw), 6abw, (acw), fone's, 6xg, 6xd, 6xw, 6xac, 6xak, 6xae, 6xaj, 9amb, 9bd, (Canadian), 9by, 9yb, 9xaf, 9ax, 5za, 5br, 5xf, 2fp, (cw), 2tt, Ibds, (cw).

BY 7TT, JAN. 1st to 20th, CANADIAN, 4CB, (CW), 9AX, 9BD.

Spark—6acr, 6xv, 6qw, 6ws, 6abw, 6sr, 6zk, 6zal, 7bh, 7bk, 7br, 7fc, 7fl, 7in, 7jd, 7mf, 7rb, 7rn, 7ru, 7tj, 7xd, 7ya, 7xm, 7sp, 7ss, 7su, cw or fone 6ale, 6xac, 6xad, 6xaf, 6xg.

BY 6EA, H. C. SEEFRED, 243 SOUTH FREMONT AVE., LOS ANGELES, CAL.

Heard—2fp-cw, 5xu, 5za spk and cw, 6fh, 6gr-icw, 6gt, 6jj-icw, 6jx-icw, 6km, 6oh, 6pj, 6to, 6tv, 6uc, 6vm-icw, 6xa-icw, 6zk, 6zx, 6zz, 6aah, 6aau, 6abx, 6afn, 6ain, 6ale-icw, 6amk, 6asv-icw, 6avb, 6awh, 6awt-icw, 6bgh, 6xaf-icw, 6xam, 7ck, 7fx, 7hf, 7in, 7jd, 7mf, 7tj, 7ya, 7zj, 7zt, 7zu, 8rl-icw, Canadian 9bd-icw, 9bex-icw, 9bji-cw, 9dth-icw, 9dva-icw, 9nv-icw, 9nx-icw, 9wd-icw, 9xaq-cw, 9xm-cw, kdpu-cw, kdpv-cw, kdpw-cw, cl8-cw and spk, and wv6—voice and music.

Worked—6ah, 6ak—spk and icw, 6as, 6dp, 6ex, 6fk, 6gx, 6po, 6pr, 6qr, 6vx, 6zu, 6abw, 6agf, 6ang, 6aor, 6xh-icw, 7xf-cw, chopper, voice and music, 7yg, 7yj, and 9amb-cw.

BY 6EB, L. F. SEEFRED, 243 SOUTH FREMONT AVE., LOS ANGELES, CALIF.

Spark—(6ah), (6as), 6cp, (6ex), 6fh, (6fk), 6gt, 6km, 6oh, 6pj, 6po, 6pr, 6qk, 6qr, 6to, 6tu, 6tv-Ariz., 6uo, 6vk, (6vx), 6ws, (6xh), 6zk, (6zx), 6zz, (6aah), 6aau, 6abr, 6abw, (6acr), 6aei, 6afn, 6agf, 6aid, 6ain, 6alv, (6amk), 6aor, 6app, 6aru, 6ath, 6atq, 6avb, 6avv, (6awh), 6xam, 7bh, 7bj, 7cn, (7hf), (7jw), 7kb, 7mf, 7tj, 7ya, 7yg, 7zm, Canadian 9ax.

C. W.—5za, 6ak, 6aat, (6ale), 6asw, 6aul, 6gy, 6jx, 6xaf, 6xw, 6za, 6zaf, 6zz, 9amb, 9dva, 9nx, 9wd, 9xaq, cl8. All those over 50 miles who have heard my spark, drop card giving date on the three tones (high, medium and low) please. Am quitting spark for "cw." Use above address.

BY 6AOW, 469 LIME ST., RIVERSIDE, CALIF.

Spark—5if, 5xf, 5xu, 5za, 5zz, 6ah, 6cv, 6ex, 6fh, 6gr, (6gt) 6hc, 6km, 6oh, 6ot, 6po, 6pr, 6qk, 6qr, 6sj, 6tc, 6to, 6tu, 6tv, 6uo, 6vx, 6ws, 6xh, 6za, 6zk, 6zu, 6zx, 6zz, 6aah, 6aau, 6abw, 6abx, 6abz, 6acr, 6afn, 6afp, 6agf, 6ahd, 6ain, 6alv, 6ani, 6anp, 6aor, 6app, 6asv, 6ath, 6atq, 6awh, 6zam, 6bfe, 6bgh, 7bj, 7ck, 7in, 7jd, 7kh, 7ly, 7mf, 7ya, 7yg, 7yj, 7ys, 7zj, 7zt, 7zu, 7zv, 9xm.

C. W.—5za, 6gr, 6gy, 6ky, 6wv, 6ws, 6xh, 6za, 6aat, 6abe, 6ale, 6asj, 6asv, 6xac, 6zaf, 9nx, 9wd, 9amb, 9xaq, 9bbf, 9bex, 9biw, 9bji, 9dtm, 9dva, 9zaf, cl-S, ag-1, db-5, fonc 6wv, 6xac, 9zaf, kwg, kyj, db-5.

BY 6XAF and 6JX, 109 GREENBANK AVE., PIEDMONT, CALIF.

Spark—6ea, 6eb, 6en, 6fk, 6gp, 6is, 6kc, 6lc, 6mh, 6od, 6ol, 6ov, 6vz, 6zr, 6aah, 6acy, 6adl, 6agp, 6ahr, 6aib, 6aif, 6aio, 6ajr, 6akl, 6ald, 6amn, 6avr, 6awx, 6zal, 7bc, 7bj, 7bk, 7gj, 7hf, 7jw, 7kj, 7ks, 7mf, 7ml, 7mp, 7my, 7tj, 7ya, 7yg, 7zj, 7zm, 7zt, 7zw, 9ax, 9bd, (Canadian), cl8.

C. W.—5za, 6cu, 6cn, 6jd, 6ka, 6zb, 6zz, 6aif, 6aoz, 6aqt, 6asv, 6atg, 6xad, 6xaq, 7xf, 9amb, 9dva, 9xae.

BY 7BJ, VANCOUVER, WASH.

Canadian 4cb, 5ak, 9ax, 9bd, 6ah, 6as, 6aau, 6aat-cw 6abh, 6abm, 6abw, 6abx, 6acr, 6adl, 6aew, 6aeg, 6afn 6agf, 6agp, 6aic, 6aib, 6aif, 6aix, 6ale, 6alp, 6aor, 6ark, 6ard, 6atv, 6avb, 6avr, 6awh, 6axv, 6bm, 6bbr, 6dd, 6eb, 6cn-cw, 6ex, 6fe, 6fh, 6gx, 6gt, 6hc, 6is, 6iv, 6jx-cw, 6ka-cw, 6km, 6ng, 6mh, 6od, 6oh, 6po, 6pr, 6qk, 6qp, 6qr, 6su, 6to, 6tu, 6uo, 6vx, 6wz spk and cw, 6xh, 6za, 6zaa, 6zal, 6zam, 6zu, 6zx, 7ad, fonc, 7aao, 7ba, 7bc, 7bk, 7bh, 7bf, 7bt, 7bz, 7cd, 7ck, 7fi, 7ge, 7hi, 7hf, 7in, 7iw, 7iy, 7jf, 7ke, 7kg, 7kj, 7ks, 7lo, 7ln, 7ly, 7mp, 7my, 7mv, 7mf, 7mu, 7nl, 7nn, 7nj, 7ny, 7ns, 7ot, 7oy, 7po, 7tj, 7tl, 7ut, 7vo, 7vz, 7zu, 7ya, 7ys. All on 1 bulb, spiderweb tuner. All correspondence answered. Total 119 stns logged out of town.

BY 6ATN, FALLON, NEVADA.

Fones—5za, 6arz, 6aat, 6vm, 6at, 6xg, 6xd, kwd, 6xak, 6xag, gy-8, ag-1, cl-8, 6xac, 7xf, 9zaf, 7cf.

Received during daylight 6xg, 6xd, kwd, 6xac. Avalon and Long Beach fones—all with detector only.

Complete Reports of the

WASHINGTON CONFERENCE

On the regulation of radio, from our special correspondent will be one feature of the

April Issue of Radio

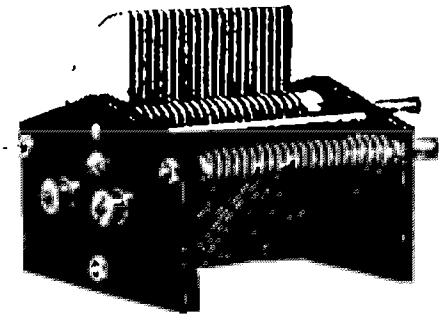
This feature alone, in addition to those announced elsewhere, will make this number of inestimable value to every radio operator.

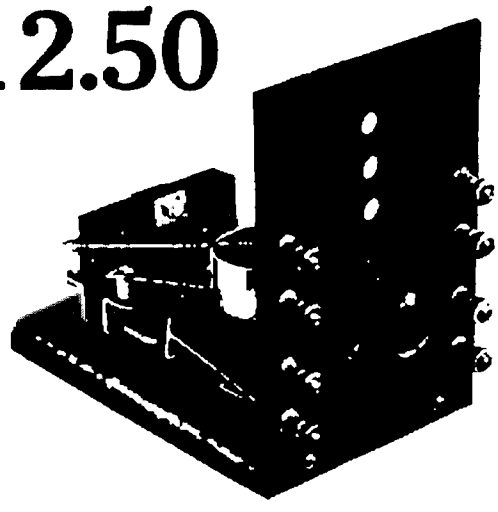
Buy it on the news stands—or better yet, send $2.00 for a year's subscription so as to insure your not missing a single number of "the best radio magazine published."

$4.60 with binding posts

"Radio supplies that R right"

$12.50





"Pen" Variable Condenser

An improved condenser at a lower price. The only unmounted condenser manufactured with binding posts—the "Pen" has two binding posts to which connection can be made without soldering. The "Pen" also has a special *adjusting screw* for stiffening the plate adjustment to prevent slipping. The best condenser of this type at any price, and priced the lowest of any—

3 plate....$2.10	11 plate....$2.60
23 plate....$3.45	43 plate....$4.60

CESCO 1-Stage Amplifier

For $12.50, the CESCO 1-Stage Amplifier is a [illegible] Made of XX Bakelite, General Radio Amplifying Transformer, Remler Rheostat, and Murdock tube socket to accommodate any standard 4-prong tube. An Amplifier that will save you money in the beginning and give you faithful, uninterrupted service to the end. Every one fully guaranteed.

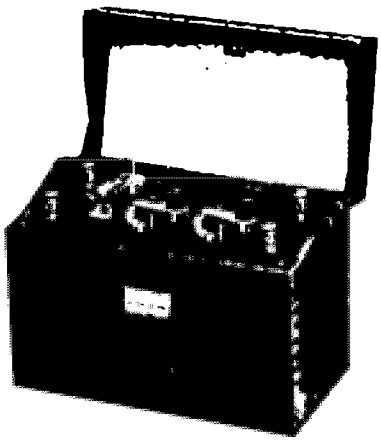
Price, mailed postpaid to any address in the U. S., $12.50
Order now for prompt delivery.

CALIFORNIA ELECTRIC SUPPLY CO.

638 MISSION STREET, SAN FRANCISCO, CALIFORNIA

San Francisco radio men—note our convenient central location at Mission and New Montgomery Streets

Announcing



LEMCO EQUIPMENT

COMPLETE LEMCO RADIO TELEPHONE RECEIVING OUTFIT

tunes to wave length up to 900 meters

No. 340A, consisting of: 1 No. 340 Crystal set (a complete self-contained, highly efficient and very selective set mounted in a very attractive mahogany finished cabinet), 1 No. 56 Murdock 2000 ohm Head-set, 150 ft. Copper Aerial wire, 4 porcelain insulators, 1 Antenna switch (2 pole double throw), and 1 Ground Clamp.

Price Complete Shipped Anywhere in the United States, $17.00.

$10.00

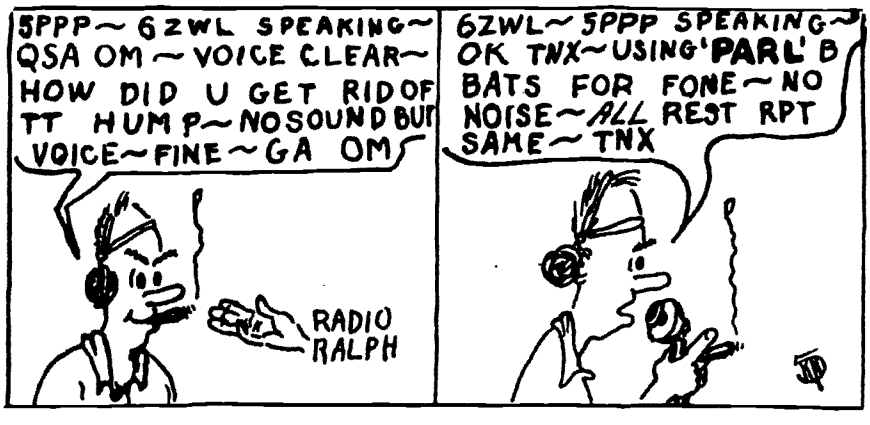
Sold on a money back guarantee. If your dealer cannot supply you order direct from this ad

Write for Bulletin No. 100L

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LEE ELECTRIC AND MANUFACTURING CO.

SAN FRANCISCO



Radio Ralph Gets Satisfaction, So Can You

BY USING

Parl B Batteries

Prices on request. Those on our mailing list have had 'em a month. Are *you* on?

PORT ARTHUR RADIO LABORATORY

PORT ARTHUR, TEXAS

PANELS

Of Gumwood Black Finish

Treated with a special process made by us. Will not Warp or Shrink and is not effected by Temperature changes. Waterproof and possesses High Dielectric properties. Easily machined and will not Crack or BREAK. Looks as good as Bakelite. We are prepared to ship promptly the following sizes:

6"x 6 "x¼" thick	$.60	9"x12"x¼" thick	$1.50
6"x 7 "x¼" thick	.75	9"x14"x¼" thick	1.75
6"x10½"x¼" thick	1.00	12"x14"x¼" thick	2.20
6"x12 "x¼" thick	1.25	12"x21"x¼" thick	3.00

Strips 3½ x 6; 3½ x 8; $.40 each; 3½ x 10, 3½ x 12, $.60 each; 3½ x 18, $.75 each .

Add Postage for 1 lb. for Panels up to 6 x 12 x¼; and 2 lbs. for larger sizes.

We will be pleased to quote prices on these panels cut to a different size on receipt of your specifications. NO FREE SAMPLES.

TENSO MFG. CO., Marshall, Minn.

U. S. STORAGE BATTERIES

For wireless use operating toy trains, motors, etc.

SPECIAL PRICES

6 Volts	40 amp	(4 Volt $7)	$10.00
6 Volts	60 amp	(4 Volt 10)	13.75
6 Volts	80 amp	(4 Volt 12)	17.50
6 Volts	80-100 amp	(4 Volt 15)	22.50

Every battery unconditionally guaranteed for one year. Shipped ready for use. Add 75 cents for special crating. 10% off above prices on orders from West of St. Louis to offset Freight rates. Dealers and Jobbers write for discounts and exclusive territories. If your dealer hasn't U. S. Batteries send money order or check direct.

U. S. STORAGE BATTERY CO.
Far Rockaway, N. Y.

Middle West Distributors
Simon Pewsner, 615 Jones St., Sioux City, Ia.

BY 9BD BARRON HOTEL, VANCOUVER, B. C.

C. W.—(4cb), (5bd), 9be-Canadians, 6ak, (6aat), (6ale), (6aif), (6awt), (6jd), (6jx), 6jj, 6xac, 6xad, 6xw, 6xg, 6sa, Avalon phone, 7dm, (7sc), (7xf), 7fw, 7ma, (dm), (rb), (cla), 9dva, 9amb.

Spark—"5's" to numerous, 6ah, 6abw, 6abx, 6adl, 6ajr, (6amk), (6agf), 6awb, 6agx, 6bm, (6ex), (6hc), 6fh, (6gx), (6oh), (6qr), 6vx, (6kl), 6ej, 6pw, (6ws), 6eb, 6aei, 6zk, 6sx, 6cp, (6xam), qra, pse, (6sx), (7bk), (7bh), (7bc), 7bg, (7bp), (7bj), 7ck, 7od, 7ed, (7fi), (7gj), 7jf, 7jw, (7hf), 7jd, 7kj, 7ke, 7ge, 7nk, (7nl), 7mu, 7nz, 7rg, 7ou, 7iw, 7cn, 7zk, (7zj), (7zm), (7zt), (7zb).

BY 7KR, DEC. 20th to JAN 13th.

4cb-cdn, 6am, 6cv, 6ex, 6fh, 6gr, 6jx, 6km, 6lc, 6ng, 6oh, 6qr, 6tu, 6tv, 6vx, 6ws, 6zt, 6zx, 6aat, 6abx, 6acr, 6afn, 6afw, 6agf, 6aia, 6aij, 6ale, 6xad, 7bc, 7bf, 7bh, 7bk, 7bz, 7cd, 7cf, 7cw, 7fi, 7ge, 7hf, 7in, 7iw, 7iy, 7jf, 7ke, 7kj, 7lo, 7mf, 7mp, 7nl, 7nt, 7nw, 7po, 7tj, 7vg, 7wa, 7yj, 7zm, 7zp, 7zu, 9ax-cdn, 9bd-cdn.

BY 6ASQ, HUNTINGTON PARK, CALIF.

5za, 5za-(cw), 6ak, 6as, 6cz, 6dp, 6eo, 6ex, 6gf, 6gr, 6gt, 6hc, 6ic, 6oc, 6pg, 6pj, 6po, 6pr, 6qr, 6to, 6tu, 6tv, 6vx, 6ws, 6xe, 6xn, 6zu, 6zx, 6zz, 6abx, 6agf, 6ajh, 6ale, 6alv, 6ang, 6bak, 6bdt, 7zu.

CALLS HEARD BY KDUK

2700 Miles West of Los Angeles on Single Tube.
8iv, 6adt, 9nx, 6aif.

BY 6ASJ, OAKLAND, CAL., JAN. 1 TO FEB. 1.

Sparks—5hk, 6at, 6abw, 6abx, 6acr, 6acy, 6adl, 6afn, 6agp, 6ahp, 6ahq, 6aib, 6aif, 6ain, 6aio, 6alp, 6amn, 6asy, 6avy, 6baj, 6bgh, 6ea, 6eb, 6en, 6er, 6fh, 6ft, 6gp, 6gt, 6gx, 6iv, 6kc, 6lc, 6mh, 6mf, 6od, 6oh, 6ol, 6pj, 6qr, 6tv, 6vl, 6wd, 6zx, 6zr, 6zal, 7ba, 7bb, 7bc, 7bj, 7bk, 7fi, 7gt, 7hf, 7in, 7ke, 7kj, 7ks, (7mf), 7mp, 7my, 7nn, 7tj, 7ya, 7yg, 7yj, 7zj, 7zm, 7zt, 7zu, coli, 9ax, 9bd (Canadian).

C. W.—5ak, 6ak, 6aat, 6aif, 6ale, (6aos)cw and voice 6atg, 6avw, 6avy, 6awv, 6en, (6gd), (6jd), (6ka), 6ky, 6rr, 6xad, 6zu, 7rn, 7xf, 7zt, 9amb.

BY 6WD

5za, 5fn, 5ae, 6ea, 6eb, 6qz, 6mu, 6is, 6bh, 6zu, 6oh, 6lc, 6zz, 6qr, 6pr, 6amk, 6ark, 6km, 7zj, 7mp, 7gj, 7mf, 7iw, 9bd, 9bz.

BY 7QL, RAINIER, OREGON.

Spark—6ab, 6af, 6ak, 6bh, 6cv, 6ex, 6gf, 6gx, 6hw, 6ix, 6km, 6mk, 6ch, 6pj, 6qr, 6ra, 6rz, 6tu, 6ui, 6xd, 6xh, 6zb, 6zk, 6zu, 6abx, 6aed, 6aag, 6aez, 6agf, 6afn, 6aid, 6alk, 6amk, 6acr, 6alp, 6atv, 6ape, 6cvk, 7af, 7ab, 7bh, 7od, 7ck, 7db, 7dw, 7eo, 7fi, 7ft, 7gv, 7bf, 7id, 7in, 7iu, 7iw, 7jf, 7ju, 7kb, 7kg, 7kj, 7kw, 7ly, 7md, 7mo, 7mp, 7my, 7mf, 7nj, 7nm, 7nt, 7nw, 7pj, 7oh, 7rs, 7rn, 7ru, 7tj, 7to, 7vo, 7xd, 7ya, 7yd, 7yg, 7yj, 7ys, 7ze, 7zk, 7zj, 7zm, 7zt, 7zs, 7bd.

C. W. and fone—4cb, 5za, 6en, 6cu, 6wv, 6xg, 6xw, 6aac, 6aat, 6ale, 6xac, 6xad, 6xaf, 6xak, 9ax, kwc, cl8 kdq, 7hw, 7th, 7tq, 7xf.

BY 6AVR

Heard on 1 tube. (Spark)—5if, 5of, 5xu, (5za), 6ah, (6as), 6ev, 6dn, (6ex), 6kc, 6km, 6oh, 6pr, 6qk, 6qr, 6sj, (6to), 6tu, 6tv, 6vx, 6vv, 6aah, 6aap, 6aau, (6abw), 6abx, 6aop, 6aeh, 6afn, 6agf, 6agk, 6aij, 6aip, (6alv) 6amk, (6ang), 6ani, 6ath, (6aor), 6atq, 6atv, 6avb, 6avv, 6awh, (6bgh), (6bgn), 6zb, (6zx), 6zs), 7bj, 7mf, 7jd, 7tj, 7ya, 7yj, 7yg, 7zj, (7zm), 7zp, 7zt, 7zu, 7zv, 9nr.

C. W.—5za, 6ak, 6ale, 6za, 6zb, 6zs, 6xac, 6xaf, 6zaf 7yj, 9wd, 9amb, 9dth, 9xaq, 9bji.

BY 7CG, NAMPA, IDAHO, JAN. 1 to JAN. 28.

Spark—5za, 6am, 6at, 6cw, 6ef, 6ft, 6la, 61c, 6mf, 6ot, 6oz, 6pr, 6qr, 6rt, 6ej, 6tu, 6tv, 6uo, 6za, 6xi, 6sr, 6zx, 6zs, 6aah, 6abx, 6acw, 6adx, 6aes, 6afn, 6ahp, 6alu, 6alw, 6ata, 6ath, 6atq, 6zai, 6zam, 7bf, 7bj, 7ck, 7dn, 7dv, (7ft), 7jd, 7lk, (7ln), 7l0, 7mf, 7mp, 7nl, 7nn, 7ot, (7py), 7qt, 7ry, 7to, 7vd, 7vo, 7vz, 7ya, 7yg, 7yj, 7za, 7zm, 7zn, 7zo, 9ee, 9nr, 9pi, 9ya, 9yk, 9yr, 9axm, 9yak.

C. W.—5za, 6en, 6ka, 6ku, 6zo, 6zi, 6aat, 6xac (Concert, fone and c. w.), 7ft, 7rn, 9ao, 9hr, 9yg, 9ays, 9bji, 9bow, 9dtm, 9xaq, 9zaf, utt5 (Concert and fone).

BY 6OM

Spark—5za, 6ah, 6as, 6bm, 6cp, 6ex, 6fd, 6fh, 6gf, 6iv, 6km, 6oh, 6pr, 6qk, 6qr, 6to, 6tu, 6tv, 6vx, 6ws, 6xh, 6zk, 6zu, 6zx, 6zs, 6aag 6aah 6aau, 6abw, 6abx, 6aeh, 6afn, 6aio, 6amk, 6atq, 6avb, 6awh, 7jd, 7mf, 7ya, 7zm, 7zt.

C. W. and I. C. W.—5za, 6za, 6acb, 6aif, 6ale, 6asv, 7cs, 8xv, 9nx, 9wd, 9amb, 9dtm, 9xaq.

BY 5CZ, 937 17TH AVE. W, VANCOUVER, B. C.

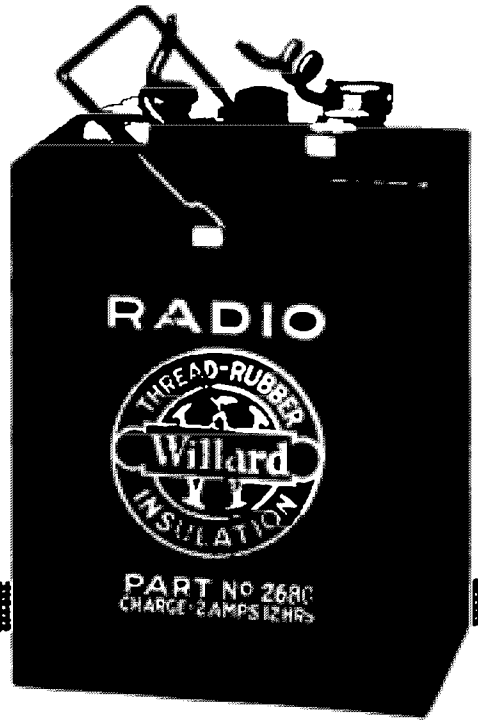
Spark—6ard, 6ki, 6kg, 6lx, 6qr, 6zam, 6zk, 6zx, 7bh, 7bj, 7br, 7bz, 7bc, 7ch, 7cn, 7ck, 7fi, 7ge, 7hf, 7iw, 7jr, 7ke, 7kj, 7kb, 7ly, 7mu, 7mf, 7mp, 7nn, 7nl, 7nw, 7oj, 7tj, 7tl, 7vx, 7vz, 7ya, 7yj, 7zj, 7zt, 7zy, 7zu, cl8. All Q. S. A.

