AUGUST, 1925

25 CENTS

RADIO

(Reg. U. S. Patent Off.)

IN THIS ISSUE---

MODIFIED BEST SUPERHETERODYNE
A. C. TUBES---MORE MILES TO THE DOLLAR
HOW TO BUILD CONE TYPE SPEAKER. 5-100 METER RECEIVER

Banish Isolation *from* Vacation

TRANSLATE a mid-summer night's dream, a fairy fantasy, into the gay reality of dance—of song—of haunting melody.

In the back-country, among the towering, snow-capped peaks, over the placid summer sea, the ether is a-thrill with those same magic impulses that soar and dip above the city's crowded streets.

For real summer enjoyment you cannot do without radio. For full enjoyment of radio you cannot do without Cunningham Radio Tubes.

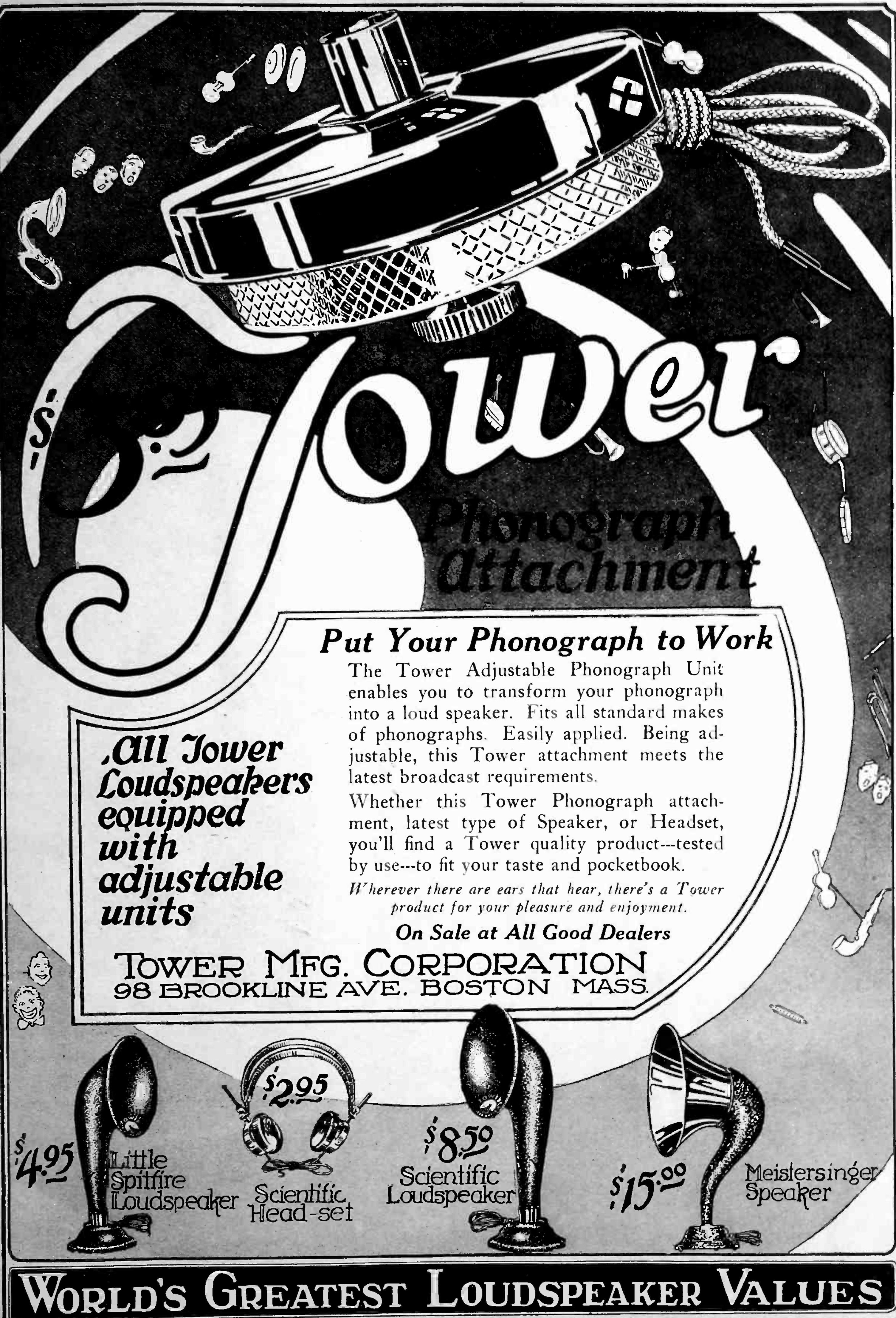
Since 1915— Standard for All Sets

TYPES C301A, C300, C299, C11, C12.

In the Orange and Blue Carton.

Home Office: 182 Second Street San Francisco — E. T. Cunningham Inc. — Chicago New York

Patent Notice: Cunningham Tubes are covered by patents dated 2-18-12, 12-30-13, 10-23-17, 10-23-17, and others issued and pending.


$
Tower
Phonograph
Attachment
Put Your Phonograph to Work
The Tower Adjustable Phonograph Unit enables you to transform your phonograph into a loud speaker. Fits all standard makes of phonographs. Easily applied. Being adjustable, this Tower attachment meets the latest broadcast requirements.
Whether this Tower Phonograph attachment, latest type of Speaker, or Headset, you'll find a Tower quality product---tested by use---to fit your taste and pocketbook.
Wherever there are ears that hear, there's a Tower product for your pleasure and enjoyment.
On Sale at All Good Dealers
All Tower Loudspeakers equipped with adjustable units
TOWER MFG. CORPORATION
98 BROOKLINE AVE. BOSTON MASS.
$4.95 Little Spitfire Loudspeaker
$2.95 Scientific Head-set
$8.50 Scientific Loudspeaker
$15.00 Meistersinger Speaker
WORLD'S GREATEST LOUDSPEAKER VALUES

RADIO

Established 1917

Published Monthly by the Pacific Radio Publishing Co.

ARTHUR H. HALLORAN, *Editor* — LAURENCE MOTT, *Associate Editor*

GERALD M. BEST, *Technical Editor* — H. W. DICKOW, *Advertising Manager*

Branch Offices:
New York City—17 W. 42nd St.
Chicago—157 E. Ontario St.
Boston—52 Irving St.