C. W. and fone—5akt, 5au, 5en, 5za. 5zx, 6aac, 6aat. 6atg, 6ak, 6bcj, 6en, 6pp, 6vv, 6xac, 6xad, 7aav, 7cf, 7en, 7ft, 7il, 7kv, 7kz, 7nn, 7og, 7rn, 7us, 7xf, 9amb, cl8, Can. 4cb. Any correspondence gladly answered.

BY 8AGO, PITTSBURGH, PA., FROM JAN. 17 TO JAN. 30

All C. W.—1lp, 1qn, 1rz, 1ts, 1un, 1zf, (1anq), 1ary, 1azw, 1bcf, 1bea, 1bqe, 2bf, 2fp, 2nz, 2ud, 2wp, (2aab), (2afp), 2ako, (2aos), 2ayu, 2bak, 2beb, 2bgh, 2bgm, 3bz, 3cc, (3hg), (3km), 3zo, 3zy, (3aad), 3ade, (3ahk), (3anj), (3aqr), (3blf), 4bk, 4bt, 4by, 4cy, (4dc), 4eh, 4ft, 4gl, 4hw, 4id, 4ze, 5da, 5fv, 5ku, 5uu, 8bk, 8ca, (8gv), 8hj, 8hp, (8iv), (8ni), (8uk), (8vy), 8zz, 8agz, 8ald, 8aqf, (8aqv), 8bdb, 8box, 8bum, 8cab, 8yas, 9as, (9dv), 9fm, (9io), 9iz, 9pg, 9us, (9zb), 9zl, 9aas, 9aja, 9ajh, (9als), 9ark, 9bcd, 9blo, (9dig).

Announcing the New All-Rubber Radio Battery



The Willard All-Rubber Radio Battery is made the right size for radio work, thereby reducing cost. Expensive and unnecessarily heavy connectors have been replaced by lighter ones, still further lowering the price at which you can get a genuine Willard Battery for your radio work.

Here's a battery built *especially* for radio service yet with all the features that created the enormous demand for Willard Threaded Rubber Automobile Batteries.

There is not a bit of wood about this new battery. Threaded Rubber Insulation separates the plates. The case is a solid piece of hard rubber without a single joint. Both insulators and case are tested with wireless transformers at 24,000 volts, eliminating possibility of leakage from cell to ground or cell to cell and thus doing away with one of the most frequent causes of noisy sets.

Any of the 3000 Willard Battery Stations can give you full information about this new battery. or we will gladly furnish it direct.

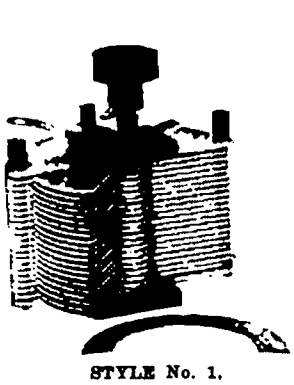
WILLARD STORAGE BATTERY CO.
Cleveland, Ohio

Willard Storage Battery Company of Canada, Limited,
Toronto, Ontario

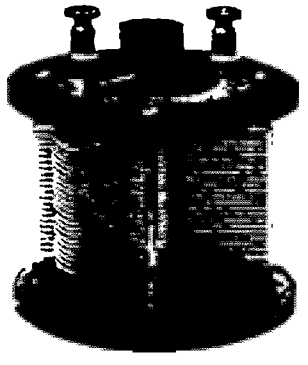
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"ILLINOIS" THE RELIABLE

MADE RIGHT - STAYS RIGHT



STYLE No. 1.



STYLE NO. 2.

Three Styles: No. 1, Panel; No. 2, Open Type as shown; No. 3, Fully Encased. Anti Profiteer. Less than pre-war prices. Fully assembled and teated.

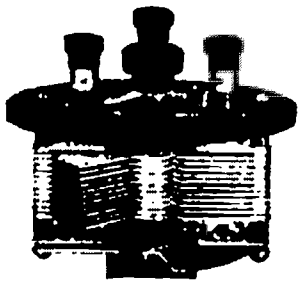
	Style No. 1	No. 2	No. 3
67 Plates,	$7.00	$8.00	$8.50
43 "	3.50	4.50	4.75
23 "	2.75	3.75	4.00
13 "	2.25	3.25	3.50

Money back if not satisfied. Just return condenser within 10 days by insured Parcel Post.

Options:—With Style No. 1—Instead of Scale and Pointer, a 3. inch Metal Dial at 50 cents extra, or a 3. inch Bakelite Dial at $1.00 extra. Large Knobs. Both excellent values. Or we will, if desired, supply the Condenser with smooth 3/16 inch center staff, without Scale, Knob and Pointer, at 15 cents off the list to those who prefer to supply their own dial.

Vernier with single movable plate applied to 13, 23 or 43 plate condenser, $3.00 extra.

We allow no discounts except 5 per cent on orders of 6 or more.



VERNIER

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Except: Pacific States, Alaska, Hawaii, Philippines and Canal Zone add 10c. Canada add 25c.

Foreign Orders other than Canada not solicited.

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Loud Speaker

$12.00

F. E. Newbery Electric Company

359 Sutter Street, San Francisco Phone Sutter 6361

MAIL ORDERS

REMARKABLE RECEPTION BY 6ZAC, HAWAII

Continued from page 30

8:24 p.m.—5ZZ de 5XU. "R QRA is University of Texas, Austin, Tex."
8:50 p.m.—7ZU de 7ZJ. (Working.)
9:01 p.m.—7ZJ de 7ZU. (7ZJ very QSA but ZU weak.) "Manuel Meyers, 730 and one-half East 14 St. Nr. 4. Nr. 5 OK. Nr. 3 sig is Jack Kerns."
9:08 p.m.—7ZU de 7ZJ. "R Nil but QSQ 7ZT." (Pau)
9:08 p.m.—7ZU de 7ZT. "1."
9:10 p.m.—7ZU de 7ZT (Sending msg, but QSS).
9:14 p.m.—7ZU de 7ZT. "R Many tnx OM N. M. 73 to 7ZN."
9:16 p.m.—7ZU de 7ZT. "ND OM QRM QTA K."
9:18 p.m.—7ZU de 7ZT. "R Thanks no more 73 to 7ZU. CLR."
9:23 p.m.—7ZJ de CL8 (500 cycle note).
9:39 p.m.—4CB de 7YA. "Say OM How does that receiver of yours work on 200 meters? I have a 200 meter wave that I would like to try to work you with, OM. QRV? for 200 meters? Hw?"

January 8, 1922.

KZY testing with 9XAB from 8:55 p.m. (my time) to 8:35 p.m. At 8:35 KZY told 9XAB to rush QSL by telegraph or phone, stating results. Told 9XAB that during test had him QSA ind period hut nd other periods. Said to phone Piedmont 7768 . . . at 8:24 p.m. . . . when arc and KHK allowed me, heard 9XAB (very fluttering 500 cycle note) saying " . . . hear you very well—do the same please—I will." (KHK has no hump—comes all over tuner.) Also heard 9XAB several other times, but his wave too long and he's right on a "mush" hump. If he was on 375 instead of 395 could read him O. K. on 1 step. (Nearly all work done on 1 step as second one still on bum.)

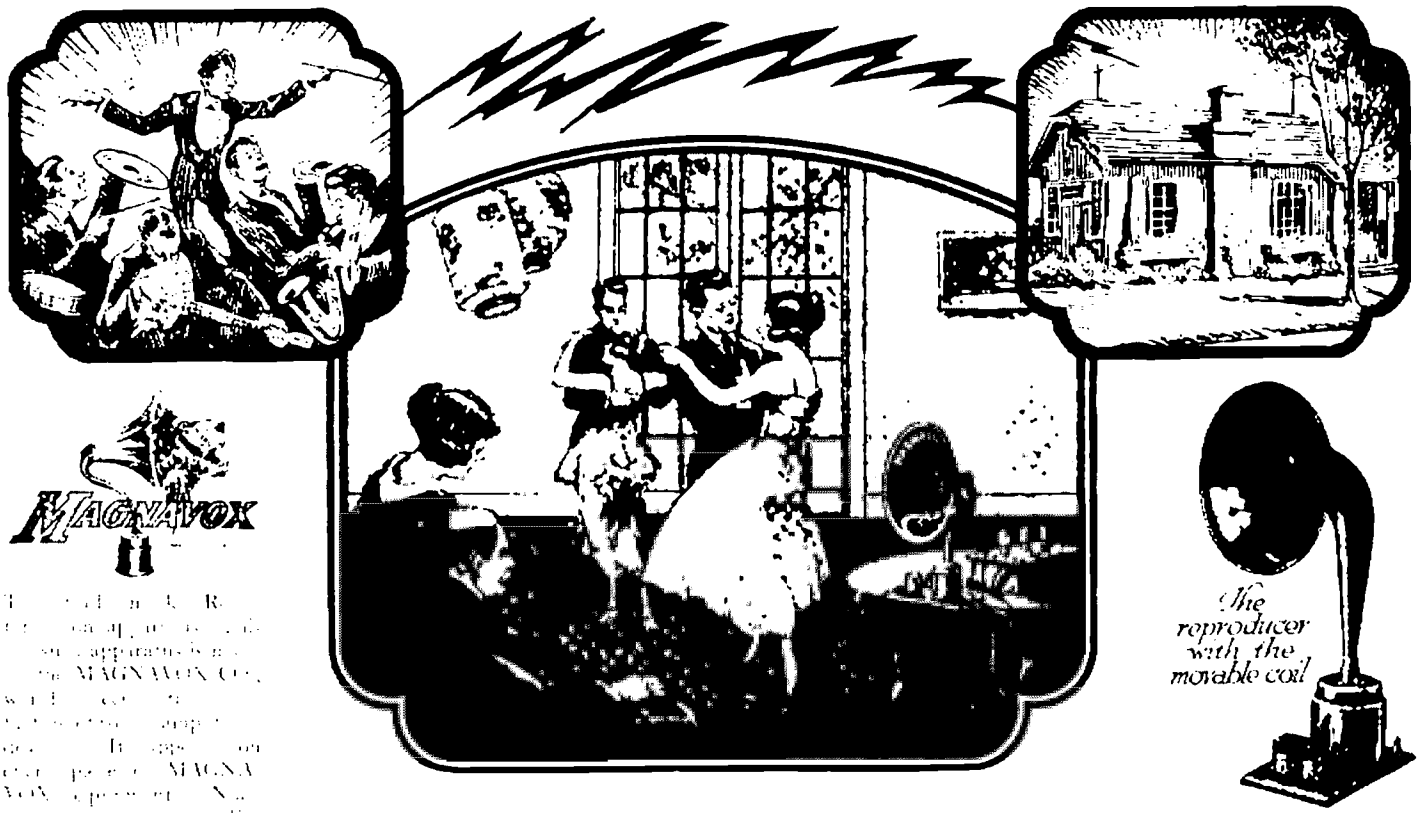
January 7, 1922.

10:03 p.m.—6ZAC de 6ZAF. "My wife said you had me in mind when you made the picture, 'Yes, Ma! I'm in Bed!'"
Some other 6 stations will call you tonight. GN.

If 6ZAF had sent the above single, as in previous QST's, it would have been N. D. as QRM fierce from arc, and big generator at mill sparking fierce at brushes. Was unable to hear any other 6's, but got 6ZAF several times agn, and conditions very bad to test with others.

January 16, 1922.

7:37 p.m.—7CK de 6ZX. "Give name again."
7:38 p.m.—6EB de 6EBR.
7:54 p.m.—6ASR de 6TQ. "Am not QRW as told my friend here that I must send . . . (QSS) . . . 6SY is out tonight as the college is giving a play and 6SY is QRW. Yep, his wavelength was higher . . . (QSS) . . . last nite for test. Do you know who won the football" (QSS).
7:58 p.m.—6TQ de 6ASR. "R. Yep, knew that the college is giving a play but didn't think 6SY had any part in it . . . (QSS) . . . yep, wave pretty high, and we ought to let YN1 know about the plan of action next time when . . . (QSS) . . . test for I think YN1 expected answer from Dow. OM, I didn't get ur last question so pls QTA."
8:00 p.m.—6ASR de 6TQ. "6SY is the electrician . . . (QSS) . . . for tonight show. . . . (Bad QSS) . . . after action GA."
(Then 6ASR's tone went bad, and fooling with it.) (Both these stations very QSA when QRK, but QSS from Very QSA to no sig at all. 6ASR slightly above 200 meters, about 215.)
9:08 p.m.—7TJ de 6EX.
9:10 p.m.—7TJ de 6EX. "QSK will try thru southern route and if OK will clear you. Hw."
9:29 p.m.—6EN de 6EX.
9:54 p.m.—6EA de 6EX. "No. 1. Dr. J. B. Ologuino, 211 W. 28 St., New York. Many thanks for the check. Hope you are all well. Will write soon. (Sig) Renato."
10:00 p.m.—6EA de 6EX. "R BK me if QRM." (I went px from KHK.)
10:14 p.m.—6EA de 6EX. "Better QSK."
10:25 p.m.—9BD de 6JD (About 250 meters. Very QSA ACCW.) "My New QRA is. V. M. Bitz, 5128 South Van Ness, Losangeles."
10:31 p.m.—9BD de 6JD. "R On first part got about half. Lost u. Will be glad to hear from you. I will drop you a card. QTC? Are you going to be at 9BD very long? Yes, know you. but ur old call is in another name. Well, O. M., see you again if no QTC."
10:36 p.m.—6JP de 6EX. "Not very gud, O. M. QRU. GE."
10:40 p.m.—9AMB de 6EN. "N D. Got bad QRM. Navy having target practice and going on their CW sets on all waves. Very bad QRM. QTC?" (Very QSA AC CW.)
10:43 p.m.—9AMB de 6EN. "OK now. QTC?"
11:04 p.m.—9AMB de 6EN. "ND QRM. Please QRA of 8XV?"
11:06 p.m.—9AMB de 6EN. "OK QRX."
11:12 p.m.—9AMB de 6EN. "Thanks very much for your trouble OM if you happen to hook up with 8XV please tell him he is very QSA here. All right, C. U. L. and 73 to 9AMB."



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genuine without it. For your protection see that it is there.

Radio MAGNAVOX—the reproducer with the movable coil. *Type R-3*, illustrated, with 14" horn—*$45*.

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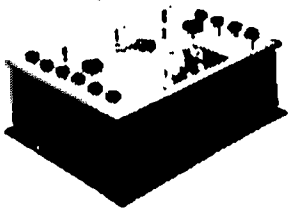
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The American Radio Sales & Service Co.
MANSFIELD OHIO

THE SMALL PERSON

Continued from page 23

temptuous slap with his cloth, and passed on to more fertile fields of endeavor.

To the rattle of chips and the clink of glasses—for the three mile limit was far astern, and this was not a vessel of American registry—the Small Person sat on, seeing nothing, especially, but warm and as contented as circumstances permitted.

His peace was rudely shattered by an uncouth, raw-boned individual — the same, if truth be told, who was ever the leader of the covert jokes at the expense of the Small Person.

"*Look who's here!* Darned if it ain't the titmouse! Time you were in bed, sonny! Losing your beauty sleep—y' know!" he guffawed. And the eyes of the crowd followed the teaser's pointing finger.

"There are *others* who might profit by going to bed early—if personal looks are bettered thereby!" snapped the Small Person, galvanized into action—much as any wee animal will show its teeth, when cornered.

His voice rang clearly, and for a moment there was a surprised silence. The creaking groan of the ship's woodwork, under stress of her heavy rolling, was impressive. And ere the other could articulate reply, the Small Person had uncurled himself from the corner and bolted—rabbit-fashion.

A yell of laughter went up—at the expense of the uncouth one—who expectorated profusely. "The durn little rat! Wait till I catch him on deck tomorrow!"

The Small Person crept in his bunk—shaking with pent fury—and there he ferociously pounded his pillow. "The big stiff! The lumberin' gook! Wish I'd punched his nose!"

And presently he fell asleep.

* * *

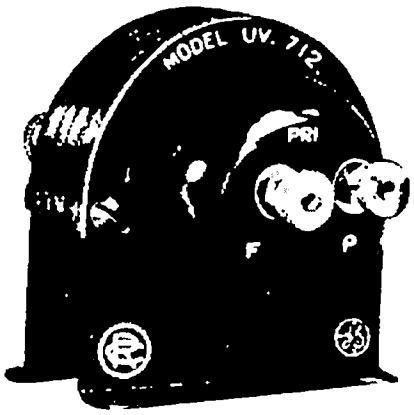
AN unusually heavy roll of the ship awoke him. And as his awakedness became more of a fact, unusual sounds came to him. He heard the rushing of feet over his head—the rattle-bang of heavy blocks being dragged along—hoarse voices—commands—the whooping of the wind—and that which brought him out of his bunk to the cabin floor in his funny little old-fashioned "nightie," was the shrill screaming of a woman —"*We're going down! I know we're going down!*"

Then he realized that the *purr-rring* throb of the engines had ceased. Climbing in his "duster" coat, and wrapping the inevitable muffler about his throat he hopped out in the corridor. A steward caromed from the alley-side, into him, nearly knocking him down.

"What's the matter?" he called after the hurrying man.

"Steering gear gone to Hell!" yelled the other, dashing out of sight.

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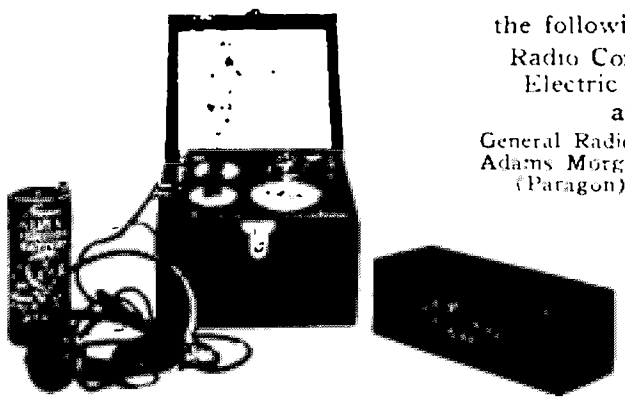
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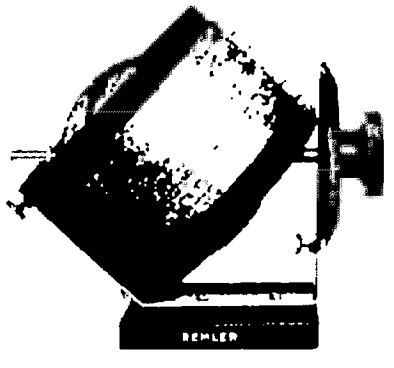
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"Funny kind of a steward, to spread alarming reports!" soliliquized the Small Person, making for the main stairways. But long ere he reached them he was being swept along by a maddened crowd of men and women, clambering over one another in their rush for the upper decks. The Small Person was promptly knocked down, and had sense enough to stay there, shielding his head with his thin arms, as best he could.

When they had all trampled over him, he picked himself up, rubbed his sides grimly. "One good thing about bein' little—not so much to get hurt!"

The dining saloon was jammed with passengers. Officers and stewards were doing their best to still the pandemonium of sounds, all of which had been originated by the hysterical screaming of one woman. And the Small Person watched the scene, quizzically.

No headway toward quiet was being made until the captain, dripping wet, a nasty gash across his forehead, jumped on one of the tables and clung to a stanchion.

"For God's sake, stop this infernal din! You are in no danger! The rudder has become damaged in some way and the ship cannot be navigated properly. But she is not leaking a drop and the storm is rapidly abating. The stewards will serve hot coffee and sandwiches here in fifteen minutes. I wish to ask if there is, among the passengers, a radio operator? One of those belonging to the ship was taken suddenly ill yesterday, and is helpless. The other has just had the misfortune of breaking his leg in three places, and is in too much pain to operate. If there is anyone who understands radio I shall be more than grateful if he will make himself known."

Silence.

The captain clung to the stanchion, searching the sea of faces below him. And the great ship wallowed heavily, an inert, helpless mass in the rush of the huge seas.

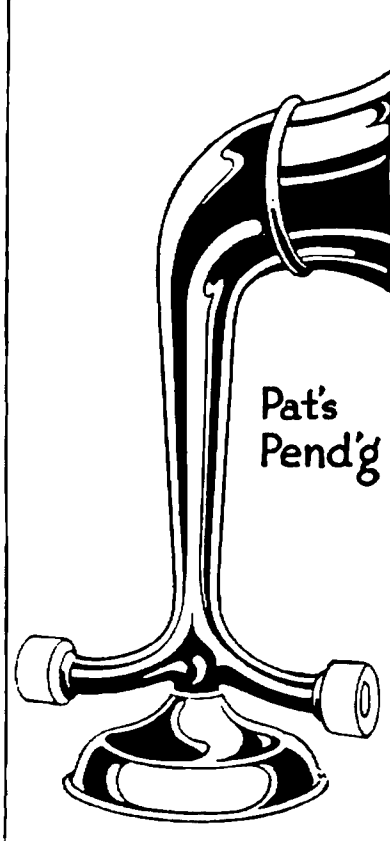
The Small Person coughed—and timidly edged forward. "I am an operator," he said, simply. The people nearest him made room and he stood before them all, a pathetically-ridiculous picture, in his "duster," from beneath which peeped the tails of his cotton "nightie."

Captain Maters stared—doubting his ears.

"Yes," continued the Small Person, with a gulp, "I have been an amateur operator all my life—hold a special license. Maybe I can be of use?"

He said it so simply that the skipper's jaw snapped shut on the unkind words that he had been about to utter. He jumped down—

"Come on, then!" seizing the Small Person by the arm and forcing a way through the mob of staring passengers. Meekly the little man permitted himself to be dragged along, and he held tightly



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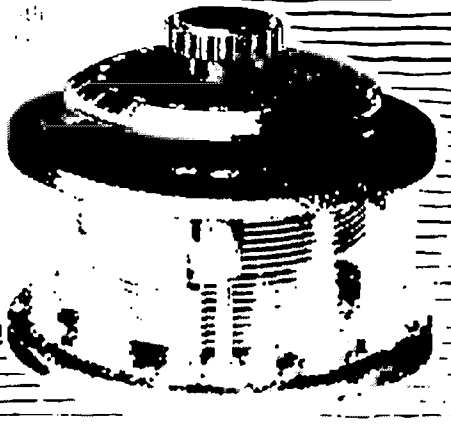
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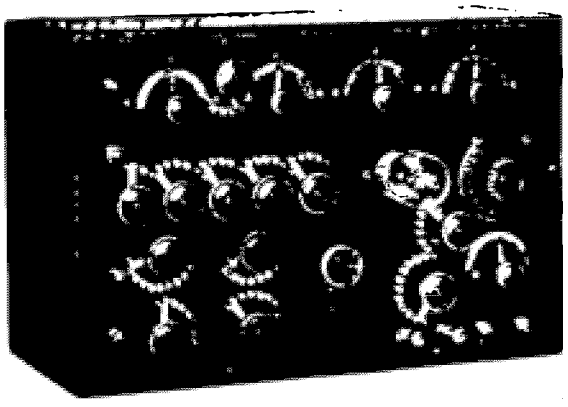
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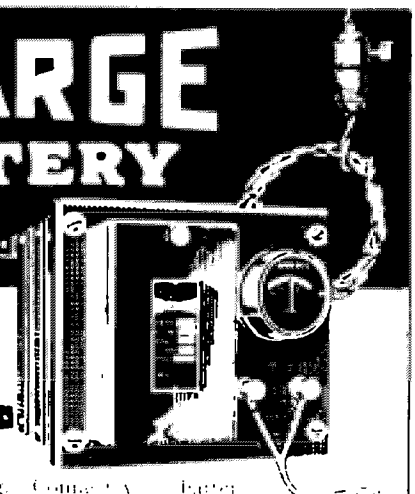
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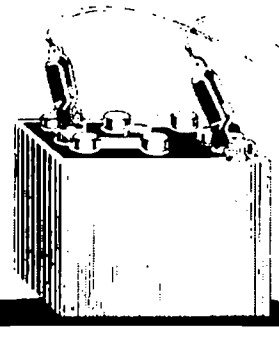
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Tell them that you saw it in RADIO

to the skipper as they crossed the one open space of the gale-swept deck, to the radio room. Several of the men passengers followed.