Kansas City, Mo.—1102 Republic Bldg.

Rates:
Issued Monthly, 25c a copy.
Subscription price $2.50 per year in the U. S., $3.00 per year elsewhere.

Correct Addresses:
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.

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

Member—Radio Magazine Publishers Association
Entered as second-class matter at Post Office at San Francisco. Calif

Address all communications to

Pacific Radio Publishing Company

Pacific Building, San Francisco, California

VOLUME VII — AUGUST, 1925 — No. 8

CONTENTS

Forecast of Contributions for September Issue

The unusual length of several of the articles in the August issue, together with the smaller total number of pages caused by the advertisers' contribution to the summer slump in radio, have necessitated holding several articles over until the September issue.

The second installment on the Modified Best Superheterodyne will describe an unshielded model intended for baseboard construction and adapted to loop reception. This has been so designed as to facilitate changes in existing sets of this type so that they may be improved with a minimum of labor. It may be constructed so as to cover any and all wavelengths by the substitution of different oscillator coils.

Glenn S. Browning gives some interesting facts about "low loss" radio apparatus, stressing the effects of a coil's power factor on its performance in a receiver.

John P. Minton describes the methods used in testing loud speakers, giving suggestions which are applicable to home as well as store determinations of quality of reproduction.

The constructional details of an inexpensive chemical rectifier are told by C. A. Weidenhammer.

G. F. Lampkin describes the several types of wavemeters best adapted for use with different kinds of receivers.

M. T. Rogers recounts the theory and construction of various kinds of ammeters and volt meters used in radio sets.

The transmitting amateurs will be interested in and helped by D. B. McGown's account of the use of the push-pull radio frequency oscillator to eliminate radiations on high frequency harmonics. Mr. McGown also describes the radio equipment of the yachts in the trans-Pacific race.

J. E. Anderson's article on "Comparative Efficiencies of Radio Tuning Coils" discusses bank-wound, spider-web, Lorentz, single layer solenoid, pancake, toroidal and other shaped inductance units.

The final article in G. M. Best's series on audio frequency amplification indicates the probable trend in future developments of transformers and amplifying tubes and also presents an account of the test methods employed.

The "For the Radio Notebook" department will give quick and easy methods for the calculation of direct current resistance at both low and high frequencies.

F. L. Ulrich presents an interesting account of short-wave experiments with the fleet.

"Rescuing Uncle Marmaduke" is a radio mystery story by John Eugene Hasty, a fiction writer, new to these columns but destined to become well-liked after this story is read.

FADA Radio

Make it *tonight* tune in with a Fada

INSTALL a Fada Neutrola-Grand in your own home tonight—

A few turns of the dials will get you *real* distance with tone so sharp and clear you can only marvel.

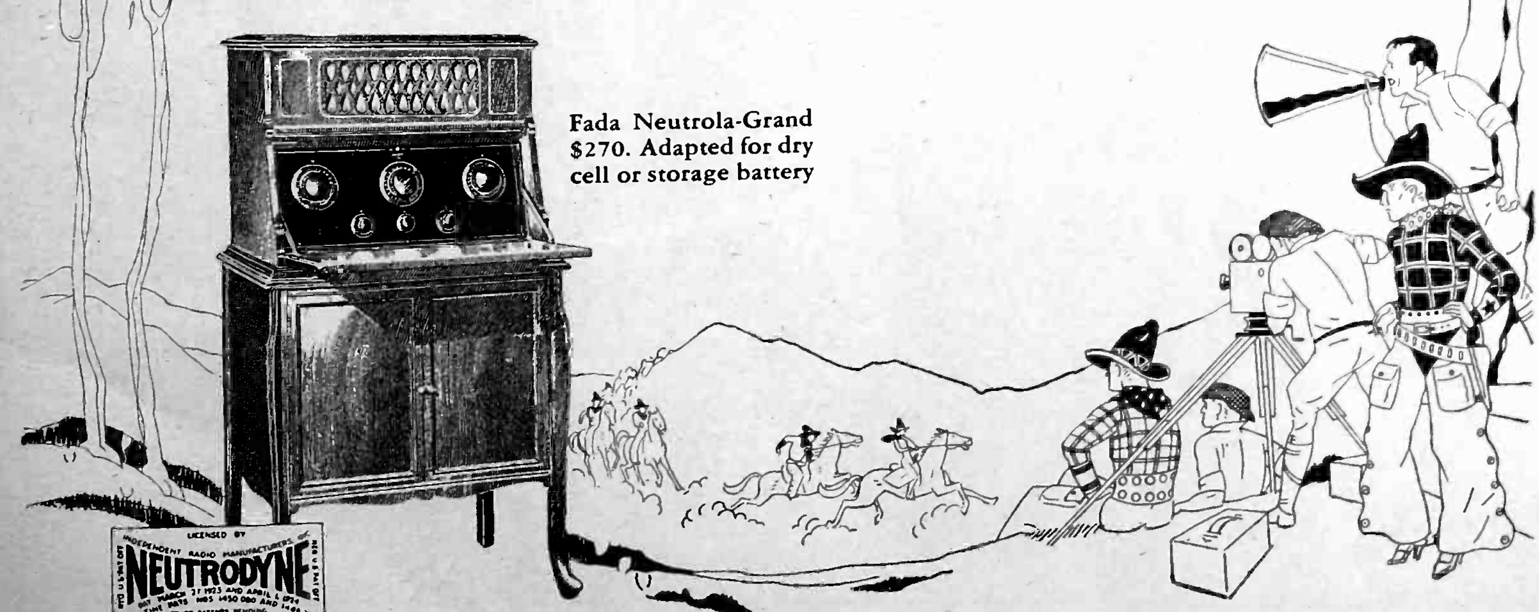
Simple to operate—Clear, perfect speech—Music just as it is sung or played—Distant stations without a jumbled program—No screeching or whistling—And cabinets that harmonize with beautiful interiors.