But once inside, the Small Person's attitude changed. He turned fiercely on the others—

"Outside—all of you! I'm running this show from now on!" He caught sight of the pallid face of his erstwhile tormentor, who was craning over the others' shoulders, to see. "Hey—you! YOU, you big, rawboned stiff! Apologize for havin' made fun of me the whole trip—or not a key do I press!"

"What's this?" began the skipper.

"*He* knows darn' well what I mean!" snorted the Small Person.

"I'm sorry," mumbled the uncouth individual.

"*Louder!*"

"I say I'm sorry!"

"All right, then! And the rest of you remember that just because a man hasn't got the shape of a prizefighter, that that doesn't mean that he hasn't got both brains *and* feelings! Outside—I want room!"

And they all went, leaving but the skipper.

"Well, what's wrong, and what do you want me to do? Speak up!" snapped the Small Person, clutching at the edges of the operating table to keep his balance.

"I—I—well, can you get in touch with the nearest ship to us and explain our situation? I think that I can make repairs as soon as this wind drops, but I am not sure—and so I—"

"You don't want me to send an *SOS*—because of salvage—and yet you haven't got the nerve to take a chance—***huh?*** I can tell you that an *SOS* is going out! Gimme your position!"

The captain hesitated, gaping at the little figure.

"Won't? Then I'll get it out of the operator's log—noon reading, yesterday!"

As one to ships born, the Small Person found the sheet of the day, ran his finger down it—"Ha!"—then he reached for the head phones. "Get out of here—or not a spark—sputters! I'm not afraid of going to Davy Jones! Who would be, with such a damnfool shape as I've got? OUT!"

The skipper went.

"You'll find the main switch——" came a feeble voice from the dark of the operators' quarters at the back.

"Shut up, OM—I know this set better'n you do! I made a hobby of radio long before you came in sight! Make yourself as comfortable as you can!"

Settling the phones firmly on his head, the Small Person wedged himself in the operating chair, carefully tucked his little feet in a fold of the cotton "nightie," threw the power switch, and began to call, while the injured operator listened with growing amaze—

"Holy smoke!" he grunted, between spasms of pain. "Gosh, but that two for a-cent is sure *some* operator! And I tried to show *him* the set!" He fainted from sheer relief of mental strain.

* * * * *

SLOWLY a strange procession crept up the Broads toward Southampton. A dingy, sea-stained freighter stordily towing a greyhound of the seas. Whistles shrieked in salute, but the liner answered them not.

In his cabin the Small Person sat clasping and unclasping his thin fingers. For hours, after leaving the radio room, when the helpless liner had been taken in tow by the ship that his signals had brought, had he resisted all efforts to roust him out, and repeated knockings at his door received the same, small-voiced response:

"Go 'way! Leave me alone!"

And—to himself—"Why haven't I got any nerve?" he muttered, with much pathos.

At the dockside Southampton he managed to dodge the entire ship's company! How—only he knew! But he did it! And that night, in a small hotel, in the backwaters of London's seething ebb and flow of humanity, he tremblingly opened an evening paper and read all about "*the vanished Mr. Beardsley radio expert*," who had indubitably saved the S. S. [illegible] with her hundreds of passengers and millions of dollars' worth of cargo! This by volunteering to act as radio operator, when the ship was in grave peril and disabled in a heavy storm, the regular operators incapacitated for duty. He read further of how it was mooted that a medal for bravery should be given him; of how anxious the steamship company was to express its great gratitude; of how the passengers desired to present him with a fitting gift, as a souvenir of the great occasion; and, finally, would Mr. Beardsley kindly come to the offices of the editor of the paper?

He read it all carefully, slowly. Then he let the sheet fall from his fingers.

"Gosh! I wish I had a *little* nerve!" he wailed softly. And, turning off the light, the Small Person crept into the narrow bed, wrapping his hands in the cotton "nightie," and tucking his feet in its lower folds.

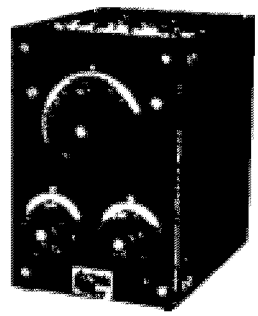
(The end.)

VALUE OF CO-OPERATION

(Continued [illegible])

Occasionally complaint is heard that radio organizations are controlled [illegible] factions. It is believed that [illegible] were investigated that it would [illegible] that the so-called clique was [illegible] body of intelligent, progressive [illegible] who were earnestly endeavoring [illegible] the interest of amateur communication [illegible] community, against the [illegible] disgruntled critics, and [illegible] the indifferent lack of [illegible] Do It All. They should [illegible]





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Radisco Better "B" Batteries	2 65
Storage Battery, "Yale" 6-60	18 00
For weaker signals we recommend	
Baldwin Phones, type "C"	12 00
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Complete receiving station, exactly as shown above, including tubes, batteries, Magnavox, and Western Electric Phones, with instructions for operating, $236.00.

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Type 231 Transformer
Price $5.00

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Combination long and short wave set, size of panel 15" x 15". Range 150 to 20,000 meters. Price.....$165.00
Real telephone set. Four tubes. Range 50 to 250 miles. Panel 12" x 15". Price.....$130.00
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SPECIAL—6-volt, 60-ampere Storage Batteries. Price this month only. Each.....$12.35
Short wave sets. Size of panel, 6½" x 16". Price.....$45.00
C. N.—113 Navy set. Slightly used. Price.....$75.00

ESTIMATES FURNISHED ON RECEIVING, TRANSMITTING AND 'PHONE SETS BUILT TO YOUR OWN IDEA AND SPECIFICATION.

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Concerts every evening from 7:30 to 10:30 p. m., except Wednesday and Saturday.

NOVO SPECIAL!

Real "B" Batteries. The ones we have all dreamed about. Size 6½" x 3¾".

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Five blocks North 149 Subway and "L" Station

HYGRADE SPECIALS SAVE YOUR MONEY

Electrose Ball Insulators, 28 cents each. Per dozen	$3.00
Rubber Cap Binding Posts, per dozen	.75
No. 14 Solid Copper Hard Drawn Aerial Wire, 100 feet	.50
3 Inch Bakelite Dials	.85
Cyclone 22½ Volt Small B Battery	.90
Cyclone 22½ Volt Large B Battery	1.60
Cyclone 45 Volt Large Variable B Battery	2.75
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MARKO STORAGE BATTERIES

4 VOLT 40 AMPEREHOUR	$7.50
4 VOLT 60 AMPEREHOUR	10.50
6 VOLT 40 AMPEREHOUR	10.50
6 VOLT 60 AMPEREHOUR	14.00
6 VOLT 80 AMPEREHOUR	18.00
6 VOLT 100 AMPEREHOUR	24.50
6 VOLT 120 AMPEREHOUR	29.00

Marko Storage Batteries are constructed with hard rubber jars, Maple case, Cedar separators, extra heavy plates, and are unconditionally guaranteed to perform their functions for a period of TWO YEARS. There is nothing superior for wireless use, spark coils or any instrument requiring a heavy and powerful spark. Above batteries are fully charged when shipped.

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Hygrade Electric Novelty Co.
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LETTERS TO THE EDITOR

Sir:—The writer, in looking over your issue for February, was much interested in the article on page 26 with reference to transformer designs.

The writer has in the past constructed a large number of experimental transformers both for general use, bell ringing work, and C.W. work, etc. It seems to the writer that the most important point about the ease of transformer designs was not sufficiently stressed in this article. This point to which the writer refers is the turns per volt per square inch of iron cross section.

The writer usually used a basis of sixty thousand lines per square inch, which resulted in 6¼ turns per volt per square inch of iron and he always kept this one fact in mind and with it was able to design a transformer for practically any work. If fifty thousand lines are used, this, of course, becomes 7½ volts per turn per square inch and this one fact should be remembered and the rest can be forgotten. The writer has memorized this and it has been of inestimable value in laying out transformers for himself and friends, and it would seem that this one point is really the gist of the whole thing. Yours very truly,

JOHN H. MILLER,
Electrical Engineer.

Sir:—I read with interest the log of 6ZAC in February RADIO.

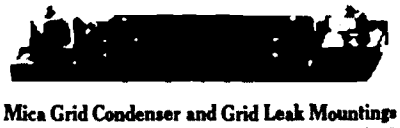
Thru the report, 5QA is mentioned several times and some extracts of msgs sent are given. I recognize the transmissions as made at my station, 5ZA, which communicated with 6AIF, 6IV, 9HT, instead of 8HT, etc. Guess my sending is punk or Mr. Dow would have gotten the Z correct. Please correct the mistake. Where Q is given, it should be Z.

You may be interested to know that 5ZA has worked 2ZL, NMW at Yorktown, Va., XF1, 8ZZ, and been reported by 1TS, 1BDU, 1BOX and many other ones and twos. Fone and music has been heard by 9XM, and reported from California, Nevada, Montana, N. Dakota, Minnesota, Wisconsin, Indiana, Illinois, Missouri and Louisiana. 5ZA has now been heard in all states except Maine; also Canada, Mexico, Honduras, Hawaii and both coasts.

I use two 50 watt tubes for C.W. with 1000 volts on plate. For fone, one 50 watt tube is used as mod. and one as osc. A 5 watt speech amplifier is being installed and two more 50 watt tubes are to be added. The circuit is the Hartley.

While I am at it, wish to say that RADIO is some class now. You surely know what is wanted and the amount of good stuff is greatly appreciated. Please continue to give us dope on C.W. and fone as to my mind that is the future of radio.

LOUIS FALCONI, 5ZA,
Roswell, N. M.



Mica Grid Condenser and Grid Leak Mountings

From .00005 to .00025 MFD	$ .50
From .0003 to .0005 MFD	.65
Grid Leak Mounting only	.25
Grid Leak Clips, 12 for	.25

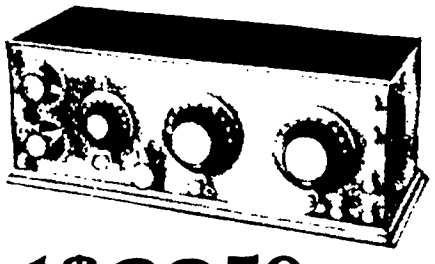
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Rotor or Stator, each	$ .05
Spaces 5/16" x ⅛" thick, dozen	.16
Spaces ¾" x ⅛" thick, dozen	.08
Triple Coil Mounting	5.00
2 Coil Mountings	3.50
Plugs for Mountings	.50

Kindly add 5c for Postage

MONTROSE MFG. CO.
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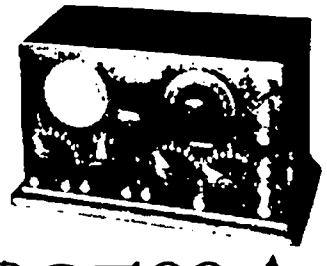
9.A.G. recommends-



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1. **Regenerative circuit licensed under Armstrong Patent.**
2. **Venier attachments on all controls—particularly desirable for Radiophone reception.**
3. **Range 175 to 1000 meters.**
4. **Special moulded variometer forms insuring maximum efficiency at all times.**
5. **Grained finish formica panel. Condensite control dials. Inductances wound formica tubes. Machine engraved lettering with permanent brilliant white. Case, dark quartered oak. .NO BODY CAPACITY.**

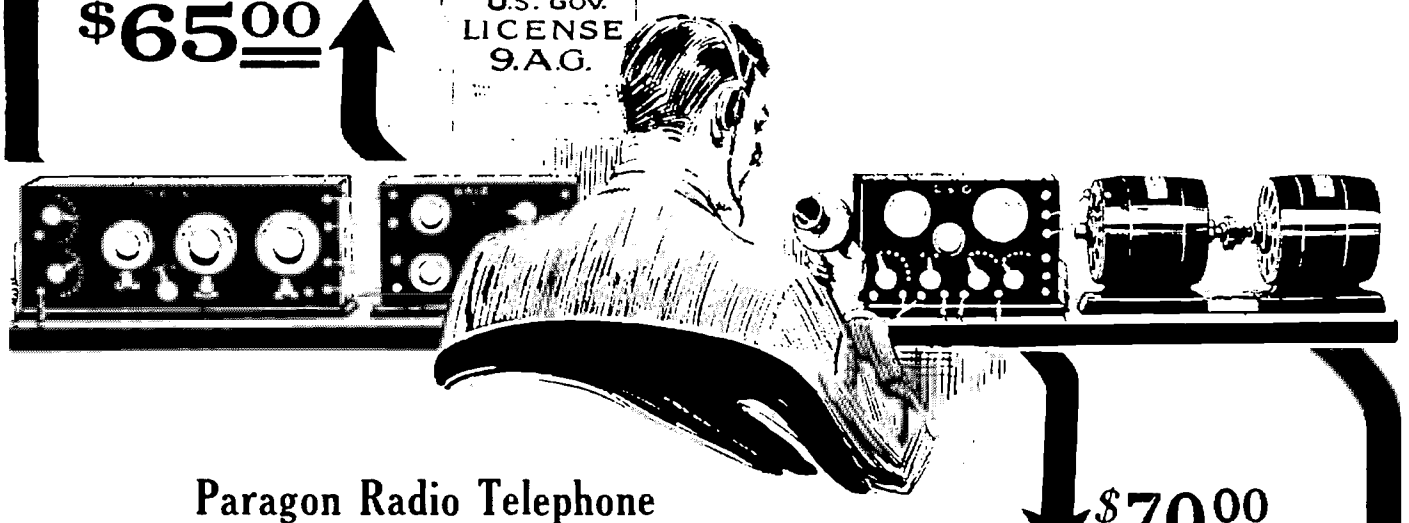
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Two Stage Detector Amplifier

1. **Special 270° dial indicators on all battery controls.**
2. Potentiometer, across filament battery for adjustment of plate potential.
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4. Best inter tube transformers used.
5. Common A Battery.
6. Maximum amplification.
7. No tube noise or howling. Cabinet dark quartered oak.
8. Plugs and jacks eliminated. Unique switch control filaments, telephone and battery.

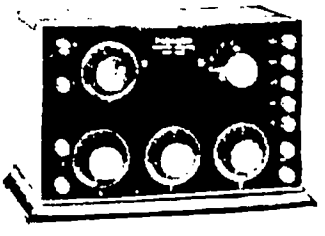
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1. Range 160 to 325 meters. Seven wave lengths available
2. Power—2 five watt tubes.
3. Provision for telephone, tone or continuous wave telegraphy. Controlled by one switch.
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RAY-DI-CO Motor Generator Type ST4

1. Capacity 40 watts giving an excess of power of 8 watts.
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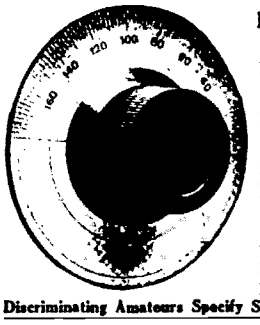
TRANSMITTING EQUIPMENT

	Price	Add postage for
UV-202 Radiotron 5 watt Transmitter	$8.00	1 lb.
UV-203 Radiotron 50 watt Transmitter	30.00	1.5 lbs.
UV-204 Radiotron 250 watt Transmitter	110.00	7.5 lbs.
UV-216 Kenotron 20 watt Rectifier for 5 watt tubes	7.50	1 lb.
UV-217 Kenotron 150 watt Rectifier for 50 watt tubes	26.50	1.5 lbs.
UR-542 Porcelain Socket for UV-202 & UV-216	1.00	0.5 lb.
UT-541 Porcelain Socket for UV-203 & UV-217	2.50	1 lb.
UT-501 & UT-502 Pair of End Mountings for UV-204	4.50	1 lb.
PR-535 Filament Rheostat for 5 watt tubes	3.00	1 lb.
PT-537 Filament Rheostat for 50 & 250 watt tubes	10.00	2 lbs.
UP-1368 Power Transformer—325 watt input	25.00	15 lbs.
UP-1016 Power Transformer—750 watt input	38.50	30 lbs.
UP-1626 Filter Reactor—160 milliamperes	11.50	10 lbs.
UP-1627 Filter Reactor—300 milliamperes	15.75	18 lbs.
UP-415 Plate Circuit Reactor	5.75	1.5 lbs.
UP-414 Microphone Transformer	7.25	1.5 lbs.
UP-1719 Grid Leak for 5 watt tubes, 5000 ohms, mid-tapt	1.10	1 lb.
UP-1718 Grid Leak for 50&250 watt tubes, 5000 ohms, mid-tapt	1.65	1 lb.
UC-1803 Mica Condenser .000025 mfd. 10000 volts	5.00	1.5 lbs.
UC-1015 Mica Condenser .0003, .0004 & .0005 mfd. 7500 volts	5.40	1 lb.
UC-1014 Mica Condenser .002 mfd. 3000 volts	2.00	1 lb.
UC-1806 Mica Condenser .002 mfd. 6000 volts	7.00	1 lb.
UC-1631 Filter Condenser 0.5 mfd. 750 volts	1.35	1 lb.
UC-1634 Filter Condenser 0.5 mfd. 1750 volts	1.50	1 lb.
UC-1632 Filter Condenser 1.0 mfd. 750 volts	1.85	1 lb.
UC-1635 Filter Condenser 1.0 mfd. 1750 volts	2.00	1 lb.
UC-1831 Variable Antenna Series Condenser .0001 to .0012	9.00	1 lb.
UT-1643 Magnetic Modulator 0.5 to 1.5 amperes	9.50	2 lbs.
UT-1357 Magnetic Modulator 1.5 to 3.5 amperes	12.00	3 lbs.
UT-1367 Magnetic Modulator 3.5 to 5.0 amperes	17.00	5 lbs.
UL-1008 Oscillation Transformer	11.00	7 lbs.
UM-530 Antenna Ammeter—hot wire type 0 to 2.5 amps	6.00	1 lb.
UM-533 Antenna Ammeter—hot wire type 0 to 5.0 amps	6.25	1 lb.
UQ-809 Mesco No. 81 Sending Key—⅛" silver contacts	3.00	1 lb.
PX-1638 Rotary Chopper	7.25	3 lbs.
Shaft Bushing for 1/4" or 5/16" shaft for above	.20	
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Besides the above, I carry a complete stock of everything worth while in Radio Apparatus.

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NEW PRICE $1.75

For the 4" Dia. Size. AND The New 31/4" Model at $1.60 is a most Fitting Companion. Real Bakelite Knob with 1/4" or 3/16" hole. Lacquered Silver Dial of Beauty and Unique Utility. Dial acts as a Capacity Shield.

Discriminating Amateurs Specify Somerville Dial Indicators

AMRAD Products

Sent Anywhere, Postpaid and Promptly.

The Short Wave Tuner and Detector Two-Stage Amplifier Cannot be Equaled in price or results in DX Reception. Send $92.50 for Both, while we can ship from a fast diminishing Stock.

1000 V. Guaranteed 2000 V. Tested.
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.0005
.001 MFD.
.002

Special .005 Model

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SOMERVILLE CW CONDENSERS



Somerville Radio Laboratory

"ADD A Page" Catalog and Treatise on CW—25c, or Free with first $1.00 order
DEPT. "R" 176-178 Washington Street, BOSTON, Mass.

Tell them that you saw it in RADIO

QUERIES AND REPLIES ON C. W. PRACTICE

Continued from page 29

mensions shown in Fig. 2 will serve the purpose. For 110 volt a.c. supply, the primary consists of 140 turns of No. 12 B.&S. double cotton covered wire, and the filament secondary is composed of 15 turns of No. 12 B.&S. double cotton covered wire with a tap at the mid point, which is 7.5 turns. This will give a sec-

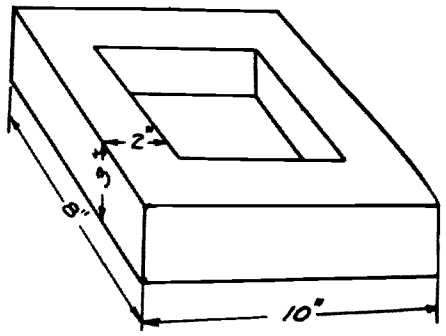


Fig. 2

ondary voltage of 12 volts. The high voltage secondary, which is arranged for 3000 volts with a center tap, is wound with 3750 turns of No. 24 or No. 26 B. & S. D. C. C. or enameled wire, with a tap at the 1875th turn. The filament secondary may be wound directly over the primary, but the high voltage secondary should be wound separately and placed on the other leg of the core. For the 3 millihenry chokes, 250 turns honeycomb coils will do very well, as they are about that value and if thoroughly wrapped with friction tape or okonite, there will be no danger of contact with other apparatus.

HOME-MADE TRANSMITTER

Continued from page 26

This set was used for demonstration purposes at the Shasta County Fair, the receiver being at Anderson and the transmitter at Redding, twelve miles away. The music was much louder than that from a phonograph and Magnavox used for a merry-go-round on the grounds.

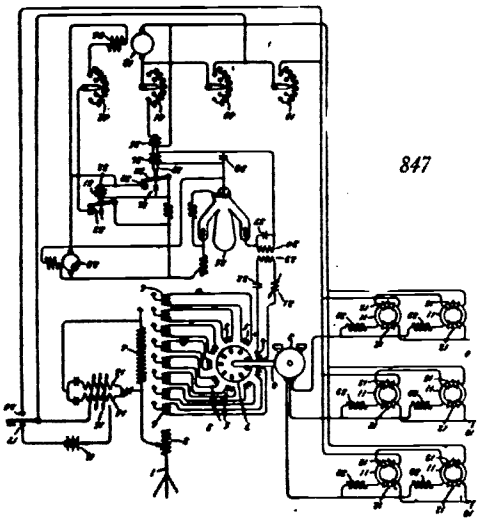
The set was also used by the Pacific Gas and Electric Co. in the course of their experiments with emergency communication between their mountain power plants. Grid leak modulation was used instead of the Heising system in this test, a radiation of 2.5 amperes being obtained from a two-wire T antenna mounted on a tin roof.

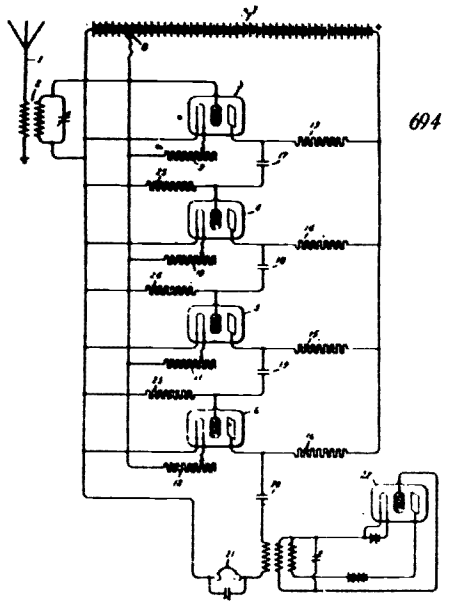
The set is now installed at the Volta power plant at Manton where a four-wire cage antenna 60 ft. long, 70 ft. high, with counter-poise ground is employed. Another set is being made for the Hat Creek power plant with which it is hoped to maintain radio communication should the power lines be down on account of heavy snow.

RECENT RADIO PATENTS

Continued from page 32

18. By varying the excitation of these windings 13 rapidly the impedances of coils 12 are also varied rapidly, and the e.m.f. supplied to the motor 9 correspondingly varied. To effect this variation in excitation, one of the coils 5 of the alternator 3 is used to supply alternating current to the rectifier 25, through a circuit 21, 22, 23 resonant at a frequency slightly greater than that which the alternator 3 must maintain. Due to the counter e.m.f. of this rectifier, current variations in the circuit 21, 22, 23 produced by changes in frequency, are magnified in the rectified current that excites coil 26 of the relay 27. This relay in turn controls the excitation of the generator 18. There is produced a rapid change in the value of the impedances of coils 12, and the relay 27 is caused to vibrate rapidly, its period of opening and closing being determined by the amount of current rectified from circuit 21,





22 and 23. A contact 20 is also arranged on the sending key 17 so that when energy is radiated, the e.m.f. supplied to motor 9 is increased so as to prevent a sudden drop in speed due to sudden increase of load.

Chester W. Rice, Pat. No. 1,401,644; Dec. 27, 1921. Method of and apparatus for amplification of small currents.

The signals received by an antenna 1 are caused to vary the potential of the grid of the thermionic device 3, the plate circuit of which includes a very high resistance 13 as

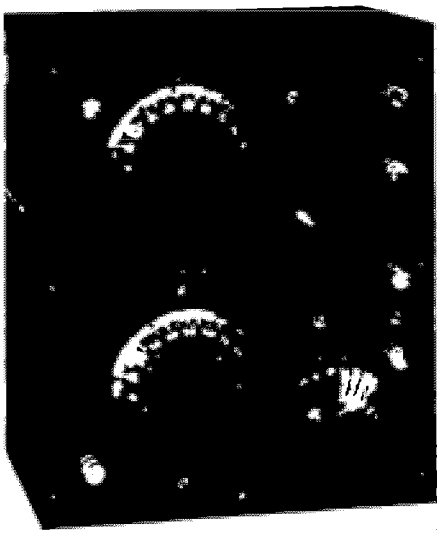
Continued on page 64

Here's A Receiving Set That Is Guaranteed

—The Clapp-Eastham, Type HR Regenerative Receiver: And the price is only $35.