Don't put it off. Tonight is the best night. You'll be certain to want Fada as a permanent acquisition.

There are six Fada models—$75 to $270. Dry cell or storage battery. Outdoor or indoor aerial. Convenient time payments may be arranged with any dealer who specializes on Fada.

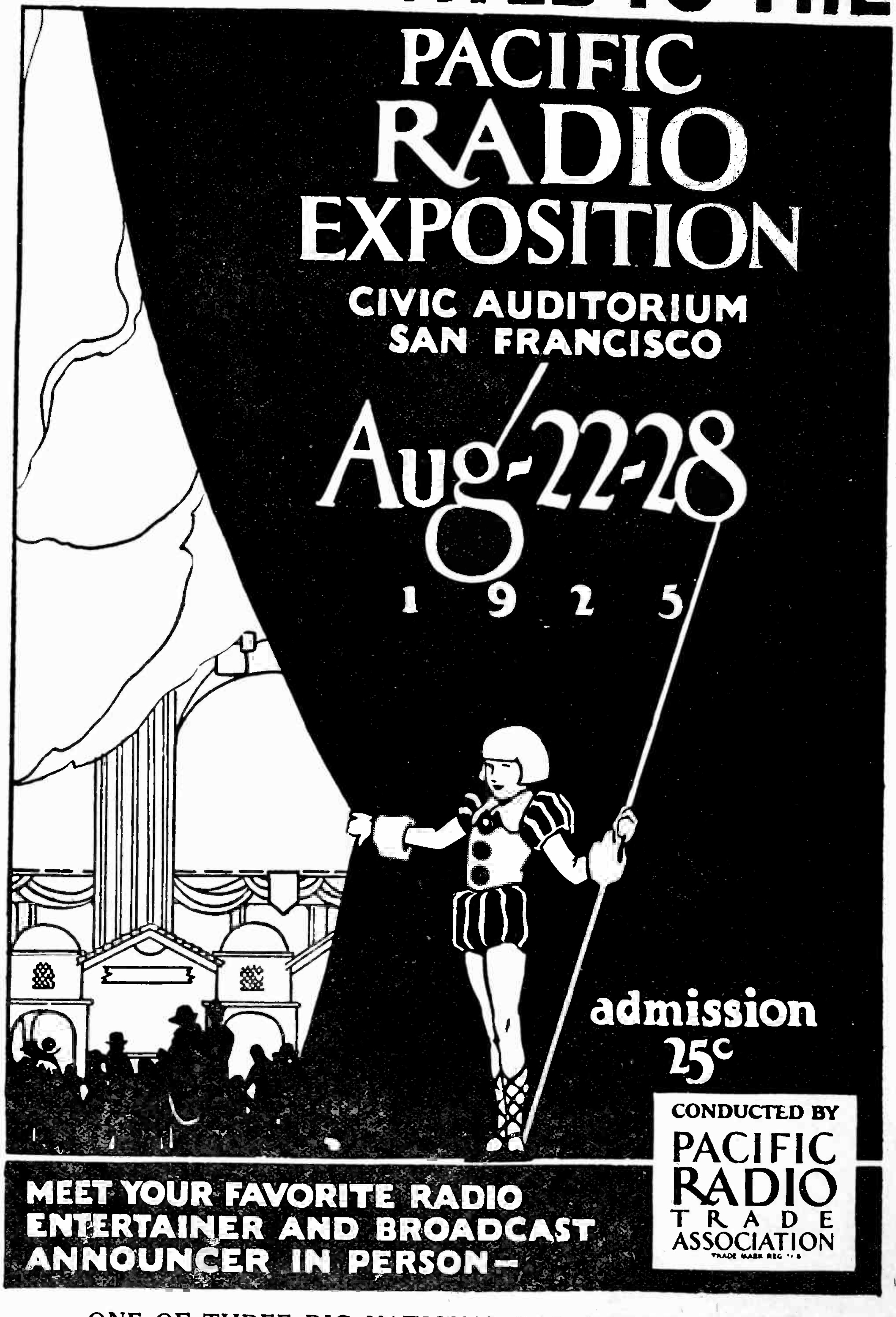
F. A. D. ANDREA, INC., 1581 JEROME AVE., NEW YORK

Chicago Office: 326 W. Madison Street   San Francisco Office: 5 Third Street



Fada Neutrola-Grand $270. Adapted for dry cell or storage battery

YOU'RE INVITED TO THE



ONE OF THREE BIG NATIONAL RADIO EXPOSITIONS

Most Every Radio Device Made Will Be Exhibited

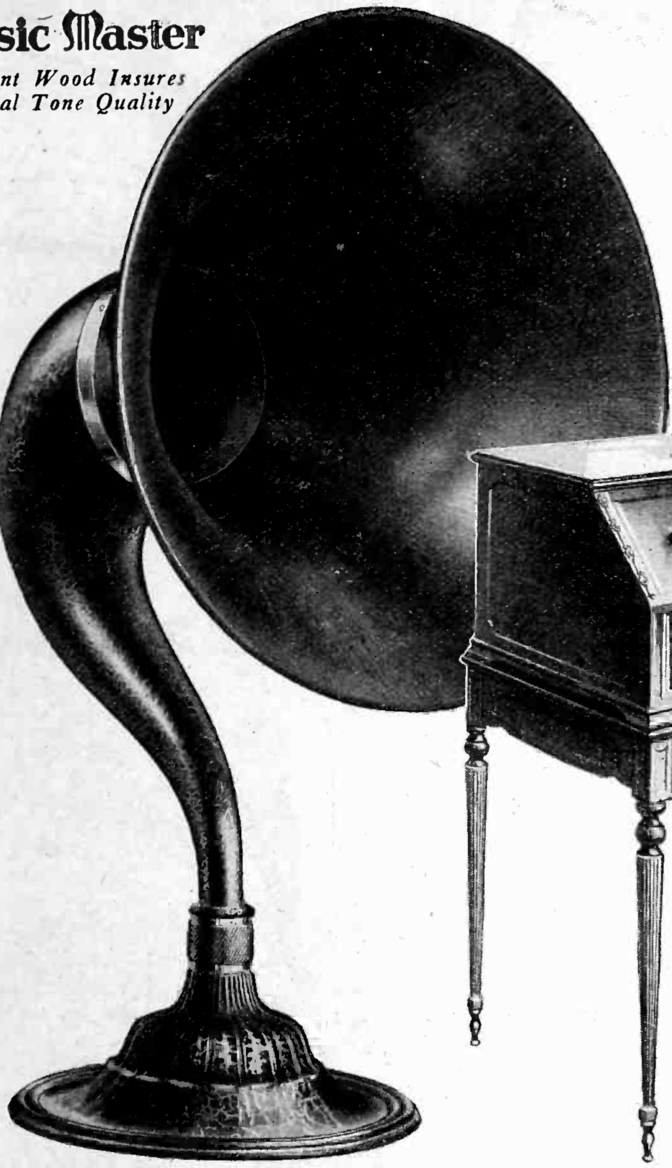
PACIFIC RADIO TRADE ASSOCIATION

HECKERT L. PARKER, Association Manager

905 Mission St. : SAN FRANCISCO : Tel. Garfield 6214

Music Master

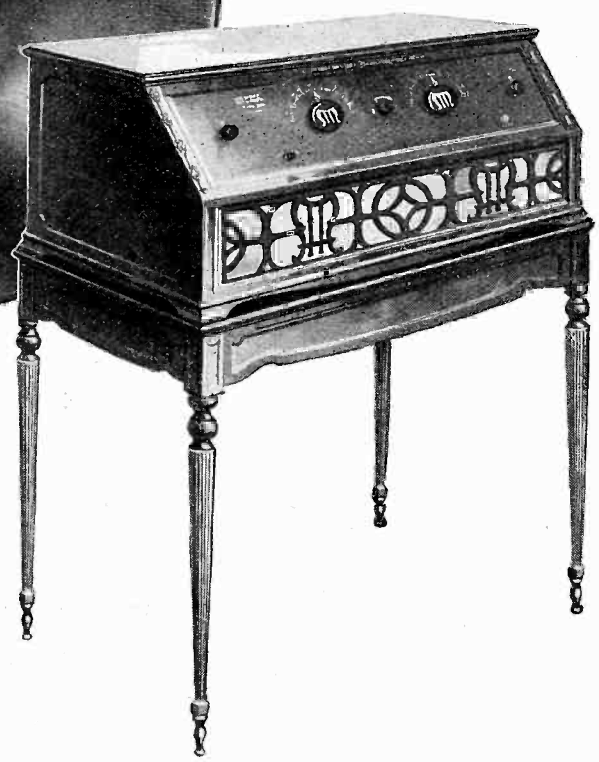
Resonant Wood Insures Natural Tone Quality