It's an easy thing to find a set that costs more money, but we'll guarantee that no matter what price you pay, you can't get a set that gives better, more satisfactory results.

Tuning is as easy as setting the hands of a watch, and the distance at which signals are received and the sharpness and loudness of tones is almost beyond belief. Regeneration is perfect on all wave lengths between 180 and 825 meters. Antenna Condenser built as a Vernier. "B" Battery may be placed in compartment inside cabinet or external "B" Battery may be used.



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The experienced radio man will appreciate the quality indicated by these specifications:

Panel—Formica, handsomely finished.
Cabinet—Dark Oak, Oil finish.
Condenser—Balanced type, 2 rotary, 3 stationary plates.
Dials—Indestructable metal. White figures on black ground.
Antenna Inductance—Wound on Formica tube.
Plate Inductance—Wound on moulded ball.
Binding Posts—Nickel-plated brass.
Switch—Fan Blade.
Rheostat—C-E type H 400.
Circuit—Single Circuit regenerative. Licensed under Armstrong U. S. Patent 1113149.

If you're looking for the most efficient receiver that can be obtained at any price, ask your dealer to show you the C-E type—or write us direct.

Send 6c in stamps for a complete Radio Catalog. Each of its three parts describes equally interesting items and it covers every radio essential from the smallest to the largest item.

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Radio Engineers and Manufacturers

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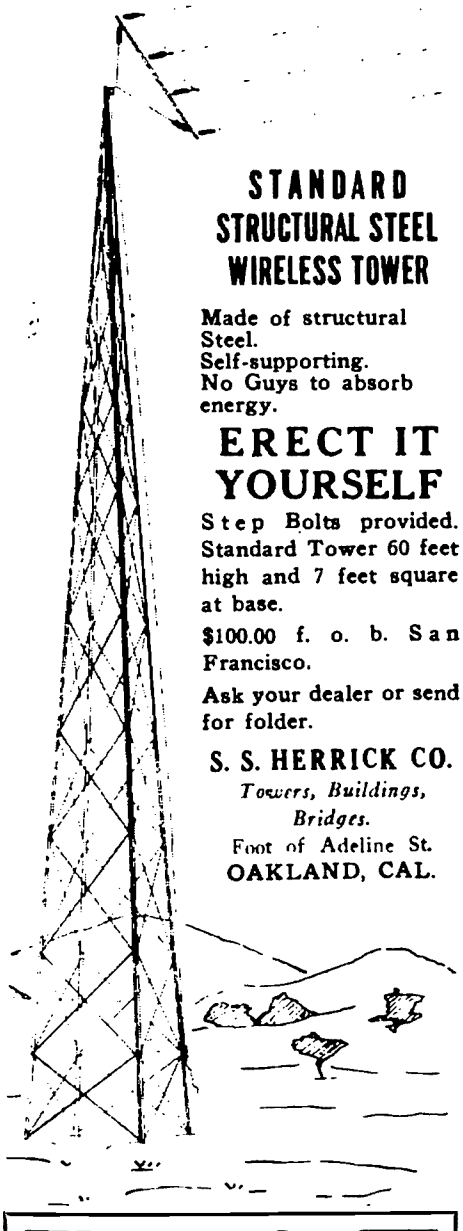
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332 S. Michigan Ave., Chicago, Ill.
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STANDARD STRUCTURAL STEEL WIRELESS TOWER

Made of structural Steel.
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No Guys to absorb energy.

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Step Bolts provided. Standard Tower 60 feet high and 7 feet square at base.

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Ask your dealer or send for folder.

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RADIO APPARATUS
"Better—Costs Less"

	Without knob and dial	With knob and dial	With knob and dial mounted in cabinet
Crosley V-T Sockets			$0.60
Crosley Variable Condensers			
Model "A"	$1.25	$1.75	$2.50
Model "B"	1.75	2.25	3.00
Model "C"	2.25	2.75	3.50
Harko Radio Receiver			9.00
Single phone, 125 feet antenna wire, Insulators, etc.			6.00
Complete set			15.00
Harko Senior Radio Receiver			16.00
Crosley Two Step Amplifier			25.00
Crosley Detector Units			
Completely assembled			7.50
Knocked down			6.00
Crosley Variometer Parts			
Using poplar wood			1.50
Using mahogany			1.75
Crosley Variocoupler			1.50
Stator only			.40
Crosley Magfon			10.00
Crosley Cabinets			
In gum		$2.50 to	5.25
In mahogany or quartered oak		$3.85 to	10.60
Crosley Rheostats—Model "A"			.60
Model "B"			1.25
Crosley Binding Posts		each	.08
Dozen			.90
Crosley Tap Switch		each	.40
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Hundred			2.50

Circulars on request
Every article guaranteed to give absolute satisfaction or money refunded. If your dealer can't supply you, send us his name and order direct.

CROSLEY MFG. CO.
Cincinnati, O. Dept. Radio P-4

COMPARISON OF SINGLE CIRCUIT WITH INDUCTIVELY COUPLED RECEIVER TUNERS

It may be desirable to arrange a radio receiving set so there is only one circuit to be tuned instead of the two as ordinarily used. This because of the fact that in time of war a great many of the radio operators will be inexperienced in the tuning of radio sets, and because the situation at the battle front may be such that men will lack the time and mental concentration needed to effect the tuning of two circuits. In the case of airplanes where the radio operator must of necessity perform other duties, a single circuit type of receiver will be of special benefit.

By the term "single circuit tuning" is meant that the only tuning adjustments are made in the antenna circuit. A detector may be tapped across a portion of the loading reactance, and the tap may include such capacity or inductance reactance only. For practical reasons the latter method is preferable. Two arrangements are possible. The first of these may be described as comprising an inductance coil and condenser in series in the antenna circuit or else the coil only. The second arrangement is with the coil and condenser in parallel. It is thought that this last arrangement is the better one.

The following brief comparison of a single circuit with inductively coupled receiving tuner is given:

Signal Strength—The signal strength obtained in a receiver depends chiefly upon the mutual inductance between primary and secondary circuits and upon the circuit design as regarding the proportion of inductance, capacity, and resistance used. The detector or amplifier introduces into the circuits a certain resistance which is important. By properly arranging the design, the signal strength on a single circuit tuner can be made equal to and even greater than that of the two circuit type.

Selectivity—In the single circuit tuner all of the selectivity obtainable results from tuning in the primary or antenna circuit; the secondary is untuned. For this reason the primary of single circuit tuner must be exceptionally well designed to reduce resistance and obtain the best values of inductance and capacity. The use of a small condenser in parallel with the antenna inductance coil materially assists in reducing the over-all resistance and increasing the selectivity.

In the two circuit tuner resonance adjustments are made in both primary and secondary. In this type of tuner the detector, being shunted across the secondary tuning condenser, introduces into the secondary circuit considerably more resistance than is the case in the single circuit tuner. This fact is one which ac-

Wanted—Laing Radio

a representative with practical radio experience in every locality. A paying proposition for live wires. No capital required.

A. K. LAING RADIO CO.
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U. C. BATTERY and ELECTRIC CO.
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Warning!

Dangerous, Expensive "Short" Curve Ahead!

That new VACUUM TUBE on your set is doomed to quick destruction from an accidental "short" unless you protect it with the

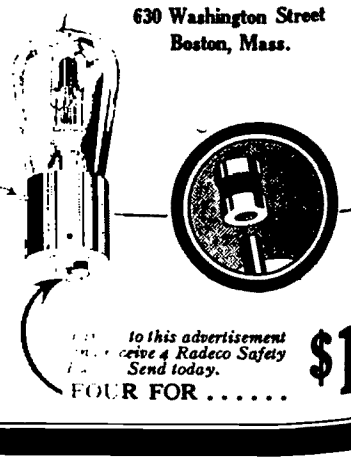
RADECO SAFETY FUSE
(Pat. Pending)

A tiny fuse that slips directly on the filament terminals and prevents blowing out from excessive high amperage. Fits any standard bulb used in any standard socket.

Now, when conditions are right for best wireless results, save money and time by using RADECO Safety Fuses on your set.

Sizes:
1, 1½, 2, 2½, 3 amp. Fits any Tube, in any socket.

Radio Equipment Co.
630 Washington Street
Boston, Mass.



to this advertisement ceive 4 Radeco Safety Send today.

FOUR FOR **$1**

counts in large measures for reduction of selectivity of the two circuit tuner for interfering signals of not too great strength which are slightly off tune.

When interfering signals are very strong they may set up currents in the antenna circuit which induce in the secondary circuit of a single circuit tuner voltages comparable to those induced by the signal to which the antenna is tuned and there being no tuning in the secondary circuit these interfering voltages are transmitted to the detector with strength comparable to that of the desired signal and thus produce interference. On the other hand when a two circuit tuner is used the comparable induced interfering voltage in the secondary does not produce currents therein of magnitude comparable to that of the desired signal on account of the high reactance offered by the tuned secondary to these off tune voltages. In this case, therefore, the two circuit tuner shows an advantage in selectivity over the single circuit one. These statements assume that the proper refined adjustments are made on the two circuit tuner.

As a matter of experience it is found that the average operator does not adjust the two circuit tuner in such a way as to secure the maximum efficiency and maximum selectivity, and thus even for the case of very strong interfering signals off tune, he obtains with a single circuit tuner about as good results as with the two circuit type.

To summarize the situation then, interfering signals which are slightly off tune and of the same order of intensity as the desired signal can be reduced approximately the same amount with either type of tuner. The two circuit tuner shows greater selectivity when properly used than the single circuit one when very strong interfering signals are encountered which are far off tune. The signal strength of tuned signals on the two types of receivers can be made equal. The far greater ease of operation and rapidity of adjustments in the single circuit type, together with the practical fact that the average operator does not have the skill or else does not have the time to adjust the two circuit receiver for maximum effectiveness, results in his being able to secure practically the same selectivity and equal signal strength on the single circuit tuner as on the two circuit type.—Signal Corps Bulletin.

WELCOME
TO OUR RADIO DEPARTMENT
DROP IN AND LOOK OVER OUR STOCK
MAXWELL ELECTRIC CO.
3100 Adeline St., Berkeley, Calif.

Before Buying C.W. Apparatus
Ask for Acme Bulletins

Anyone having an alternating current supply can have a telephone and telegraph station.
No storage batteries or motor generator required.
Plate voltage and current supplied by transformers.
Filaments lighted by transformer.
High voltage direct current is easily obtained by rectifying alternating current and smoothing out by means of choke coils and condensers.
No moving parts to require attention.
No noise.

ACME has the Most Complete Line of C. W. APPARATUS
C. W. INDUCTANCE

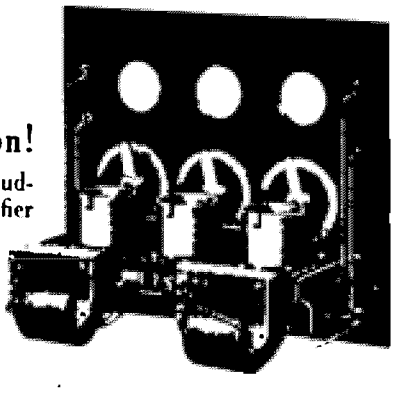
C. W. Power Transformers
Filament Heating Transformers
Choke Coils
Amplifiers
C. W. Plate Transformers
Modulation Transformers
Amplifying Transformers
Detectors

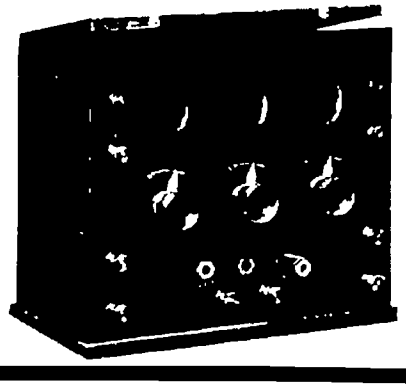
THE APPARATUS WITH THE GUARANTEE

Acme Apparatus Company
188 Massachusetts Ave. Cambridge 39, Mass.
New York Sales Office: 1210 Broadway, N. Y.

$35.00 DETECTOR AND TWO-STEP AMPLIFIER $35.00

Satisfaction!
That's what the Proudfoot Detector and Amplifier is built to give. *The Price* was made to fit your pocketbook.





Maximum Amplification. No Howling
Plug for fones furnished with each instrument. Automatic filament control by plug $10.00 additional

Detector and One-Stage Amplifier
$25.00
Subject to change without notice

G. M. PROUDFOOT
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Phone San Jose 2126-J
Established 1909
1200 Students

OUR WAR RECORD—200 Men Trained—130 Placed in Service

HERROLD COLLEGE
OF ENGINEERING AND RADIO

SPECIAL ATTENTION TO EXPERIMENTERS AND AMATEURS

467 South First Street SAN JOSE, CALIF.

Tell them that you saw it in RADIO

M. P. M.

NOW INTRODUCES:

LATEST AND GREATEST

"Almost as good as a tube"

Tested

DETECTOR CRYSTAL

Simply Wonderful

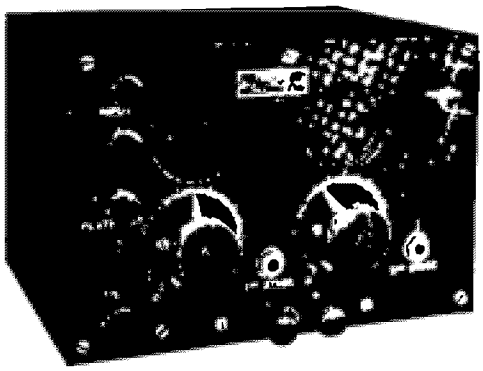
At your dealer or send One-Dollar Bill or M. O. for Large Box

Million Point Mineral Co.

1254 Clay St. San Francisco

See Engineer McNamee's Article on page 21 of this issue.

P. S.—There is no better Crystal than M. P. M.



A New Two-Stage Amplifier

This welcome new addition to the Federal line is meeting with the same popular approval that has so consistently distinguished all

FEDERAL

Radio Apparatus

Metal shielding; metal diaphragm between each stage, tube sockets and transformers of latest design and mounted on metal brackets; metal brackets grounded to cabinet and one side of filament battery; eliminates howling; highest degree of amplification; rheostat of ample capacity to prevent heating; sturdy construction; beautifully engraved panel with binding posts marked for ease in connection.

Federal Telephone & Telegraph Co.

Buffalo, N. Y.

News of the Radio Clubs

TOTEM RADIO CLUB

The Totem Radio Club of Seattle has elected as officers: President, H. F. Mason, 7BK; vice-president, O. Nicholson, 7KM; secretary, T. J. Bidner, 7HQ; treasurer, V. W. Payne, Air Service, U. S. A.; corresponding secretary, G. E. Kinsey, 7PO; publicity agent, S. G. Hagen, 7ON. G. E. Kinsey, 7PO, was chosen for traffic manager, Walter Hemrich, 7SC, first assistant, and H. L. Jones second assistant. The C.W. men were given a chance in this election, Mr. Hemrich being a persistent C.W. hound, and Mr. Jones both spark and C.W. Under direction of these men, it is hoped to eliminate, with the help of the tuning committee, the strife between the fones and the spark stations which has hitherto hindered the efficient working of either type of transmitter. C.W. stations will not be allowed to call and sign for nine minutes straight without listening in or interruption, as was reported against one station at the last meeting; on the other hand, they will have their chance to do DX work the same as a spark station. The club meets every Friday night in the Chamber of Commerce rooms, Arctic Building, where visiting amateurs are always welcome. All communications should be addressed to the Corresponding Secretary at 907 West 58th St., Seattle, for prompt attention.

TACOMA, WASH.

Our Friend Richards seems to be keeping a continuous watch lately. How do they do it?

Anyone wishing to talk to 7EK will please do so before 6:15 p.m., as his time is *taken* after that hour by one "fairer than radio."

Dame Rumor has it that 7CE, our promising C.W. expert, is going to enter the University of Washington. Now that our two C.W. wizards will be there, Otto and "Howdy," we are of the opinion that the students will witness some heated C.W. arguments.

The newspapers came out the other day with a lengthy article stating that the amateur wireless operators were stealing the city's watt hour meters from residences, and using them to construct apparatus. The local club took proper action and 7CE also called on the commissioner of light, and—well, what he told him we won't print here.

Miss Martha Kleiber, our promising Y L op., is getting discouraged with radio. Cheer up, Mart! Otto will be home from the "U" this summer.

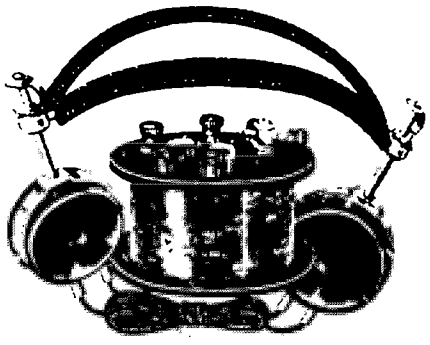
7BA is trying awfully hard to hook-up with some station in Spokane. If I were you, Merle, I'd build her a set and then you wouldn't have any trouble getting those messages thru.

It would certainly do certain Northwestern stations good if they would read Mr. McGown's letter on "Instructions for Calling" in December RADIO and then comply with it. Let's brush up a bit, fellows!

Did you hear the big scrap the other night between 7BC and his three friends, 7WX, 7VX, and 7BA? It was all on HIGH power, too. Say, fellows, next time you want to scrap go on out in the vacant lot and tell the other fellow how you feel about it and let the perfectly good ether alone. Or do it by telephone—it's lots quicker.

All operators wishing to enroll in the City College School here under the direction of Professor (?) K. B. A., kindly see Karl Weingarten and he will give you all the latest "dope" on it.

Special Complete Receiving Set



[illegible] Total $[illegible]

FOR A SHORT TIME ONLY, $10.50

We carry a full line of all the best Wireless Apparatus and Parts

Murdock	Firco
Acme	Federal
DeForest	Eby
Westinghouse	Brandes
Grebe	Baldwin

SOLID OAK CABINET

7" x 18"	$4.00
7" x 12"	$3.00
7" x 7"	$2.50

WAXED FINISH

Hinged Cap 50 cents extra

ORDER NOW — DEPT R

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Keep up-to-date. Learn about all the big recent improvements in radio apparatus. 84 pages chock full of best and biggest values of America's 51 leading manufacturers. Most complete, includes everything

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Arlington Tested Crystals, Galena or Silicon. Certified super-sensitive. Per crystal 25c

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"B" BATTERIES

AN

EVEREADY

PRODUCT

43V. Batteries, tapped	$4.50
22½ V. Batteries, Navy Type	3.00
22½ V. Batteries, Commercial Type	2.00

Latter two types especially adapted to Cunningham and Radiotron Tubes.

Postage Prepaid Anywhere in U. S.

ETS-HOKIN & GALVAN

Wireless Engineers

10 Mission Street San Francisco

Don't Forget to Read the Classified Ads on Page 74

POLYTECHNIC RADIO CLUB

The Polytechnic Radio Club of San Francisco has appointed as its traffic manager, Charles Bertrand, 6ABY (C.W. & Spk.), assisted by John Morton, 6AKC (Spk.).

They will be responsible for the control and supervision of all transmission of club members. In case of complaint against members of the P. R. C., all details should be referred to the above-named managers for subsequent action.

The following are the licensed members of the P. R. C.: 6MX, 6QC, 6QP, 6QZ, 6TK, 6AAW, 6ABY, 6AKC, 6AMA, 6AOU, 6ASL, 6ATS, 6ATY, 6AUN, 6AWG, 6BAO, 6BAQ, 6BCZ, 6BDA, 6BEY, 6BGQ. This club has an active membership of twenty-five. Its two-step amplifier and honeycomb receiver and ½ K.W. transmitter have all been constructed by the members. The construction of a C.W. transmitter is being contemplated. The officers of the club are: President, B. Greensfelder; Vice-President, H. Bartmann; Secretary, T. Graham; Treasurer, C. Tinsley; Sgt.-at-Arms, P. Fritsch; Chief Op., C. Bertrand.

RADIO CLUB TO SUPERVISE AIR TRAFFIC

The San Francisco Radio Club, Inc., has installed a complete transmitting and receiving station in the new club rooms, 709 Mission Street, for the purpose of enforcing the regulations of the new "Pacific Plan." The new station will be in operation every night from 7:30 to 10 p.m., and commercial first grade operators will be "at the key." Meetings will hereafter be held on Friday evenings at 8:30 p.m. Lectures will be delivered weekly, except on the first Friday of each month. All correspondence should be addressed to the secretary, room 702, 709 Mission Street, San Francisco.

The Burbank Wireless Club has been formed at the Burbank School, Berkeley, Calif. William Pennington is president, Thomas Clark vice-president, and Lloyd Harrison, secretary-treasurer.

The Ashbury Radio Club has been organized at San Francisco, Calif., through the efforts of John Signer of 1021 Cole St.

6TT, the Associated Radio Amateurs, 2944 Avalon Ave., Berkeley, Calif., are a group of licensed radio operators organized to promote the welfare of amateur communication. They maintain a complete experimental laboratory where research is carried on to develop new and better apparatus. Experimenters are invited to submit their difficulties.

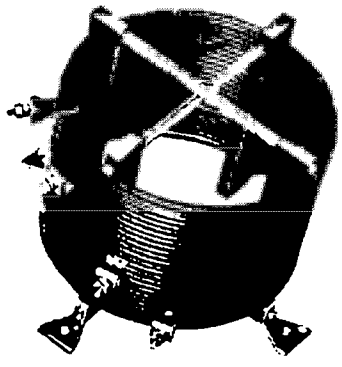
COZY NOOK RADIO CLUB

The Cozy Nook Radio Club of Chewelah, Washington, claims to be the pioneer wireless outfit of the Northwest to be installed in a rural school. The outfit is modern, consisting of a vacuum tube outfit, with honeycomb coils, a one-step amplifier, and phonograph attachment. Musical concerts from California and Denver come in clearly. The news that is sent out is used for current events in the school. The music from other stations comes in loud enough to be heard all over the room.

THE CROSLEY
FOUR-PRONG V-T SOCKET
One piece of porcelain, the same as used in vacuum tubes for insulating the four prongs, given *free* with each Cunningham C-300 at $5.00; or C-301 at $6.50. Add 25c for mailing
CALIFORNIA RADIO LABORATORY
P. O. Box 463 - Hanford, Calif.

The New Benwood "CW" Inductance

The ONLY Inductance Made for Table and Panel Mounting



Standard size as shown consists of 25 turns of edgewise wound soft drawn copper ribbon 3/8 inch in width, 1/16 inch in thickness and the turns are SEVEN INCHES in diameter.

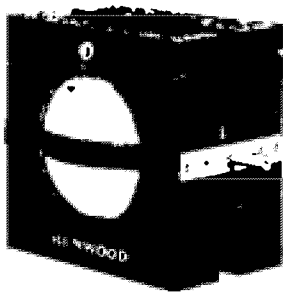
The ribbon is wound on FORMICA supports, thus giving PERFECT INSULATION. The inductance is furnished with FOUR of the NEW BENWOOD "CW" HELIX CLIPS that fit either flat or round inductances. Each clip has moulded INSULATED HANDLE, allowing operator to tune the set while same is in operation.

INDUCTANCE COMPLETE AS SHOWN $8.50. 50 turn size $12.50.

These are ideal for 3 or more 5 watt tubes and especially made for the 50 watt tubes that require high conductivity in inductance.

THE BENWOOD VARIOMETER

All radioists know that there is no equal to the conventional type of variometer for the reception of wireless signals and those of the radio telephones. A properly designed variometer will bring in signals 2 to 10 times louder than the various other types of inductances on the market. With this fact in mind we have designed what we believe to be the "last word" in variometers. Our inductances are wound with double cotton covered wire and no shellac, paint or varnish is allowed to cover the wire.



These variometers cover a wave length range of 150 to 650 meters when used in conjunction with the average variocoupler. The features are, minimum distributed capacity, minimum distance between stator and rotor, large size wire on both coils, positive contact bearings and properly designed mechanically as well as electrically.

Variometer as shown, $5.00 each.

IMMEDIATE SHIPMENTS ON ALL APPARATUS WE MANUFACTURE

Send ten cents in stamps for the NEW BENWOOD CATALOGUE. Contains the latest price dictionary. Lists all RADIO TELEPHONE APPARATUS.
Shows and describes the new MU-RAD radio frequency transformer that has caused such a sensation in the east. We are western distributors for this item and can make immediate delivery.

$9.00 each. Dealers, write or wire.

The Benwood Company, Inc.
ST. LOUIS, MO.

All Wizard Batteries Are Absolutely Guaranteed

FROM MANUFACTURER TO USER

ALL BATTERIES SENT POSTPAID

Buy direct from the manufacturer and receive a Fresh Battery

Announcing Wizard's 2 New Improved Type "B" Batteries

No. 1632—1 tap 45 Volt Var. Battery,
Size 6x5x2⅜ in. (Wt. 3¾ lbs.) Price....$2.80
No. 1630—6 tap 27 Volt Var. Battery,
Size 6x3x2⅜ in. (Wt. 2½ lbs.) Price.... 1.80

These new types are not made of the same size cells as a small size "B" Battery. The volume of one of the cells in these types is 4.7 cu. inches as compared with 2.5 cu. inches, the volume of a cell used in small "B's". You can easily see that the life of these two types are almost double the life of the small "B's."

OTHER WIZARD TYPES

Cat. No.	Size	Taps	Vltge	Weight	Price	Cat. No.	Size	Taps	Vltge	Weight	Price
1623 Plain	2½x2x3¼		22½	1 lb.	$1.00	1625 Variable	3x4x6⅝	5	22½	5 lbs.	$2.25
1623 Variable	2½x2x3⅝	5	22½	1 lb.	1.20	1626 Plain	3x8x6⅝		45	10 lbs.	3.75
1625 Plain	3 x4x6⅝		22½	5 lbs.	1.85	1626 Variable	3x8x6⅝	6	45	10 lbs.	4.15

Send all money orders to

Write for Bulletin No. 6

WIZARD BATTERY CO. *Dept. P* 1315 42d St., Brooklyn, N. Y.

Phone Kearny 2778

PACIFIC RADIO SCHOOL

ARC & SPARK SYSTEMS

Hours:

1 to 5 P. M.
7 to 9 P. M.

433 Call Bldg.,
San Francisco, Cal.

Send for descriptive circular.

ARCS

are fully explained in the

"ARC RADIO MANUAL"

A most complete book dealing with the various types of arc radio apparatus for ship and shore station work.
Illustrated with many photos and wiring diagrams. You need this book if you are a commercial operator or desire to take the radio examination.

Price $2.50 Postpaid

RADIO, Pacific Bldg., S. F., Cal.

The "QSA" Line of Equipment

COMBAT

A Storage Battery especially designed for Radio work. The only Battery with non-corroding binding posts. Write for particulars and incidentally get your name on our mailing list to receive our monthly bargain sheets.

Here is one of the many items listed for December:

Dry Cell B-Battery 45 volts $1.85 ea.

INDEPENDENT RADIO SUPPLY COMPANY
3716 W. Douglas Blvd., Dept. P-12
Chicago, Ill.

"Better Results with Less Effort"

—RADIO INSTITUTE—

OF AMERICA

Conducted by the greatest and most experienced radio telegraph organization in the world.

Thorough training given in radio operating, traffic, and in damped and undamped systems.

Tuition ten dollars a month for either the day or evening sessions or both combined.

Prospectus mailed on request

RADIO CORPORATION OF AMERICA
Phone Douglas 3030 — 331 New Call Bldg., San Francisco

Try "9ZAF" **REYNOLDS RADIO** Service "9ZAF"
***from* DENVER**

Kennedy—RECEIVING OUTFITS—Grebe

Type 110 Universal	$250.00	GREBE-CR5	$80.00
Type 2201 Intermediate	125.00	GREBE-CR8	80.00
Type 281 Short Wave	80.00	GREBE-CR9	130.00
Type 525 Amplifier	85.00	GREBE-RORD	75.00
Type 521 Amplifier	55.00	GREBE-RORK	55.00

Phones

Baldwin	Brandes
Murdock	Federal

Antenna Wire

Aluminum No. 14, per lb. (about 175 ft.) $1.00
Copper No. 14, per lb. (about 80 ft.) .60

REYNOLDS RADIO CO., Inc. 613 19th Street DENVER, COLO.

Distributors - Dealers — *Write for Proposition*

THE DESIGN AND BUILDING OF A C. W. SERVICE

Continued from page 27

as a feed back tickler. This hook-up, while not as selective as the regular regenerative hook-up, seems to be the best for C. W. work, especially the voice.

In the transmitter circuit we are using two C 302 tubes, one as an oscillator and one as a modulator. The plate voltage is supplied from a motor generator set rated at 100 watts at 400 volts d. c.

No. 8, or the antenna inductance, consists of a paper tube 4 in. in diameter wound with 1/8 in. copper tubing spaced by winding chalk line between each turn. This winding is tapped every other turn. We obtain best radiation in our antenna, which is of the 6 wire T type, 60 ft. long, 50 ft. high, by placing the plate lead at the extreme top, grid and ground at the extreme bottom and the antenna lead at the 18th turn. At these points we are radiating .55 amp. at a true 200 meter wave. If the antenna top is moved up to the 30th turn our radiation would be 1.8 amps. at 275 meters.

No. 10 is made by winding 300 turns No. 32 d. c. c. on a thread spool. No. 11 is made by turning down a wooden spool 5 in. long, 1½ in. in diameter with hole in the center 3/4 in. diameter, so that the walls surrounding the hole is about 1/32 in. thick. This spool is wound full of No. 30 d. c. c. magnet wire and the hole is filled with a bundle of soft iron wires. We put the wire of both of these coils (No. 10-11) through a bath of hot wax while they were wound.

Three coils like No. 11 should be made for the set, one to be used as a tone frequency choke, and the other two are to be used in conjunction with two mfd. fixed condensers as filter coils for the generator.

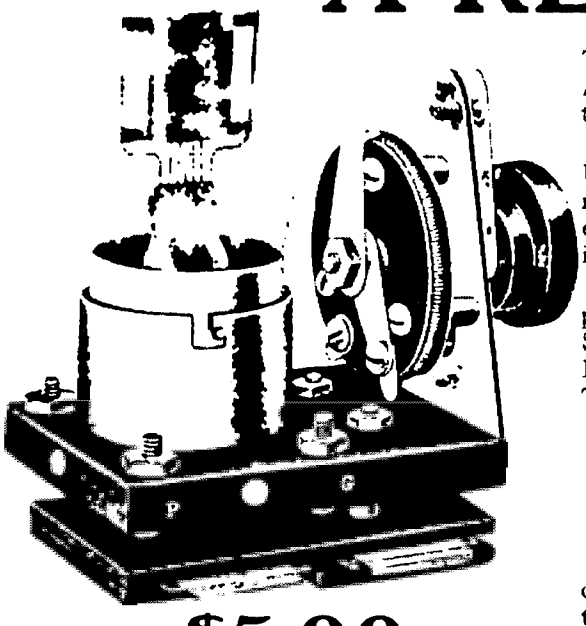
All other units can be found by reference to the legend and hook-up drawing.

Our change-over switch we consider quite an institution. It is made from a Federal anticapacity switch and is operated by a solenoid plunger. This solenoid is controlled by two small push buttons fastened on the lid just beside the key.

This solenoid switch is placed on top of the desk so as to get the leads of the a. c. circuit as far as possible from the receiving set. The wiring is so arranged when the switch is on the receiving side there is no a. c. in the set except at the two poles of the change of switch. We have shielded this as best we could by removing the switch points not in use and placing a piece of zinc thru the switch at this point. You will be surprised at the ease with which this switch handles the 110 volt a. c. that supplies filament transformer and generator motor. The a. c. hum is hardly distinguishable in the phones.

Tell them that you saw it in RADIO

A REAL DETECTOR



$5.00

THINK IT OVER. WHEN YOU CAN BUY A COMPLETE AUDION CONTROL UNIT FOR $5.00, does it pay you to buy the separate instruments and mount them in your set?

The NEW NO. 40 WIRELESS SHOP AUDION CONTROL UNIT is complete in every detail, and includes a socket, filament rheostat, mica grid condenser and mica bypass condenser. It is easily attached to your panel by only two screws, and can be wired into your set in a jiffy.

WHAT MORE COULD YOU WANT? Every detail is complete. Each and every part is manufactured by THE WIRELESS SHOP—A GUARANTEE THAT YOU WILL GET A REAL BARGAIN, AND A STRICTLY QUALITY PRODUCT. ASK THE OTHER FELLOWS.

And the Amplifier Unit to Match the Detector

The No. 41 Amplifier unit is identical to the detector in general construction, with the addition of a high grade shell type amplifying transformer, which is mounted directly on the back of the socket shelf. And this unit costs you ONLY $11.00. We can also furnish the front formica panel, with all holes drilled, panels engraved, and all necessary parts for completing the set, less the case. All of these parts are fully described and listed in our new BULLETIN No. 3, which will be mailed to you upon request. Where shall we send yours?

USING "WIRELESS SHOP" STANDARD UNITS, YOU CAN BUILD UP A COMPLETE 2-STEP AMPLIFIER, INCLUDING 2 No. 41 AMPLIFIER UNITS, ONE GORTON ENGRAVED PANEL with all holes drilled, 2 SPECIAL GORTON ENGRAVED RHEOSTAT DIALS WITH KNOBS, 2 "WIRELESS SHOP" JACKS, and 8 RUBBER TOPPED BINDING POSTS, for the sum of only..... **$30.00**

AND REMEMBER—QUALITY WILL ALWAYS PREDOMINATE WITH

THE WIRELESS SHOP
A. J. EDGCOMB

1262 West Second Street **Los Angeles, Cal.**

NOTICE

Radio—7XC

The Northwest Radio Service Co., the largest Radio Supply house in the Northwest has moved to

1637 Westlake Avenue Seattle

where a larger stock of up-to-the-minute radio equipment has been received. If you want fast *Service*, send your order to us. Service is our middle name, and incidentally the corner stone of our success. Remember the new address

Murdock, DeForest, Radio Corporation, Radisco, A.-P. and other standard lines.

Builders of "PUGET" RADIO PRODUCTS—None Better

Tell them that you saw it in RADIO

You Should See

RADIO TOPICS

In its new Rotograve form

It is the most attractive and interesting Radio Magazine that you have ever seen.

The November number is published in this new modern Artgrave style.

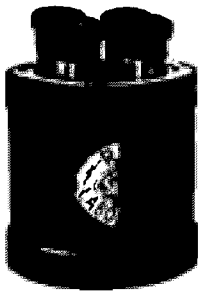
Send 15 cents for a Sample Copy.

RADIO TOPICS

RADIO TOPICS
4533 N. Sawyer Ave., Chicago, Ill.

First on the Market

Radio Frequency Transformers



For Amateur and Broadcasting
Range 175-500

Type RF-1,
Price $6.00

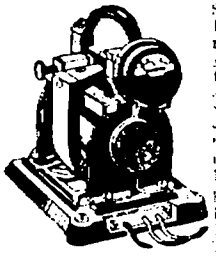
Mr. Amateur: Hook up a radio transformer ahead of your detector and get acquainted with stations you have not heard before.

The Type RF-1 is a—

Transformer of special R. F. iron core construction. (Patent pending.)
Transformer having complete shielding.
Transformer covering the amateur wave-length efficiently.
Transformer giving maximum amplification per stage.
Transformer designed by former Government radio engineers
Commercial and special range R. F. transformers supplied

Radio Service Laboratories INC. **Asbury Park, New Jersey**

10c Charges Your Storage Battery AT HOME WITH AN F-F Booster



So You will never have to give up in disgust when working a distant station. Is it not gratifying to feel Your Filament Battery will always be ready when needed? You Know what it's like to have friends call to Listen In & then find your battery dead. The F-F Battery Booster is a rugged Charging Apparatus, unfailing in its ability to deliver service day and night; requiring no skill to operate; charges automatically and operates unattended. Screw Plug in lamp socket, Snap CLIPS on Battery Terminals and watch the gravity come up. AMMETER shows amount of current flowing. Everything Complete in Compact Self-Contained Portable CHARGING UNIT. The F-F BATTERY BOOSTER is an automatic Magnetic Rectifier for 105-125 Volt 60 Cycle A. C. These types last a Lifetime. PRE-WAR PRICES:

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The Larger Types are recommended for large batteries, or where time is limited. Shipping weights Complete 12 to 15 Pounds. Send check for Prompt Express Shipment. If via Parcel Post have for Parcel Include Postage & Insurance charges, or order us to ship Type you desire C. O. D. Order Now or Write Immediately for FREE Descriptive Booster & Rotary Bulletins 33 & 33-A.

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DESIGNERS — MANUFACTURERS — DISTRIBUTORS
225 Superior Street Toledo, Ohio

S. O. S.

or Going Under at Midnight

By C. J. DOW

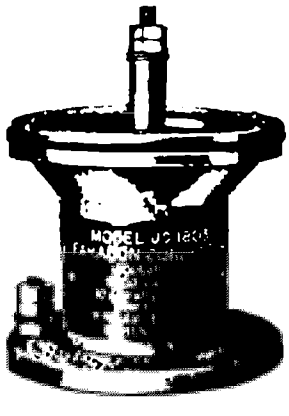


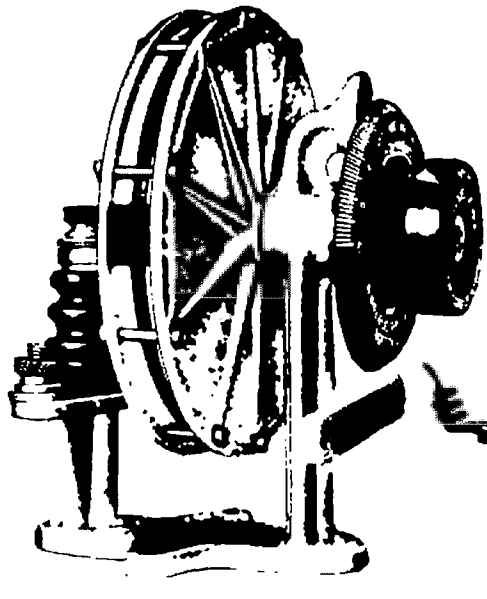
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for better CW Transmission

all designed for Radiotron Vacuum Tube Operation

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For use as blocking or coupling condenser in CW radio telegraph and telephone circuits. Lowest loss of any condenser on the market and is the only compact and satisfactory unit of its kind available for CW work today. Positively necessary to prevent "swinging" of CW telegraph signals. Has a capacity of .000025 MFD, and is rated at 10,000 volts.

Price, $5.00

Faradon UC-1831

Variable Type

Essential for tuning of CW transmitters. Designed as a series antenna condenser and will stand five amperes of CW and its maximum capacity setting. Will vary your radiated wave length by 50 to 100 meters. Minimum .0001 MFD, maximum .0012 MFD. Rated at 4000 volts.

Price, $9.00

Faradon UC-1014

For use as a key condenser, grid leak condenser, or radio frequency bypass condenser in circuits utilizing Radiotrons UV-202 or UV-203. It is fitted with mounting tabs on back. Has a capacity of .002 MFD. and is rated at 3000 volts. Will carry two amperes at a 200 meter maximum setting.

Price, $2.50

OTHER FARADONS

Model UC-1015

Series antenna condenser and intermediate CW circuit condenser utilizing Radiotrons UV-202 and UV-203. Three capacities possible with each unit; .0005, .0004, .0003, at 7500 volts effective.

Price, $5.75

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Suitable as a grid condenser in higher power Radiotron transmission. Also for insertion across plate transformer in sets where high potential surges follow key transmission. Has a capacity of .002 MFD, and is rated at 6000 volts.

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NOTE: These two models are similar in appearance to UC-1014

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THIS loud speaker has many unusual features, first and foremost being the swivel adjusting device which allows the horn to be swung into any desirable position. Secondly, it is constructed in such a manner that a simple turn of an adjusting screw will allow almost any kind of a head phone being used for the loud speaker.



Price without phone **$7.00**
F. O. B. Richmond

With Baldwin Phone - - $12.50

A 3-foot green cord included with every loud speaker

This loud speaker can be supplied with or without phone. It will be a valuable addition to your station as the workmanship is excellent. The stand is of Mahogany finished wood.

Write for our price list on other makes of radio equipment. We carry a large stock of standard parts and supplies and construct equipment to your order.

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To Order Specials of Any Article



Insist on "INSULATE" When Ordering Through Your Local Dealer







GENERAL INSULATE CO.

1111 Atlantic Ave. Brooklyn, N. Y.

THE C. W. MANUAL

Continued from page 14

device in conjunction with the Heising system of modulation as previously explained. Full constructional details for this important piece of apparatus will be found in Fig. 29.

A plate current milliammeter with a scale reading to 150 milliamperes and a radiation ammeter reading to 1.5 amperes should be used with this circuit.

The battery of Fig. 11 represents the source of high voltage for the plates, and it is shown as such for conventional reasons only. The "C" battery of the same figure must be inserted in the grid circuit of the modulator tube for the purpose of maintaining a negative grid potential. The value of potential necessary for this purpose will vary with the type of tube in use, and will in ordinary cases lie between the limits of 22 and 40 volts. If the grid potential is not sufficiently negative, the plate current to the modulator tube will rise to an excessive value and the tube will overheat as evidenced by a bright red plate. If too much "C" battery is used, poor modulation is liable to result. Usually, just sufficient "C" battery to prevent overheating of the tube by excessive plate currents will be found most satisfactory. Ordinary flashlight cells as used in the plate circuit of receiving apparatus will suffice for this purpose.

Adjustment, Tuning and Operation of the Experimental Five Watt Set

By referring to Fig. 28, the reader will observe that there are one fixed, and three variable connections to the inductance. The fixed connection divides the inductance into two unequal parts: the lower seventeen turns constituting the input inductance and the twenty-three above, the output inductance. Inasmuch as this fixed connection is tied to earth (see Fig. 11), it represents a point of zero potential, and the potential impulses on either side are out of phase by 180°. This is a necessary condition in the operation of vacuum tube oscillators. The necessary input coupling and resultant impressed grid potential are obtained by altering the position of the lower variable connection on the portion the inductance below the fixed connection. The position of the antenna lead determines the period of oscillation of the circuit, which may, however, be influenced by any alteration in the position of the plate coupling tap represented by the upper flexible lead in Fig. 28.

In the initial tuning and study of this circuit, the reader is urged to make use of an artificial antenna wherein the phenomena attending the introduction of resistance into the oscillating circuit may be studied in detail.

Tuning this circuit with a wavemeter is recommended, though the ease with which the various adjustments may be made and the ease with which the circuit oscillates admits of other methods.

The following procedure is outlined for the experimenter in using the circuit for the first time (see Fig. 28):

1. Disconnect antenna lead to radiation ammeter and substitute an artificial antenna consisting of a small variable capacity, 0.001 micro-farad, and a small variable resistance device, 10 ohms, and cut out all resistance.
2. Place the various leads to the inductance approximately as shown in Fig. 28.
3. Remove the modulator tube from the circuit temporarily, and by means of the filament rheostat adjust the oscillator tube filament to the correct operating temperature.
4. Cut in the plate current supply.

Before the circuit is properly adjusted the plate current milliammeter may indicate that upwards of 100 milliamperes is flowing, and there may be no deflection of the radiation ammeter pointer. If the grid input tap (lower one in Fig. 28) is shifted, the plate current should fall off rapidly until only 30 or 40 milliamperes flow, when oscillations should be in evidence by a deflection of the radiation ammeter pointer. To obtain a maximum output current, it will now

be necessary to shift the plate coupling tap until the correct position is found. Note here, that the output current (radiation) increases as the e.m.f. to the plate is increased and that the radiation increases also as the filament temperature is increased to a certain point, beyond which no further increase in the filament temperature without a corresponding increase in the plate potential, will increase the output current.

Thus far, the oscillating circuit has been one containing little resistance and abnormal output currents may have been observed.

Gradually, cut in resistance in the artificial antenna circuit and follow up each change with corresponding circuit adjustments. The radiation will fall to a fraction of its former value. After the circuit has been studied in this manner, substitute the real antenna for the artificial one, and when the circuit is readjusted for this change, cut out the supply of high voltage to the plate, and place the modulator tube in its receptacle. Adjust both filaments to the correct temperature and again close the plate supply circuit.

The circuit is now ready for use, except for the adjustment of the "C" battery and the regulation of the microphone battery circuit.

NOVEL METHOD OF SHOWING STATIONS REACHED

Continued from page 11

1ARY—Burlington, Vermont.
1BCG—Greenwich, Conn.
2ZV—Jamaica, Long Island, N. Y.
2FP—Brooklyn, N. Y.
3EM—Baltimore, Md.
8AQR—?
4BT—?
5ZV—Houston, Texas.
5X5—?
6JX—San Francisco(x).
7MP—?
7ZT—?
Many other 7's.
8AGO—Pittsburgh, Pa.
8AGZ—East Cleveland, Ohio.
8VY—Kalamazoo, Mich.
8AG—Toledo, Ohio.
8AM—Detroit, Michigan.
8EA—Pittsburgh, Pa.
8BO—Detroit, Mich.
8BR—Lansing, Mich.
8KF—Bellevue, Ohio.
8KP—Lima, Ohio.
8AIP—Charleston, W. Virginia.
8IQ—Akron, Ohio.
8VY—?
9XAQ—?
9BL—Chicago, Ill.
9XI—U. of Minnesota, Minn.(x).
9ANG—Racine, Wisconsin.
9EK—St. Louis, Mo.
9ZL—Manitowoc, Wisconsin.
9AJ—Peoria, Ill.
9AX—Chicago, Ill.
9EE—Valley City, N. Dakota.
9WV—Topeka, Kansas.
9PS—Wichita, Kansas.
9ZV—St. Louis, Mo.
9APW—St. Paul, Minn.
9APJ—Chicago, Ill.
9AVY—Denver, Colo.

Here, again, there are scores that I have heard, but I pick these "without fear or favor," as they show a wide stretch of the nation—covering it rather thoroughly and illustrating that 6XAD is in a GOOD geographic position for hearing! These stations I hear consistently.

The results that the map show—for the work at 6XAD—are very satisfying. It gives me much pleasure to call attention to the performance of 3FS—the station of Charles G. Benzing, at 2425 South 12th Street, Philadelphia. His signals come in here *very* QRK—not on one night by a "freak" happening—but I hear him several times each week! I quote, verbatim, from a recent letter to me:

" . . . Your telegrams and letters, correctly reporting my signals, certainly convey good news to me, as I am only using ten watts here. The furthest distance reported before was by 5ZL, at Little Rock, Ark.

"You are correct about the time that I was working—from 1 to 5:30 a.m., our time—on the night mentioned in your first letter. I heard you on the night of the first test. It was 12 m.—our time—and I would like to have you verify this. The signals were very QSA, but QRM broke them badly. . .

"I am using 2 five watters, 550 V rectified with a jar rectifier. Radiation 2. amps. Have just changed to 3 five watters, with a radiation of 2.6 amps., with plate V of 700. Expect to increase radiation when I increase number of jars. . .

"CHARLES G. BENZING,
"Radio 3FS.

"Antenna: 60' and 50' high, 45' long—6 wire inverted L, 3' between wires."

I think that I am entirely safe in saying that THIS is a world's record for low-powered C.W. effort, and I most cordially compliment 3FS on his wonderful achievement. My log shows that I have heard him six times in two weeks.

MURDOCK No. 56
RADIO RECEIVER



2000 Ohm Double Set — $5.00
3000 Ohm Double Set — $6.00

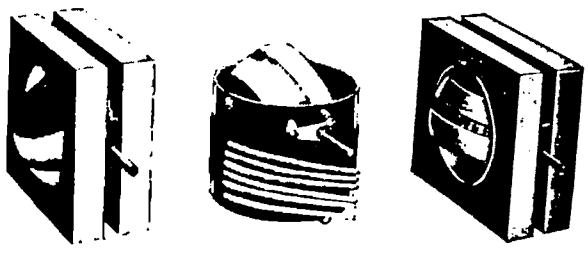
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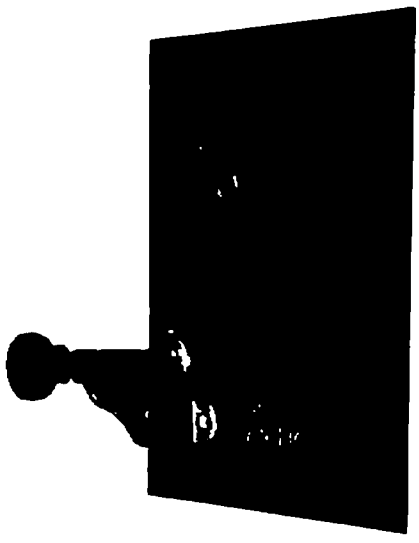
The "Q-R" Vernier Adjuster

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First and only real adjuster which may be quickly and easily attached to your set without removing the panel.

Brass, highly nickeled, with screws and full instructions for installing.

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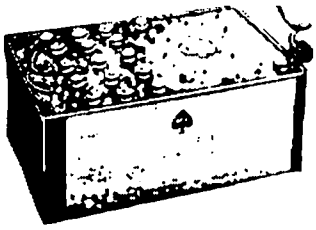
Without ACE "B" Batteries

BETTER SERVICE ACE TRADE MARK LONGER LIFE

ANNOUNCING

the new Ace 4½ Volt Block Battery. If your B Battery is a trifle weak connect an Ace 4½ Volt Block Battery and note the improvement.

5 Block Batteries connected together is equal to 1-22½-volt Navy type B Battery. The main features are Standard Battery Binding Post, which eliminate the necessity of soldering terminals, and the fact that in case one cell would go dead it would only be necessary to discard one 4½-volt unit and not a complete "B" Battery, size 4" x 3" x 1¼", weight 1 lb.



Price 50 cts.

This cut shows the Ace special 45 volt variable battery which is going strong and showing the way as to being the one Battery to meet all "B" Battery requirements. Size 6x5x2⅝, weight 3¾ lbs. Price.....$3.50

OTHER ACE TYPES

Cat. No.		Size	Voltage	Lbs.	Taps	Price
623	Plain	2½x2x2⅝	22½	1		.....$1.50
623	Variable	2½x2x3⅝	22½	1	5	..... 1.75
625	Plain	3 x4x6⅝	22½	5		..... 2.50
625	Variable	3 x4x6⅝	22½	5	5	..... 3.00
626	Plain	3 x8x6⅝	45	10		..... 5.00
626	Variable	3 x8x6⅝	45	10	6	..... 6.00

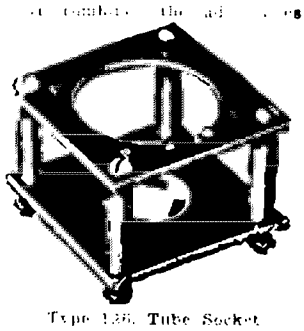
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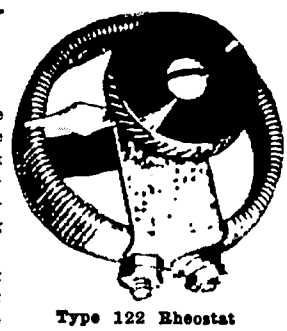
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Tell them that you saw it in RADIO

BOOK REVIEWS

Continued from page 34

raphy are given full consideration, as is also telephony and especially the question of modulation. In the chapter on antennæ and radiation is a logical development of radiation formulæ and of the theory of direction finders and coil antennæ. Wavemeters and their use, amplifiers of various types, and an outline of a laboratory course of radio experiments are taken up in the last chapter. While the general treatment is mathematical and requires a knowledge of trigonometry and the calculus in order to gain the fullest possible benefit, the general reader will find the book to be filled with valuable information which clears up many obscure points. Especially noteworthy is the explanation of the use of vacuum tube as a detector, amplifier and generator of high frequency current. With so much to praise, it is unfortunate that the book is marred by many typographical errors not noted even in the errata sheet. As a whole, the book is one that should be in every radio man's library.

6AFN

C. E. Warriner is the owner and operator of 6AFN, 2462 Kuhio Ave., Honolulu, which has been heard so much lately on the mainland coast. This is the first time that a Hawaiian amateur has been heard in the United States. It now remains for an officially conducted test to be carried out. Mr. Warriner will have the U. S. Navy to assist him on the Honolulu end of the test if arrangements can be made with some Pacific Coast operators to complete the test. He usually chooses wet, rainy days for distant transmitting in the dark of the moon. This is the best time in the tropics. He was a Western Union operator in Chicago, then took up railroad work and became a train dispatcher on an Eastern railroad and finally a radio operator. He was the organizer of the "Radio Club of Hawaii," and is its present secretary-treasurer. The transmitter is of his own design and ideas, although the actual construction, according to drawings, was done by a mechanic.

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Contact Points, nickeled.....6 for 30c
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⅛x 7.....15c	¼x 7....20c	
⅛x 9.....15c	¼x 9....20c	⅛.....25c
⅛x13.....20c	¼x13....25c	¼.....30c

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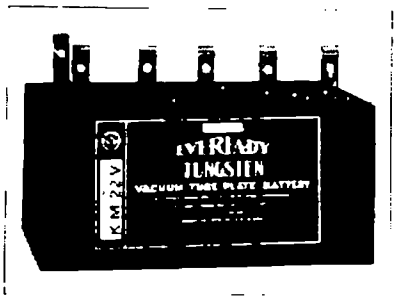
B.&S. Ga.	Enameled		Double Cotton		Double Silk	
Price per	½ lb.	¼ lb.	½ lb.	¼ lb.	½ lb.	¼ lb.
No. 18.....	...	...	.75	...	...	...
No. 20.....	.60	.30	.80	.40	1.00	.50
No. 22.....	.65	.35	.85	.45	1.05	.55
No. 23.....	.70	.40	.90	.50	1.10	.60
No. 24.....	.70	.40	.90	.50	1.10	.60
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No. 766— EVEREADY



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This is just the thing for the amateur—will give long and valuable service and can be absolutely relied upon to deliver a clear, steady current.

This battery has 1 negative and 5 positive leads, each having a flat brass strip with a 3/16-inch hole in the end for connection with the binding posts. These 5 positive leads allow a range of 16½, 18, 19½, 21 and 22½ volts in steps of 1½ volts.

15 cells connected in series and packed in a strong box make this battery substantial and easily handled. All cells are solidly packed and are sealed in paraffine and packed with ½-inch of sealing wax, rendering a weather proof unit and one that will withstand practically all variations of climate and temperature. This Wireless B Battery has been standardized for use in the United States Navy.

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Wire.....75c per 100 feet
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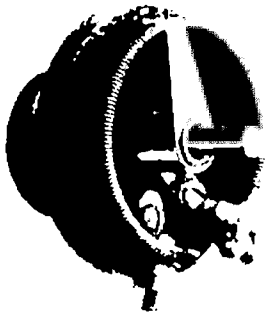
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KEYSTONE RHEOSTAT



The "Keystone" is one of the finest constructed rheostats on the market, and is made of the best heat resisting and durable material possible to obtain. Neat in appearance, is 2¼" diam., ¾" deep, and ¼" shaft. All parts are made of brass, and pointer is of heavy brass, nickel plated and polished. Resistance is 6 ohms, 1½ amps. carrying capacity. Can be easily mounted on back of panel by only drilling two holes, also dial can be used, instead of the knob and pointer furnished. Resistance is wound tightly on an insulating strip and can not become loose. Sold on a guarantee of satisfaction or purchase price will be refunded.

PRICE $1.25

Amateurs and constructors, don't miss sending 5 cents in stamps for our complete set of bulletins on raw materials, machine screws, wire, standard apparatus, audion and amplifying apparatus, and save money and time.

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Greenville, Penn.

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22½ volt Hi-Gee B-bat plain 90 cents
22½ volt Hi-Gee B-bat tapped $1.10
If that burnt-out tube is not broken we allow you 50c on the purchase price of any new tube.

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to write us today for full details on our new subscription agency. You can make many extra dollars in your spare time. Write NOW.

RADIO
Pacific Bldg., San Francisco, Cal.

HOW TO MAKE A GOOD RADIO RECEIVER

Continued from page 25

sary to re-wind the rotor, with smaller wire, so that 35 or 40 turns will be available for tickler. A common variometer may be made up into a regenerative receiver, of the same type, by using the ball as the tickler, and the stationary windings as the first sections of the inductance. This will give a wavelength range up to about 450 meters, which may be increased by placing a tapped coil, of a diameter equal to that of the "hole" at the end of the variometer, either bank wound or wound in single layer, with 200 or 250 turns on it.

In any case, it will be found to be a very sensitive and reliable tuner, which will work extremely well over the wavelengths within its range for both C. W. and spark signals.

RECENT RADIO PATENTS

Continued from page 51

well as the battery 7. Variations in potential of the grid will produce variations in the opposite direction of the potential of the plate and these variations are in turn impressed, by means of condenser 17, upon the grid of tube 4. The signal is finally recognized in the telephone 12, in the circuit of which may be induced a current from an oscillation generator 22, whereby the heterodyne method of reception may be used. The effect of static or strays is prevented from exceeding that of the signals, due to the well defined limits of grid potential between which variations in the plate potential can be obtained.

RADIOPHONE PLACED IN PRESIDENT'S STUDY

A wireless telephone receiving outfit has been installed in President Harding's study on the second floor of the White House. Installation was made at Secretary Denby's request, it is understood. The instrument was connected with an aerial, and hereafter, when he likes, the President will be able to put the phones to his ears and listen in to the latest news of the day.

CALLS HEARD BY 7VO, M. K. BAUGHMAN, MEDFORD, ORE.

6ab, 6acr, 6ak, 6aid, 6ar, 6aje, 6az, 6ajr, 6gp, 6ale, 6gx, 6amk, 6jd, 6ape, 6kk, 6ard, 6km, 6ark, 6ku, 6atq, 6mw, 6atv, 6qr, 6avv, 6ru, 6xab, 6su, 6xak, 6sj, 6tu, 6wv, 6xd, 6xz, 6zb, 6zm, 6zx, 7ac, 7nw, 7aj, 7qr, 7ar, 7tq, 7ba, 7tu, 7bj, 7tw, 7bw, 7vk, 7cn, 7vx, 7da, 7wa, 7fi, 7xf, 7gx, 7xj, 7jd, 7ya, 7ks, 7zp, 7lc, 7zr, 7ly, 7zu, 7mf, 7zx, 7mp, 7afn, 7mu, 7nl, 7nn.

BY RADIO STATION SACR, BETWEEN JAN. 1 1922 AND JAN. 19, 1922

5za, 6ah, 6cu, 6cv, (6eb), (6ex), 6fh, (6gt), 6gx), 6iv, 6kc, 6ki, (6km), 6lc, 6mh, 6ng, 6od, 6ot, (6po), (6qr), 6sj, 6tj, (6tu), 6tv, 6to, (6uo), 6uv, 6vs, (6vz), (6aah), 6abx, 6acw, 6aeh, 6afn, 6ahp, 6ahv, 6aif, 6ald, 6alp, 6alu, 6alv (6ale), 6amk, 6aor, 6aoz, 6apg, 6aru, 6atq, 6atv, 6awq, 6baj, 6bcj, (6zal),7bh, 7bj, 7cd, (7ck), 7iv, 71y, (7mf), 7mp, 7tj, 7vo, (7zm), (7zt) 9nx, 9bbf, 9xaq.

Variometers Couplers

$3.75 Each

Wound but unassembled $3.00 Each

These instruments embody best workmanship and materials, all wooden parts genuine mahogany, coupler primary wound on Formica tubing. Wound to assure maximum results for short wave work. Shafts 3/16 inch. With Chelsea Dial and Knob $1 extra. Send for bulletin describing panels, parts and other apparatus.

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RTS

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Send for complete circulars now
Radio Testing Stat'n, Dept. A, Binghamton, N.Y.

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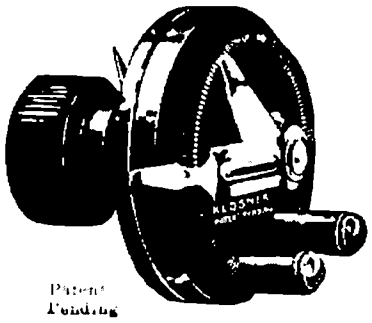
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With each of the listed tubes—**Radiotron U.V. 200, $5.00,** and **A. P. Moorhead Detector, $5.00; Radiotron U.V. 201, $6.50** and **A. P. Moorhead Amplifiers, $6.50**—we will supply free of charge your choice of either of these four premiums: Latest **Fada** Rheostat, $1.00, No. 810 Remler Bakelite smooth-running Rheostat $1.00, R. C. of Am. Porcelain V.T. Socket $1.00, or **Murdock** V.T. Socket, improved contact type $1.00. Either of the **Federal** single, closed or double circuit jacks, listed respectively at $0.70, $0.85 and $1.00, will be given as premiums with each R. C. of Am. Amplifying Transformer U.V. 712, $7.00 or **Federal** Amplifying Transformer $7.00. **Fada** 5 ampere **Nichrome** Power Rheostats $1.35, or R. C. of Am. Porcelain V. T. Socket, supplied free of charge with each $8.00 U. V. 202 5-watt **Radiotron** Power Tube for C. W. or **Radiophone** Transmission. We absolutely guarantee the foregoing apparatus. Only new and high-grade equipment carried in stock. Unsatisfactory goods returned within five days replaced at once. All orders are filled within twelve hours and shipped post paid and insured, thereby saving time and money.

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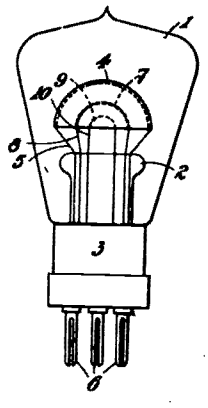
REMLER RHEOSTAT AND SOCKET.
BUS BAR No. 14 Hard drawn copper.
SEND FOR BULLETIN

QST RADIO SHOP

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Some Recent Radio Patents

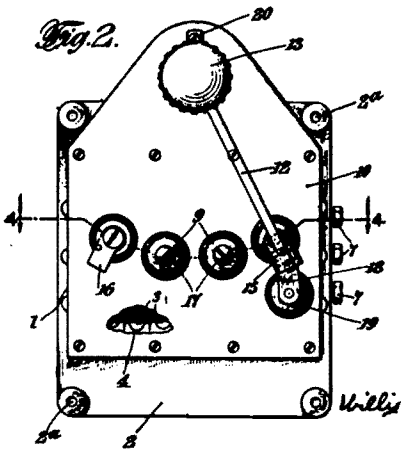
Fig. 1.



Horace St. J. De Aulâ Donisthorpe, 1,391,671, Sept. 27, 1921. Thermionic valve for use in wireless telegraphy and telephony.

This invention deals with a three electrode valve of the audion type, in which the plate 4 and grid 7 form concentric hollow spherical surfaces. The filament 9 is disposed near the center of these surfaces. The cathode stream, due to this arrangement, is more uniformly distributed, with the result that disintegration is more uniform and the life of the tube is increased. It is also stated that microphonic disturbances and noises are eliminated.

Fig. 2.



W. Dubilier, 1,391,673, Sept. 27, 1921. Antenna shortening device.

A condenser of special construction is described, which has a switching means co-operating with a plurality of taps from the condenser. This means is so arranged that a detachable contact piece may be placed on any one of the taps, so that the switch arm will contact with none but that tap upon movement of this switch arm. The device is described in connection with an antenna circuit for shortening the wave length of the antenna by a definite, predetermined amount.

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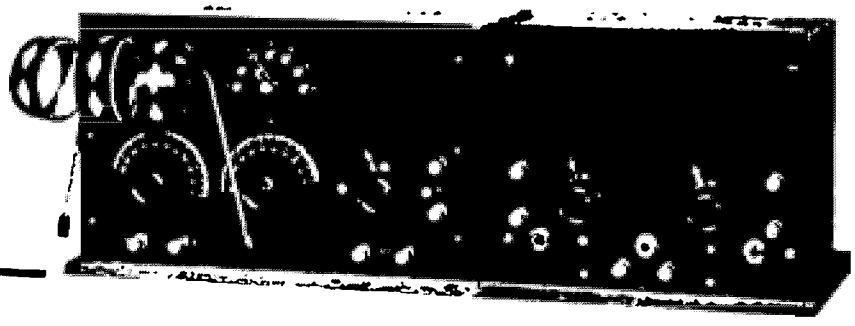
Herewith 4 cents in stamps to pay mailing expense on my copy of your latest booklet.

_____

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R-3-2



HERE'S THE RECEIVER

Does It Work?---Yes!

LONG WAVES

POZ on one tube, Nauen, Germany.
POZ 6 inches from the phone on two steps in the day time

SHORT WAVES

7MF Bozeman, Montana, at N[illegible] M. through the concert.
The Avalon phone all over a room 20 × 25 in Mill Valley, Calif.

Does It Amplify?---Yes!

From a concert 50 miles away.
On detector 5 feet from phones.
On the first step 15 feet from phone.
On the second step 75 feet from phones.
These signals were easily readable. Just a plain head set was used with Magnavox 5 blocks.

Is It Easy To Work?---Yes!

Yes, all this was done by an amateur of one month's experience.

Has It Quality?---Yes!

The best that there is. Remler dials, General Radio transformers, Pen Brand condensers, Fee tal jacks, complete panel, etc.

The Price---

The tuner-detector combined $35. The two step amplifier $45
(No Bulbs or Batteries)

[illegible] complete panel complete [illegible] battery [illegible] switches, bells, [illegible] wire [illegible] The right detector and amplifier [illegible] coils, [illegible] Remler [illegible]

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INTELLIGENT ELECTRIC SERVICE

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THE WESTERN ELECTRIC TEST

The remarkable result attained in the tests conducted by L. M. Clement of the Western Electric Co. in December, 1921, constitutes additional evidence of the commanding importance of continuous wave transmission.

The Western Electric Company does not maintain a regular broadcasting station, the transmission being merely for test purposes on new apparatus of Western Electric design. The station is located in the engineering laboratories at 463 West Street, New York. The antenna system, which consists of six wires about 250 feet long, is supported by two masts on the roof of a thirteen story building.

The radio telephone set was a Western Electric vacuum tube transmitter of 500 watts output. Four Western Electric 250 watt (Code No. 212-A) tubes were used; two as modulators and two as oscillators. A 50 watt (Code No. 211-A) tube was used as a speech amplifier.

Direct current from a motor generator supplied both the filaments and the plate circuits, the filaments being operated from a 14 volt and the plate circuit from a 1600 volt source. During the tests the antenna current was about 8 amperes and rose to an average of about 9 amperes while talking.

The tests which have been conducted have been of a purely experimental nature and were completed on December 27, 1921.

The following places from which we have received letters, are mentioned to give some idea of the area over which our transmission has been received: Halifax, Nova Scotia; Miami, Florida; Vera Cruz, Mexico; Baudette, Minnesota; Denver, Colorado; Pima, Arizona, several places in California and the steamship Col. E. L. Drake, 1000 miles west of San Francisco en route to Honolulu. Voice and music were heard in these cases.

Calls Heard

HEARD DURING JANUARY AT CANADIAN 3GG, OWNED BY M. J. CAVENEY, TIMMINS, NORTHERN ONTARIO, CANADA.

1al, 1ary, 1tv, 1aj, 1bua, 2cf, 2om, 3xm, 3gn, 3hj, 3fo, 3rf, 3zy, 3bfu, 3asv, 3bo fone, 3aqr, 3blf, 4el, 6fv, 8iv, 8bl, 8br, 8aj, 8ea, 8ym, 8vy, 8bo, 8uk, 8sp, 8hj, 8aqo, 8anw, 8ago, 9ql, 9aw, 9ca, 9aj, 9fm, 9als, 9dkv, 9diw, 9dso, 9aoe, 9bbf, phones kyw, kdka, wjx, wdy, nsf.

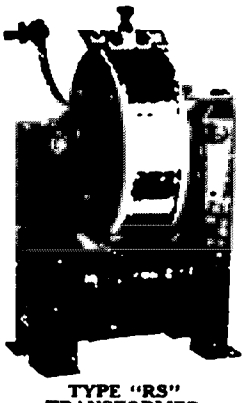
HEARD AT 8ART, PHILADELPHIA DURING JANUARY

spark—1aw, 1hk, 1chj, 2fp, 2om, 2pl, 3aia, 4ea, 8gk, 8uh, 8vw, 8bmc, cw—1ha, 1qn, 1ts, 1afv, 1alg, 1ary, 1avi, 1awb, 1bkq, 1bqe, 2nq, 2awf, 2aws, 2bgm, 2brb, 3zm, 3zo, 4bq, 4by, 8dr, 8hj, 8ih, 8iq, 8ni, 8sp, 8uk, 8abp, 8afa, 8aio, 8aqs, 8awp, 8bfo, 8bfx, 9dwj, an5, Can. 9al, nof.

HEARD AT 6GY DURING JANUARY 1922 ALL CW

4cb (Can.), 5fv, 5za, 6aat, 6acb, (6aif), 6ak, 6akw, 6ale, 6alu, (6aoz), 6asj, 6asv, 6asx, 6atg, 6aul, 6avy, 6awp, (6awt), 6awv, (6cu), 6df, 6en, (6jd), 6jj, (6jq), 6jx, (6ka), (6ky), (6mn), 6my, 6ni, (6oo), 6pt, 6ws, 6xad, 6xw, 6za, (6zn), 6zt, 6zz, (7go), 7mw, 7nf, 7rn, 7tq, 8ea, 9als, 9amb, 9bji, 9bx, 9dtm, 9hk, 9nx, (9wd), 9xaq, an5, cl8, cl5. Would appreciate any reports on my CW signals.

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B16 Rotor (16 Tooth)	5.00
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(Specify diameter of motor shaft when ordering rotors.)

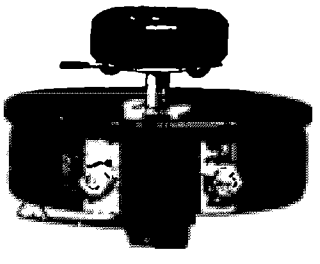
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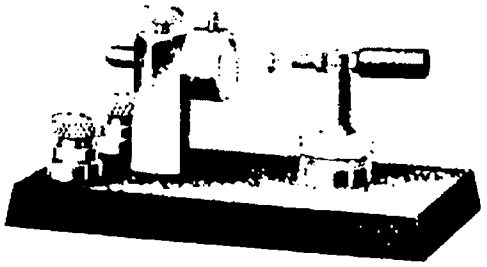
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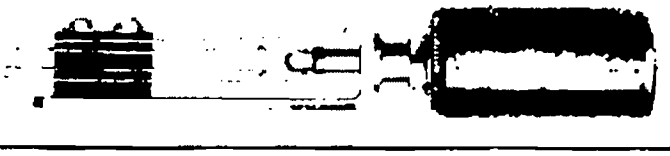
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A Power Amplifier for a Loud Talker

By A. K. Aster

DUE to the large number of radio telephones which are broadcasting music and news, every up-to-date radio amateur wants to install a loud talker in order to entertain his friends. Most amateurs become disgusted with the distortion produced by the ordinary amateur amplifier. So I shall describe an amplifier which will not distort. But if the input is distorted due to faulty detector operation or if the output is distorted by a faulty loud talker, don't blame the amplifier. See Fig. 1 for connections.

Probably the most important unit of the amplifier is the intertube transformer. In order that a transformer shall work most efficiently the following points must be considered:

(1) The input impedance of the transformer should be approximately the same as the output impedance of the tube from which it is fed.

(2) It must not have a leaky magnetic path; in other words, there should be no butt joints in the core.

(3) Its transformation ratio must be as high as possible without producing unstable operation.

(4) The d.c. plate current must be kept out of the primary winding in order to prevent saturation of the core, which would produce bad distortion. This is accomplished by inserting a 2 m.f.d. condenser in the primary circuit and feeding the d.c. plate current to the tube thru a 30 henry choke coil. (This choke coil will be described later.)

(5) The secondary of the transformer must not work into an open circuit but into a resistance equal to the output impedance of the transformer. The input impedance of a tube is practically infinite when the tube is working as an amplifier, that is, with a C battery.

(6) The transformer should be properly shielded so that it will not have any external field and will not be influenced by neighboring coils and circuits.

The successful operation of an amplifier depends also on the proper choice of the tubes to be used in the amplifier. Choose a tube which is suitable for an amplifier, this means a "hard" tube. A gas type tube will not do for the following reasons:

(a) Unstable operation and a distorted output due to the action of the gas in the tube.

(b) Low output due to the fact that the tube will not work on a high enough plate voltage.

(c) Remember that a gas type tube is only intended as a supersensitive detector for radio telegraph and not for telephone signals and should not be used for anything else.

(d) Choose a tube that will be large enough to take the output of the previous tube, as an overloaded tube is an excellent distorter.

(e) Always use sufficient C battery so that the grid of the tube will never become positive, for as soon as the grid becomes positive it will modulate as well as amplify and distort. At this point the reader is referred to an article in the January issue of RADIO by Mr. G. M. Best on tube operation.

GENERAL

How many steps shall I use, is always the big question. If a radio head receiver is to be used as the reproducer, two steps is all that one can use, otherwise the receiver will be overloaded and distort. But if a large loud talker is to be used, three steps will be necessary.

The next question is what size of tube shall I use? If two steps are to be employed the ordinary amplifier type tubes should be used, but if three steps are to be employed, the last step should be a 5 watt type tube, while the others should be of the amplifier type. If an output of more than 5 watts is desired a fourth step consisting of a 50 watt tube should be used, but remember that there is no loud talker on the market that will take 50 watts input.

Fig. 1 shows a three step amplifier that will be sufficient for ordinary use. I have seen amateurs use 5 watt tubes in all the steps of their amplifiers, thinking that they would get increased amplification thereby, but this idea is incorrect. The usual result is a decrease in amplification due to the fact that the amateur is unable to obtain a suitable intertube transformer for 50 watt tubes on the market. Furthermore there is no object in using a tube any larger than necessary to take the output of the previous tube and certainly there is no detector that needs a 5 watt tube as the next step.

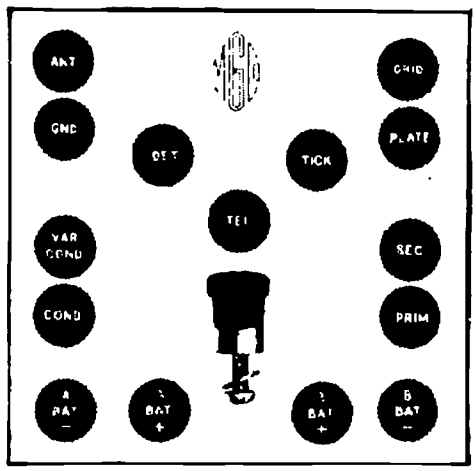
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Condenser	B-Battery +	Secondary
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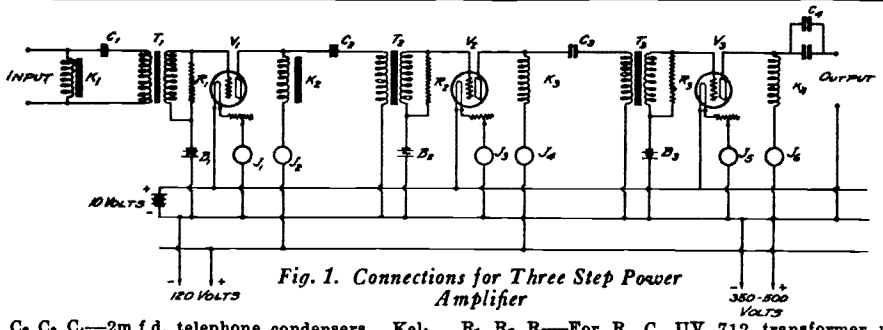


Fig. 1. Connections for Three Step Power Amplifier

C_1 C_2 C_3 C_4—2m.f.d. telephone condensers. Kellog Type 53 is suggested.

K_1 K_2 K_3 K_4—30 henry choke coil. As there is no coil on the market for this purpose I recommend the smallest size of Wayne Bell-ringing transformer, using the primary as the choke coil and leaving the secondary open. The inductance of this coil is about 30 henry, which is very satisfactory for this purpose.

B_1 B_2—For Radio Corporation or Moorhead amplifier tubes use a 4½ volt flashlight battery.

B_3—For Radio Corporation 5 watt tubes use a 45 volt B battery.

T_1 T_2 T_3—For Radio Corporation tubes use the Radio Corporation UV 712 transformer and for Moorhead tubes use the Federal 226W transformer.

J 1 to 6—Any closed circuit jack.

R_1 R_2 R_3—For R. C. UV 712 transformer use 1.5 megohm resistance (grid leak). For Federal transformer use a 0.25 megohm resistance.

V_1 V_2—Radio Corporation or Moorhead amplifier tubes.

V_3—5 watt power tube.

(Note: Radio Corporation tubes and Cunningham Audiotron tubes [I don't mean the old type 2 filament tubes] are the same, both being made by the General Electric Co.)

C_1 and C_2—8 m.f.d.s. Telephone condenser.

L_1 and L_2—These two coils may be placed on a single rectangular core of ½"x½" crossectional area. Each coil consists of 5000 turns No. 28 s. c. c. wire.

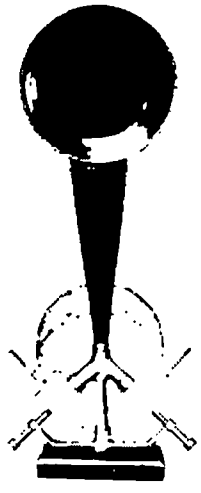
Connect terminals marked input to the telephone terminals of the receiving set.

Connect terminals marked output to the loud talker.

WIRELESS CATALOGUE

W[illegible]

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The special construction of the manifold originated in the Rhamstine* Shops. The angle of the receivers, the manner of holding them firmly at the two openings and proportions of the horn were all carefully determined. Maximum amplification is obtained from two receivers in combination with the Adapt-O-Phone.

The entire unit is 20" high.
Price, without receivers, $12.00.
Send for complete folder.
Dealers wanted everywhere.

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Add 25c for postage and packing. West of Rocky Mts. 40c.

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Murdock	$1.00	Cyclone—22½ volt (small size)	$1.00
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OPERATION

It will be noted that there are ammeter jacks in the filament and plate circuits of every tube. I don't believe that the average amateur realizes how important it is to maintain these currents at their proper values. It should be remembered that working a tube filament at ten per cent overvoltage reduces its life to half. The reason for watching the plate voltage is that the variation of the plate current while the tube is working tells whether the tubes are being overloaded and hence whether it is distorting. While working under normal conditions the variation in plate current should not exceed the following values:

One watt tubes—Radio Corporation or Moorhead amplifier tubes working at 120 volts plate voltage, variation not to exceed ¼ milliampere once in five seconds.

Five watt tubes—Variation not to exceed 1 milliampere once in five seconds when plate voltage is 350-500 volts.

A good low range milliampere meter should be used for checking the plate current such as the Weston Model 301. For amplifier tubes a range of 0 to 15 milliamperes is good, but if 5 watt tubes are to be used the range should be 0 to 50 milliamperes.

For a filament ammeter one having a range of 0 to 2.5 amperes is suitable. Don't buy a cheap meter, as they don't hold their calibration and are worse than none at all.

In case the plate current shows more variation than the allowable amount it is necessary to cut down the input into the tube from the previous tube. This may be accomplished in several ways. In case the input is derived from a detector tube the best way is to open the coupling in the tuner, while if the input is derived from another amplifier tube the best way is to cut down the plate voltage on the previous tube. The output of a tube is approximately proportional to the square of the applied plate voltage. Always remember that while an overloaded tube may give increased signal strength it distorts the output.

PLATE SUPPLY

The source and voltage of the plate supply is a thing that must not be overlooked. To get maximum amplification out of the ordinary amplifier tube you must use about 120 volts on the plate of the tubes. For 5 watt tubes you must use from 350 to 500 volts for satisfactory results. As a source of plate supply for amplifiers I consider flashlight batteries unsatisfactory, as the drain is too heavy on them for economical use. The only solution is a set of small storage batteries or a motor-generator set. See Fig. 2 for dimensions and connections for a filter for a motor-generator set.

READ THIS TAPE

You don't have to be a professional operator to read the high speed traffic that is going thru the air. The **Hall Radio Relay** will copy messages at any speed automatically and register these messages on tape. Note the border of this advertisement. It is a sample of the relay recording tape that is made possible thru the use of the **Hall Radio Relay.**

THERE is nothing complicated about the **Hall Radio Relay.** You just hook it to your set in place of the phones and the recorder will copy the signals of either damped or undamped wave stations regardless of speed. On a recent test the relay was in operation all night and hundreds of messages were accurately recorded. This is an ideal instrument for the reliable recording of weather report, news matter or stock quotations.

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Don't labor with a pad and pencil—trying to put down the traffic. Let the relay solve this tiresome problem. The tape is easy to read. Note the distinctiveness between the dots and dashes.

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Our beautiful 55 page radio catalog describing in detail the HALL RADIO RELAY and other high class radio equipment will be sent to you for 15 cents.

PRICE of RELAY complete with motor blower **$125.00**

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We will gladly demonstrate this RELAY and RECORDER and show you its advantages over the ordinary system. It is being used for the most exacting requirements in many parts of the country. It is priced exceedingly low for such a device, and is guaranteed to give satisfactory service. Get in touch with us at once.

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Detector and two stage amplifier Type SR-2. Size of panel 10 1-2x12 3-4. Complete less tubes and battery $70 f.o.b., Portland.

A detector and two stage amplifier that will give you results. This instrument is in use in many stations in the Northwest and its performance is a proven fact. You must see this set to appreciate its value. Material and workmanship are the best.

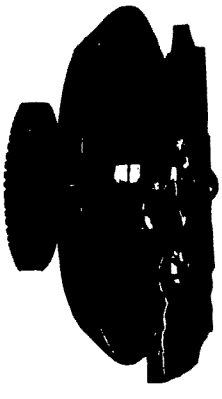
Specifications — Panel quarter inch grade XX bakelite dilecto. Gorton pantograph engraving. Oak Cabinet finished in flemish oak.

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At this point the reader is referred to an article by the author in December, 1921, RADIO on the Armstrong Super-Heterodyne for further data on the use of a motor-generator set as a source of plate supply. Remember that bad batteries or an unsteady plate source is the commonest cause for noisy operation of an amplifier.

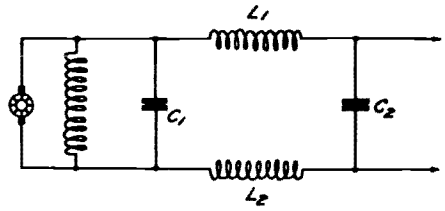


Fig. 2. Dimensions and Connections for Motor Generator Set Filter

SHIELDING

In order that an amplifier may operate quietly it must be properly shielded. The reader is again referred to the author's article in December RADIO on the Armstrong amplifier for a discussion of shielding. An important thing to remember is that in order to stop howling the input and output leads of an amplifier should be separated as far as possible.

Calls Heard

CALLS HEARD BY 6ANK, SPARKS, NEVADA

4cb(cw) calling 9aao at 9:38 p.m. Pac. time, 12-6-22, 5qa(cw), 8jl(cw) 10:20 p.m. Pac. time 11-24-21, 8uj(cw) 11-5-21 between 11:35 and 11:45 p.m. Pac. time and 11-6-21 between 8:40 and 8:50 p.m. Pac. time, 9zaf(cw and fone), 9dva(cw), 9amb(cw), 9yal(spk), 9zac(cw), 9yae(spk), 9wd(cw), Canadian 9bd(cw), 9bex (cw), 9akr(cw), 9nx(cw), 9dtm(cw), 9xaq-wc (cw), 9aya(cw), 6wv U. S. Gen. Hospital No. 21, Denver, Colo. (cw and fone), cl8(cw), cl8 (spk and cw), "rb"(cw), kwg(fone), 4cb(cw), 5qa(cw); "sixes"—ak(cw), aif, aoz(cw), alw, atz, agf, aba(cw), ale(cw), afn, avy(cw), ahp, er, ka(cw), ky(fone), ot, pr, ru, tv, fh, oh, sj, gt, jd(cw), xw(fone), xg(fone), xh(cw), xad (cw), zam, zr, zx, xac(fone), zaa; "sevens"—nd(fone), qt(cw), nn, fn, un, jd, mf, ry, cd, ny (cw), zj, zu, zt; "eights"—uj(cw), jl(cw); "nines"—amb(cw), wd(cw), nx(cw), dva(cw), dtm(cw), aya(cw), xaq-wc(cw). yae(spk); kwg (fone), cl3(cw), cl8(cw and spk).

HEARD AND WORKED AT 6KY, S. DALTON, 121 EAST 23rd ST., LOS ANGELES, CAL.

Stations heard—1bcg(cw), 2fp(cw), 5za(cw), 5if, 5xu, 6cz, 6dp, 6fh, 6fn, 6ib, 6ii, 6ik, 6iv, 6jx(cw), 6kl, 6lu, 6pj, 6qx, 6st, 6to, 6tu, 6vk, 6wo, 6za(cw), 6ze, 6zt(cw), 6zaf, 6aak, 6aat, 6aau, 6abm, 6abr, 6abw, 6abx, 6ach, 6aeh, 6ael, 6aey, 6ahu, 6ahy, 6aif, 6ala, 6amk, 6ang, 6ani, 6atv, 6aul(cw), 6avr(cw), 6bds, 6**, 7bb, 7bk, 7hf, 7iw, 7jd. 7xf(cw), 7ya, 7yg, 8os, 8xv(cw), 9anf, 9arj(cw), 9ayv, 9ayw(cw), 9zn, 9dtm(cw), 9zac, 9xaq(cw), 9nx(cw), 9bex(cw).

Stations worked on spark—6ah, 6ak, 6as, 6ex, 6fk, 6gf, 6gr, 6gt, 6hc, 6kc, 6km(cw), 6oc, 6oh, 6po, 6pr, 6qs, 6qr, 6uo. 6vx, 6wz(both), 6xad (cw), 6zb, 6zu, 6zx, 6zz(both), 6zad(cw), 6acm, 6afn, 6agf, 6akl, 6ale(cw), 6asj(cw), 6asx(cw), 7bp, 7in, 7jw, 7mf, 7oz, 7tj, 7zm, 7zt, 7zu, wv6 voice, 9amb.

Stations worked with C. W. and voice on 5 watts—6as (voice-cw), 6ex (voice-cw), 6gt (voice-cw), 6xh (voice-cw), 6agf (voice-cw), 6aif (voice-cw), 6awt (voice-cw), 6xad (voice), 7zj (voice-cw), 7zt (voice-cw), 9wd(cw) 9dva (voice-cw), 9amb (voice-cw).

STATIONS HEARD AT RADIO 7GE, PASCO, WASH.

Spark—6ak, 6aw, 6ax, 6cv, 6dd, 6dp, 6ea, 6en, 6ex, 6ey, 6gb, 6gf, 6gq, 6gr, 6gt, 6gy, 6jx, 6ka, 6km, 6lc, 6lx, 6mh, (6qr), 6to, 6tu, 6vx, 6vy, 6wz, 6zx, 6aat, 6aau, 6abj, 6abm, 6 abx, 6aex, (6afn), 6afy, (6agf), 6aif. 6ala, 6alp, 6amk, (6ape), 6arc, 6ard, 6asj, 7au, (7ba), 7bf, 7bg, 7bh. (7bj), (7bk), 7br, 7bz, 7cw, 7ee, (7fi), 7fl, (7hf), 7hi, 7im, 7in, 7iw, 7jf, 7jj, (7jw), 7kb, 7ke, 7ks, 7la, (7ly), (7mf), 7mo, 7my, 7mz, 7nj, (7nl), 7nw, 7nz, 7on, 7oo, (7tj). 7tl, 7vo, (7vz), 7wa, 7wm, 7zj, 7zn, (7zt), 7zu, (9ax Canadian), 9bd Canadian.

C. W.—4cb (Canadian), 6aa, 7ce, 7xf.

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Get Into the Fastest Growing Field

You amateurs who already know something of radio, and you who know nothing of radio,—have you stopped to think what a wonderful career you can have in the field of radio communication? Radio is something more serious than a mere hobby. It has become the leading international profession and is the fastest-growing field in the world. The radio era is here—and as an industry is growing faster than the telephone, telegraph or automobile.

Twenty years ago, radio was a scientific plaything; today it is a world necessity; twenty years from now it will eclipse all other methods of communication. Train yourself now in a professional way and cash in on some of the opportunities that are presenting themselves in the radio field. Do not be a stay-behind. Do not let the other fellows beat you to the high-paying jobs when they are within your grasp at this very moment. Many thousand trained radio men will be needed this year. Prepare yourself now and step into a real radio job next summer. You can have your choice of operating either on land or sea.

Put the Final Polish to Your Training. Do Not Stop Half Way

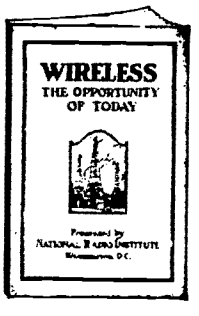
Many wireless amateurs are so absorbed in the fascinating work of radio that they do not realize that big opportunities await them in the commercial field. They love the work and yet they do not seem to appreciate how urgently the field of radio communication needs trained men. Some of them do, however. We can name twenty-five big radio men, whom you know, who have climbed to their present position by putting the final polish on their radio education. You can do the same thing. America's largest and oldest radio school is holding out its hand to you. It will help you to the last step. It will broaden you out into a professional radio man, with a keen insight into the commercial side of radio communication. It will also complete your technical education and put you in a position of trained radio expert.

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This is the day of learning by doing. That is why we have backed up our wonderful course of copyrighted lessons in wireless telegraphy and wireless telephony with four wireless instruments that will be sent to you without charge during the course, to be used at intervals as you progress. You, therefore, learn by active practice in your own home. Among these instruments is our wonderful Natrometer. It is an almost human machine that will teach you the code. You listen and learn, the Natrometer will do the rest. First we teach you to transmit rapidly and correctly; then you learn to receive correctly by slow transmission; after that the Natrometer does its work sending messages to you automatically, the same as though the messages were coming to you from distant stations. The Natrometer will train you to receive messages at 20, 25 and 30 words a minute, enabling you to pass the code requirements of the Government examination. Following this you are taught to receive from other operators with a real receiving outfit. Hand in hand with this practical training you will receive our regular lessons and your work on them will be guided by trained, nationally-known experts here at headquarters.

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Wireless operators receive upwards from $110 per month and their expenses paid. Experts receive anywhere from $2,400 per year to $10,000 and there is no danger of them losing their jobs, because the radio field is not overcrowded. You can probably save more as a wireless operator than you now earn. Then, too, think of the beautiful outfit you could have in your own home. You could have all the instruments you have ever wished for. You can have an outfit that will be the envy of all your amateur friends, and moreover you can give it professional attention. Many other amateurs have cashed in on the opportunities in radio. You should do the same. There is nothing to prevent you. A few hours each week and a few cents a day will complete your training within four months. Start now. Send for our interesting booklet, "Wireless, The Opportunity of Today." It is yours for the asking with no obligations attached. Your copy is waiting to be addressed.



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FOR SALE: Variometers, rotors, hardwood 45 cents, wound 60 cents, wound and complete with rods 95 cents. Louis Grievish, 300 So. Oakland, Green Bay, Wis.

It isn't a LOUD TALKER if it isn't a KING "AMP-LI-TONE." See page 45.

FOR SALE: 2 Federal Amplifying Transformers. New, good condition. Cost $7.50 each. Sell for $5.00 each. Radio Operator, 494 Haight St., San Francisco.

Compare it and you will buy the KING "AMP-LI-TONE." See page 45.

TRESCO B S TUNER, $6.50; 2 Murdock .001 MFD variable condensers, $3.00 each; D. L. coils Nos. 25, 35, 75, 100, 200, 250, 300, all for $6.00. B. W. Casselberry. 620 Plumas St., Reno. Nevada.

SORSINC TUNIT—$13.50 each, postpaid. Immediate deliveries. List for stamp. Jennison, 83 Russell Street, Waltham, Mass.

HAVE Grebe C R6, trade for Grebe C R5 and $25 cash—must be in good condition. Stuart B. McLoughlin, 1518 Courtney Ave., Hollywood, Calif.

The Price is RIGHT and is based on quantity production; it's up to you "SPARKS." Send in that "TWELVE" Quick delivery. KING "AMP-LI-TONE." See page 45.

BARGAIN. Radio Shop RS-124 Universal Regenerative Receiver, wavelength range 100 to 24000 meters. In perfect condition. Used only a few weeks. Regular price $100. Sell for $65.00. Guaranteed in every respect. Pacific Radio Exchange, 439 New Call Bldg., San Francisco.

TRANSMITTING APPARATUS

HERE IS JUST WHAT YOU ARE LOOKING FOR. A snappy, 3-4 KW spark set, very compact and efficient. The transformer is a ½ to ¾ KW Thordarson variable, on the side of which is mounted a dubilier condenser and at the end is the oscillation transformer of the pancake type. Under the O. T. is the rotary gap with wide sparking surfaces, no leads over 6" long. The transmitter is well protected by dubilier protective devices, and the key has large silver contacts. This set must be seen to realize what a bargain it is at $60. M. F. Rogers, 1426 San Pablo Ave., Berkeley, Calif.

FOR SALE: Type F-1 Acme transformers, ½ K.W., 11,000 volts secondary. Want $26.50. Money talks. First money order closes the deal. Arthur Liffring, 708 N. 4th St., Missoula, Montana.

SALE—Benwood gap, aluminum case, 10 point rotor—used one hour—$18.00. Dubilier condenser—.007 mfd—14000 volts, ½ K.W.—cost $31.00—perfect condition, $20.00. G. E. induction motor, 3600 R.P.M., $28.00—sell $16.00. Wilcox Rotor, 8 point, $3.50. Costic key, nickel plated, $3.00. Articles above in as good condition as when bought. Lawrence Snell, 407 West Ave., 52, Los Angeles, Calif.

FOR SALE. Sacrifice. 500 cycle transmitter. ½ H.P. A.C. motor, ¼ K.W. generator and exciter, spare armature transformers, two quenched gaps, oscillation transformer, Dubilier condenser, radiation ammeter power panel with 60 cycle and 500 cycle volt and ammeters, generator field rheostat and necessary switches. This is a bargain, fellows. Call or write to F. A. Brandis, 1039 Merced Ave., Berkeley. Calif.

INSTRUCTION

BKUMA YRLSBUG—TWO HUNDRED beginners tell how memorized wireless code in thirty minutes to two hours. Booklet, 10 red stamps. Dodge. Box 220. Mamaroneck, N. Y.

TELEGRAPHY—(Morse and Wireless) and Railway Accounting tanght thoroughly; big salaries; great opportunities. Oldest, largest school. All expenses low—can earn large part. Catalogue free. DODGE'S INSTITUTE, Hass St., Valparaiso, Indiana.

C. W. APPARATUS

FOR SALE: Complete new 10 watt I. C. W. telegraph set, including Power & Filament Transformer, antenna and filament ammeters, tubes, rheostats, key, protection, etc., mounted on heavy bakelite, with oak base. This set will radiate 2 amperes on 200 meters. Price $125.00 complete F. O. B. Oakland, Calif. Photo and detailed description sent on request. A. P. Tryon, 109 Greenbank Ave., Piedmont. Calif.

RADIO PHONE OWNERS! Better batteries increase your service. Rhodes builds them. Best type "A" gives you greater range and clearer tone. They cost less from Rhodes. George F. Rhodes. 2035 Third Avenue, Seattle.

FOR SALE: Double choke filter coils fully mounted on brass standard for audio frequency chokes or filters for C-W sets. Guaranteed to smooth out the worst commutator ripple. Price $3.00 plus parcel post charges, 10 cents. Address Dept. A., 140 South Oxford Street, Los Angeles, Calif.

MISCELLANEOUS

Audion Renewals—Any type single stem, tung-sten filament, detectors repaired for $2.75; amplifiers as above, $3; 5 watt power tubes, $4; VT-1 oxide filaments and to use 20-35 volts "B", $3.50. Terms cash, or C.O.D. plus charges. Trimount Laboratory. Milford. Mass.

RADIO CABINETS—Mahogany or oak finished or unfinished, to your design. Send rough sketch for quotation. Prompt service. Formica cut to size. Radio supplies, parts, etc. Pacific Radio Exchange, 439 Call Bld., San Francisco, Calif.

IMPROVE YOUR STATION. 5% discount on all new apparatus. Use any catalog. Used apparatus taken in exchange, bought for cash, or sold on commission. Used apparatus for sale. Inquire now. James B. Howell, Cedarville. N. Y.

FOR SALE: Complete set Alexander Hamil-ton Institute course on business methods with supplementary pamphlets of instruction; perfect condition; original cost $120; now $60 cash will take it; a snap for the radio enthusiast about to take up a business career. A. H. H., 2721 Forest Ave., Berkeley.

Only Exclusive Amateur Radio Dealers in Western Canada. We handle complete line of standard Amateur Radio supplies, specializing in Mail Orders. Send stamp for list. WESTERN CANADA RADIO SUPPLY, 919 Fort Street, Victoria, B. C.

EXPERIMENTERS, ATTENTION. We are headquarters for wireless insulations of all kinds. We sell Condensite Celoron, Bakelite Dilecto Formica, hard rubber, rods, tubes, sheets. Special inductances wound to order. Receivers and transmitters built to order from your specification. All makes of storage batteries rebuilt and repaired. Washington Radio Shop, 764 Gresham Pl., N. W., Washington, D. C.

SMALL PARTS: Let us know your wants in screws, nuts, knobs, magnet wire. etc. Give us a chance to estimate on your apparatus. We can surprise you. Long Radio Works, Cornelius, Oregon.

WILL TRADE 15 dial omnigraph in excellent condition, aluminum W.E. hard phone, with case, 1 W.E. 3-bar generator, for 2 stage amplifier standard make. D. W. Papst. Sisson, Calif.

SPECIAL OFFER. Genuine Condensite Celoron Panels, 3/16"x6"x14", $1.85. 3/16"x6"x14", $2.75. Crosley products, Chelsea condensers, Federal plugs and jacks. F.A.D.A. Rheostats. Radio Corporation tubes, etc. We can't ship your order the same hour it is received. BUT our service IS prompt and we prepay all shipments. Washington Radio Shop, 764 Gresham Pl., N. W., Washington. D. C.

EXCHANGE—1A Graflex camera, Cook F45 lens, also No. 1 Special Eastman Kodak. Zeiss-Tessar F45 lens. Both cameras worth $236.00. Exchange for first class detector and amplifier or send list of what you have. G. G. Griffeth. 1414 50th Ave., Oakland, Calif.

LOOP ANTENNA. 3½ feet high. Shipped knocked down postpaid, $2.50 money order. P. Panico, 421A West 26 Street, New York City.

Tell them that you saw it in RADIO

You can Talk to More than 21,000 people by means of a sound amplifier if your audience is grouped in a limited space but the only way to carry your message to a widely scattered audience is thru advertising.

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An ever increasing number of our readers are realizing this fact.

That's why this issue of "RADIO" carries more classified advertising than any previous issue.

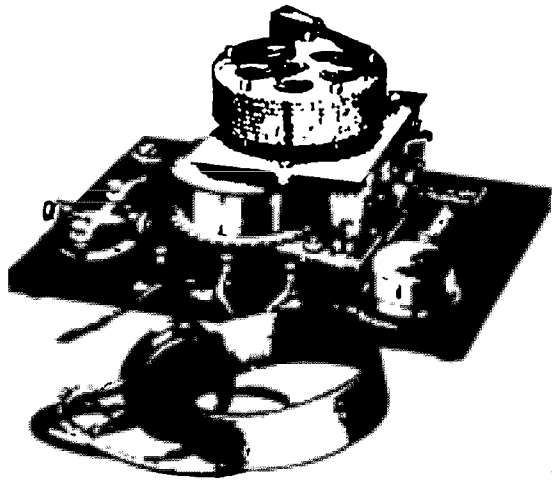
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Talk to more than 21,000 thru a RADIOAD

DON'T DISCARD your used equipment. A little Radioad will sell it for you. The rate is only 3 cents a word.

If you want to
BUY—
SELL—
OR EXCHANGE—
Use the RADIOADS

Let the Natrometer Give You Sending and Receiving Speed in Half Usual Time



Don't be cut off from other advanced amateurs because you do not know how to handle the code, or be held back because you don't know how to send and receive fast enough. Get the full pleasure from your outfit. Listen-in on and understand all the commercial stuff too. There's no fun in hearing a lot of dots and dashes. You want to know what they are saying. The Natrometer will teach you quicker than any other known method.

There is Only One Natrometer

Employing the Natrometer is like having the assistance of an expert operator to help you learn the code; an expert who can send to you accurately at any speed, slow or fast at your command any hour, day or evening. The Natrometer will do that and it never gets tired. Sends with perfect accuracy, and the speed is instantly adjusted with a small thumb-screw, from three to thirty-five words a minute. Six hundred different messages can be sent with a single dial. When you exhaust your message dial, you can exchange it for another one without cost. The Natrometer's powerful motor allows it to run for twenty minutes. The sending is as clear as a bell. No bother with static interference and no choppiness.

The Natrometer is fully covered with patents owned by the National Radio Institute. That is why there is ONLY ONE NATROMETER. Yet, with all of its exclusive features, it costs no more than other machines. Prices range from $20 to $30.

Ten Points That Make the Natrometer Best

1. Perfect commutation which eliminates inaccuracies.
2. Large, powerful driving motors (not a clockworks).
3. Audibility coil.
4. Hi-tone Buzzer.
5. Governor speed control.
6. Hundreds of message combinations with single dial.
7. Large, heavy spring.
8. Automatic dial shift.
9. Accurate and easy speed control adjuster.
10. Machine cut gears.

WRITE FOR FULL DESCRIPTION

We will gladly send you booklet telling more about the Natrometer. Just put your name and address on the attached coupon. Send no money.

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National Radio Institute

Radio Headquarters

1345 Pennsylvania Ave., N. W. Washington, D. C.

COUPON

Sales Department, Room No. 1003,
NATIONAL RADIO INSTITUTE,
1345 Pennsylvania Ave., N. W.
Washington, D. C.

Gentlemen: Please send me by return mail your free booklet giving complete information about the Natrometer. This obligates me in no way.

Name .....

Address .....

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

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SAVE TIME—SAVE DOLLARS

BUY FROM US IF YOU WANT ACTION!

Seattle NORTHERN Seattle

OUR NEW CALL IS
KFC

INTELLIGENT—RADIO
SPEEDY—RADIO
RELIABLE—RADIO

MOST COMPLETE STOCK IN THE PACIFIC NORTHWEST

Chelsea

No. 1 Mounted 0011	$5.00
No. 2 Mounted 0006	4.50
No. 3 Unmounted 0011	4.50
No. 4 Unmounted 0006	4.00
3/16 Bakelite Dial and Knob	1.00
¼ Bakelite Dial and Knob	1.00
21 Variable Grid Leak	3.00
31 Oscillator	3.00

General Radio

0-1 Hotwire Meter	$7.75
02½ Hotwire Meter	7.75
0-5 Hotwire Meter	7.75
0-10 Hotwire Meter	7.75
231A Amplifying Transformer	5.00
231M Modulation Transformer	5.00
214 2½ Amp. 2 ohm Rheostat	2.50
214 1½ Amp. 7 ohm Rheostat	2.50
156 Socket Bakelite	1.50

Vacuum Tubes

C300 Cunningham Detector	$5.00
C301 Cunningham Amplifier	6.50
C302 Cunningham 5 Watt Power	8.00
C303 Cunningham 50 Watt Power	30.00
AP ELECTION RELAY	5.00
AP VT Amplifier	6.50
DE FOREST Rectifier	9.75
RADIOTRON 250 Watt Power Tube	110.00

Sockets

92 REMLER Socket	$1.50
156 GENERAL RADIO	1.50
550 MURDOCK	1.00
R300 DE FOREST	1.60
DE FOREST Moulded Bakelite	1.40
RADIO SERVICE Triple Socket	3.50
RADIO SERVICE Double Socket	2.50
VICTORY Shell-Less Socket	1.00
CROSLEY Porcelain	.60

Variometers

REMLER 505 Moulded Bakelite	$6.00
RADIO SHOP	5.75
RADISCO	7.00
CLAPP-EASTHAM	6.50

Vario-Couplers

REMLER 503 Vario-Coupler	$5.40
MURDOCK Vario-Coupler on Unit Panel	8.50
REMLER 505 Coupler on Unit Panel	12.75
RADIO SHOP Vario-Coupler	4.75
CLAPP-EASTHAM	6.50

Westinghouse Apparatus

RA Short Wave Tuner	$65.00
DA Detector Two Stage Amplifier	65.00
CB Loading Coil	5.00
RC Short Wave Receiver with Det. 2 step	125.00
DB Crystal Detector	5.00
RE Aeriola Jr. Receiver	25.00
AD Antenna Outfit	7.50
PA Antenna Protective Device	2.00
SA Lightning Ground Switch	4.00
ME 100 watt MG Set 500VDC 110-V., 60 Cycle, Ac.	85.00
MH 250-watt MG Set, 1000VDC, 110-V., 60 Cycle, AC	145.00
Rectigon 2½A Battery charger	18.75
Rectigon 6A Battery Charger	29.50
Rectigon 2½ Renewal Bulb	4.40
Rectigon 6A Renewal Bulb	8.80
LS Victrola Attachment	15.00
LS Grafanola Attachment	15.00

BALDWINS NEW PRICES!

Type C, Set	$12.00
Type E, Set	13.00
Type F, Set	14.00

Amplifying Transformers

UV-712 Radio Corporation	$7.00
231A GENERAL RADIO	5.00
226W FEDERAL	7.00
A2 ACME, unmounted	4.50
A2 ACME, semi-mounted	5.00
A2 Fully mounted	7.00

Jacks and Plugs

FEDERAL 1421 Open Circuit Jack	$ .70
FEDERAL 1422 Single Circuit Jack	.85
FEDERAL 1423 Double Circuit Jack	1.00
FEDERAL 1435 Automatic Filament Control Jack	1.20
FEDERAL 1438 Automatic Filament Control Jack	1.55
WESTERN ELECTRIC Plugs	2.00
FEDERAL Plugs	2.00
PACENT UNIVERSAL	2.00
NEW FEDERAL Universal Plug	1.75
RHAMSTINE Plug and Jack, complete	1.50

Remler Apparatus

810 Jr. Rheostats	$1.00
811 Rheostats	1.75
813 3 Amp. Rheostats	1.75
92 VT Socket	1.50
330 Audion Detector Panel	8.00
331 Amp. Panel	6.00
333 Amp. Panel	9.00
400 3 Coil Mounting	6.50
96 Variable Grid Leak	.60
97 Grid Condenser	.35
503 Variocoupler	5.40
500 Variometer	6.00

Wireless Shop Variable Condensers

Approximate Maximum Capacity		
No. 20	2 Plate, Vernier Condenser	$2.00
No. 70	7 Plate, .0001 m. f.	2.35
No. 130	13 Plate, .0002 m. f.	2.75
No. 170	17 Plate, .0003 m. f.	3.15
No. 230	23 Plate, .0005 m. f.	3.60
No. 310	31 Plate, .0007 m. f.	4.30
No. 430	43 Plate, .001 m. f.	5.25
No. 630	63 Plate, .0015 m. f.	7.50

Remler QSA Honeycomb Coils

Type Number (No. of Turns)	Wave Length Range with .001 Mf Cond.	M't'd	UnM't'd
L25	170—375	$1.40	$0.50
L35	200—515	1.40	.50
L50	240—730	1.50	.60
L75	330—1030	1.50	.60
L100	450—1460	1.55	.65
L150	660—2200	1.60	.70
L200	860—2850	1.65	.75
L200	1120—4000	1.75	.80
L300	1340—4800	1.75	.85
L400	1860—6300	1.80	.90
L500	2340—8500	2.00	1.00
L600	2940—12000	2.15	1.15
L750	3100—15000	2.35	1.35
L1000	5700—19000	2.60	1.60
L1250	5900—21000	3.00	2.00
L1500	7200—25000	3.50	2.50

Rheostats

REMLER Jr.	$1.00
FADA—with new Knob	1.00
GENERAL RADIO No. 214 7 ohm or 2½ Amp. 2 ohm	2.50
DEFOREST, new type	1.75
PARAGON	1.75
MURDOCK 560	1.00

OUR PRICE LIST BRINGS RADIO SMILES O'ER MANY RADIO MILES
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Northern Radio & Electric Co.

606 PINE STREET, SEATTLE, WASH.

OPERATING THE SEATTLE POST INTELLIGENCER'S RADIO TELEPHONE NEWS AND CONCERT BROADCAST

Send for Concert Schedule

Tell them that you saw it in RADIO

PERFUME BY RADIO

By JOHN P. MEDBURY

A RUSSIAN scientist claims to have invented a machine which will send perfume by wireless. A man in Boston can buy a dime's worth of perfume at the 10-cent store and sprinkle his girl in St. Louis with it.

Any kind of an odor can be transmitted. For $1.30, a husband living in New York can chloroform his wife in Los Angeles.

If he wants to wait until evening he can do it for 70 cents.

A woman in San Francisco can peel onions and make her husband cry in Chicago.

It will be a great boon for the drinking man. A friend of his in Cuba can send him alcohol messages.

Instead of his going into a bootleg joint and paying 50 cents a swig, he'll call up his friend and get it for 10 cents a sniff.

If he's got a cold that's his own lookout.

Prohibition agents will be using this instrument for looking into our cellars.

A man can point the machine toward his kitchen and find out what the wife is having for dinner.

You may think she's going to have a steak, but the machine will register corned beaf and cabbage.

Another thing about it is that we can now enjoy cheese from a distance.

A lot more people will like it when they don't have to get so near it.

This will be a great thing for doctors; they can now treat asthma by wireless.

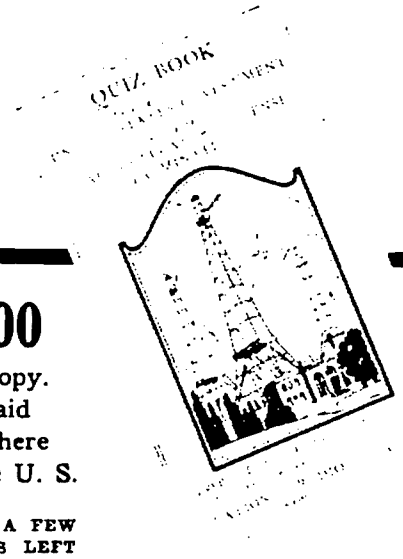
Asthma sufferers who can't afford a doctor will be outside all day sniffing treatments which belong to people in the next state.

Doctors who send whisky by wireless will have to be careful. They may be sending it to some man in Atlanta and a prohibition agent in Augusta may get the benefit of it.

This new invention will send all alcholic rays through the air and it ought to be healthy, it will keep everybody out of doors.

PA (interested in radio) to irate wife: "Well, I'd have come down sooner, but I was listening to Marion and L. C. M. chewing the rag together on a long wave."

WIFE: "'Elsie M.' and 'Marion,' is it? So now it comes out whose gloves those were in your overcoat the other night." (Curtain on remainder of the proceedings.)



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Life and Duties of an Operator.
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Types of Antennae and Aerials.
Damped Wave Receivers.
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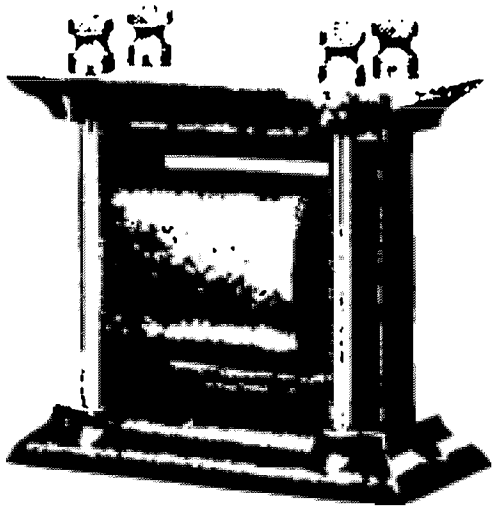
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No. 50 Amplifying Transformer

was designed for use with the present day models of vacuum tubes, and when so used produces remarkable amplification, with minimum noise. It is well adapted for table mounting or may be panel mounted in any position.

Terminals are marked for best connection. Only highest grade materials and workmanship employed. Its high efficiency together with its neat appearance and compactness, makes it a predominating feature in any radio receiving equipment.



IMMEDIATE DELIVERY

Price as shown, $4.50

Unmounted . . $3.75

Bulletin sent upon request. Purchase from your dealer. If he does not have it, send to us.

CHELSEA RADIO COMPANY

150-156 Fifth St. Chelsea, Mass.

SERVICE-TESTED RADIO EQUIPMENT

We have determined to secure a portion of the radio business on the Pacific Coast and realize that to do so we must offer some inducement to make our efforts successful. Our idea of the reasons that Western amateurs do not purchase from Eastern markets on a larger scale is that we dealers are located too far away from would-be customers. To eliminate objections arising from this handicap we have inaugurated our "SERVICE-TESTED" plan of selling equipment.

Every article which we ship out will be tested thoroughly in our laboratories before it is sent to our customer. There will be no such things as tubes which do not oscillate or "B" batteries which go dead in a short time for the simple reason that any of these articles will be exhaustively tested in ACTUAL SERVICE before the purchaser receives it.

Secondly we will pay all postage charges on orders exceeding $5.00. This will make our equipment even cheaper than it can be bought on the coast where prices are often higher than listed by the manufacturer. It is needless to mention that our prices are strictly list as can be seen by the following list:

Radio Corporation Products

We are distributors and jobbers for the Radio Corporation of America and always carry a complete stock of their apparatus. We list below their complete line and in addition can supply you with the Radio Corporation C. W. instruction book at 25c per copy.

Item	VACUUM TUBES	List Price
1	Radiotron (detector) UV—200	$ 5.00
2	Radiotron (amplifier) UV—201	6.50
3	Radiotron (5-watt) UV—202	8.00
4	Radiotron (50-watt) UV—203	30.00
5	Radiotron (250-watt) UV—204	110.00
	POWER TRANSFORMERS FOR C.W. SETS	
12	325-watt, UP—1368	25.00
13	750-watt, UP—1016	38.50
	A—Filament heating Transformer for UV—204, UP—1633	.....
	B—Power Transformer for UV—204, UP—1636	.....
	C.W. ACCESSORIES	
14	Oscillation Transformer UL—1008	11.00
15	Magnetic Modulator (½ to 1½ amp.) UT—1643	9.50
16	Magnetic Modulator (1½ to 3½ amp.) UT—1357	12.00
17	Magnetic Modulator (3½ to 5 amp.) UT—1367	17.00
18	Filter Reactor (160 mill amp.) UP—1626	11.50
19	Filter Reactor (300 mill amp.) UP—1627	15.75
20	Plate Circuit Reactor, UP—415	5.75
21	Filter Condenser ½ mfd.—750 V., UC—1631	1.35
22	Filter Condenser, 1 mfd.—750 V., UC—1632	1.85
23	Filter Condenser, ½ mfd.—1750 V., UC—1634	1.50
24	Filter Condenser, 1 mfd.—1750 V., UC—1635	2.00
25	Transmitter Grid Leak (5-watt tubes), 5000 ohms UP—1719	1.10
26	Transmitter Grid Leak (50 and 250-watt tubes), 5000 ohms, UP—1718	1.05
27	Antenna Ammeter, 0-2.5 amp., UM—530	6.00
28	Antenna Ammeter, 0-5 amp., UM—533	6.25
29	Sending Key UQ—809	3.00
30	Microphone Transformer UP—414	7.25
31	Filament Rheostat (for UV—200, 201 and 202) PR—535	3.00
32	Filament Rheostat (for UV—203 and 204) PT—537	10.00
33	Rotary Grid Chopper PX—1638	7.25
34	Shaft Bushings for ¼" or ⅛" motor shaft	.20

Item	KENETRON RECTIFIERS	List Price
6	20-watt Kenotron, UV—216	$ 7.50
7	150-watt Kenotron, UV—217	20.50
	VACUUM TUBE SOCKETS	
8	Porcelain Socket (for UV—200, 201, 202, 216) UR—542	1.00
9	Porcelain Socket (for UV—203 and UV—217) UT—541	2.50
10	Bakelite Socket (for UV—200, 201, 202, 216) UP—552	1.50
11	Mountings (250-watt tube) UT—501, UT—502	2.00
	SPECIAL CONDENSERS FOR C.W. SETS	
35	Antenna Series Condenser, 7500 V. .0003, .0004, .0005 mfd., UC—1015	5.40
36	Plate and Grid Condenser—3000 V. .002 mfd., UC—1014	2.00
37	Special Condenser—10,000 V. .000025 mfd., UC—1803	5.00
38	Special Condenser—.002 mfd., 6000 V., UC—1806	7.00
	VACUUM TUBE DETECTOR ACCESSORIES	
39	Intervalve Amplifying Transformer, UV—712	7.00
40	Special "A" Battery Potentiometer, PR—536	2.00
41	Tabular Grid and Plate Condenser	
	.00025 mfd. UC—567	1.20
	.0005 mfd. UC—568	1.35
	.001 mfd. UC—569	1.50
	.0025 mfd. UC—570	2.00
42	Grid Leaks	
	UP—509, .05 megohm / UP—518, .75 megohm	
	UP—510, .1 " / UP—519, 1.0 "	
	UP—511, .15 " / UP—520, 1.25 "	
	UP—512, .20 " / UP—521, 1.5 "	
	UP—513, .25 " / UP—522, 1.75 "	
	UP—514, .30 " / UP—523, 2.00 "	
	UP—515, .40 " / UP—524, 2.50 "	
	UP—516, .50 " / UP—525, 3.00 "	
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Wireless Telephone Concerts

IN response to the tremendous interest in wireless, created by the erection of wireless telephone broadcasting stations all over the country, many styles of complete ready-to-operate receiving outfits have been developed. The Continental Store has carefully selected certain of these sets, of a wide price range, which seem to combine the features of efficient service with simplicity of operation.

These sets are being demonstrated in operation daily at our store in New York. If you live in the metropolitan district, you can listen to these demonstrations every hour of the day on the hour. For those who live farther away, we maintain an efficient mail order department which will serve you promptly and courteously. Some of the sets which we can heartily recommend to the beginner are:

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This is a complete outfit which is entirely satisfactory for short distances (25 to 30 miles from a broadcasting station). Price $15.00, no accessories required whatever.

The de Forest "Everman" Radiophone Receiver is a compact, light weight portable set which will receive wireless telephone clearly up to 50 miles. Price $25.00, including headphones. Antenna equipment $2.00 extra.

The Westinghouse Aeriola Jr.

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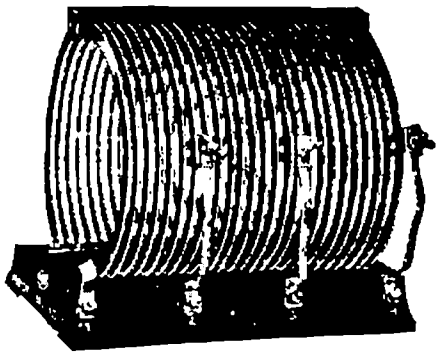
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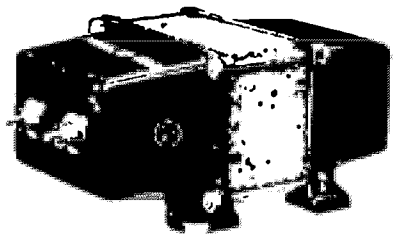
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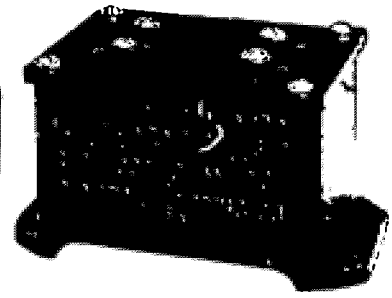
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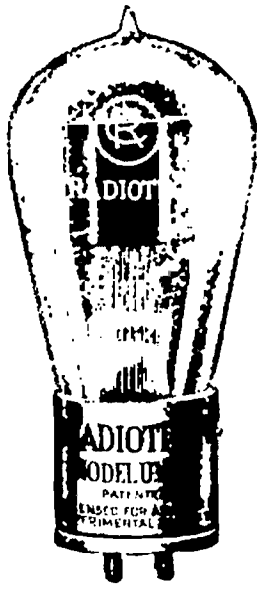
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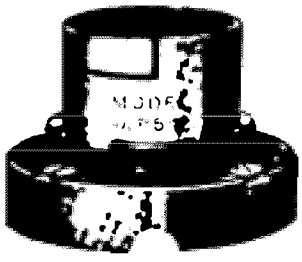
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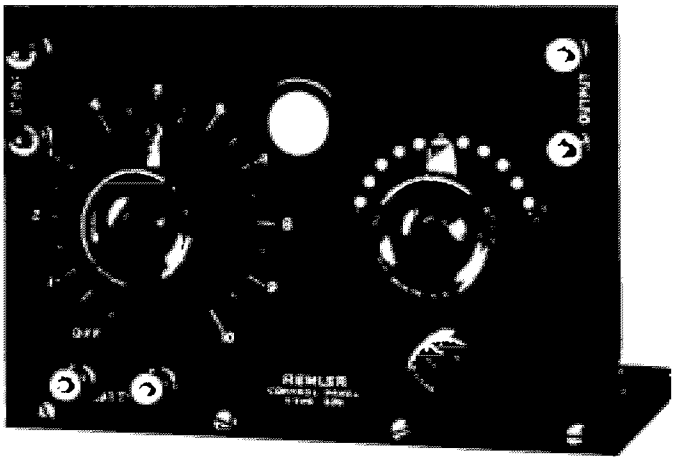
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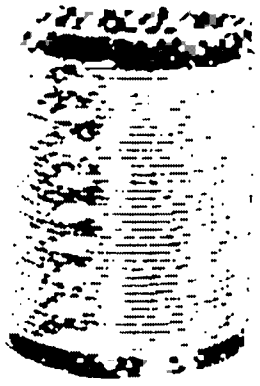
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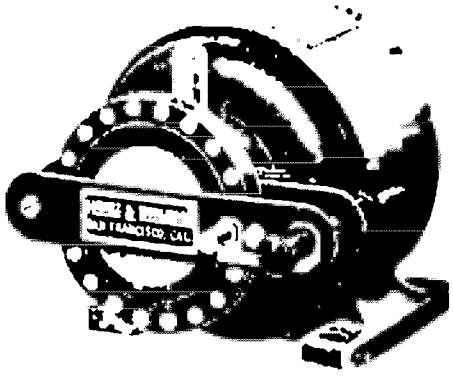
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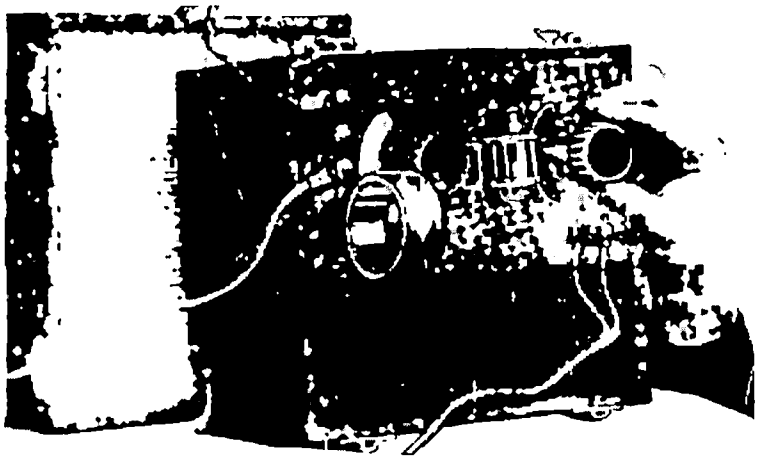
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