—evolution

A series of receivers designed to provide powers of radio reception equal to the capacities of Music Master Reproducer.

The Musical Instrument of Radio
—there IS no substitute



Type 215

Six Tubes. Special Music Master Circuit. Built-in Music Master Reproducer. Very selective, long range, splendid tone quality.

Table Base equipped with drawer and battery compartment finished in same style as cabinet. Detachable legs.

Table Base Only -	$ 40
Set Without Base -	175
Set and Base Complete - - - -	215

MODEL VI *14" Wood Bell* -	$30
MODEL VII *21" Wood Bell* -	$35

Canadian Prices Slightly Higher

AT LAST—radio reception incorporating the demonstrated results of latest radio research, and combining in one superb radio ensemble the proved principles of Music Master Radio Reproduction.

Audition will prove MUSIC MASTER'S outstanding powers of long range and high selectivity, its clarity and volume, and above all, its supreme Tone Quality based on MUSIC MASTER Reproducer as a vital element of the ensemble.

Sold by authorized distributors and by Registered Dealers everywhere. Call on your MUSIC MASTER *dealer—today. See* MUSIC MASTER*—hear—compare—before you buy* ANY *radio set.*

Ten Models
$50 to $460
Guaranteed
Unconditionally

Music Master Corporation
Makers and Distributors of High-Grade Radio Apparatus
128-130 N. Tenth Street
Chicago *New York* PHILADELPHIA *Pittsburgh* *Montreal*
Canadian Factory: Kitchener, Ontario

Merchants of standing desirous of profiting by Music Master prestige and reputation are invited to communicate with Music Master Corporation

Music Master
RADIO PRODUCTS

ZENITH
TRADE MARK REG.

→LONG DISTANCE← RADIO
TRADE MARK REG.

Arctic Explorers Stake Their Lives on Zenith Radio—

Costs More
But Does More

Super-Zenith IX

It is one thing to select a radio set for pleasure only—it is quite another to select a set which may be called upon most unexpectedly to save your life.

Alone in the Arctic—cut off from the nearest rescue post by hundreds of miles of ice and open water—men cannot run to the nearest radio shop for repairs. If transportation fails, ***and radio does not work,*** they are in the gravest peril.

This summer—across the million square miles of unexplored territory stretching between Alaska and the North Pole—MacMillan and his party of explorers will fly in three great navy planes. Each of these cruising airplanes is equipped with Zenith radio, as are the ***Bowdoin*** and the ***Peary,*** which will locate at Etah as their base. Between ships and airplanes messages will be sent and received.

When Arctic explorers of MacMillan's calibre stake their lives—repeatedly—on Zenith performance, one reason only can explain their choice—***Zenith has proved to be the best obtainable, at any price.***

Call this evening at your nearest Zenith dealer and let him prove it to you by a demonstration.

ZENITH RADIO CORPORATION
310 South Michigan Avenue, Chicago

THE complete Zenith line ranges in price from $100 to $475.

With either Zenith 3R or Zenith 4R, satisfactory reception over distances of 2,000 to 3,000 miles is readily accomplished, *using any ordinary loud speaker.* Models 3R and 4R licensed under Armstrong U. S. Patent No. 1,113,149. They are NON-RADIATING.

Zenith 4R - $100
Zenith 3R - $175

The new Super-Zenith is a six-tube set with a new, unique, and really different patented circuit, controlled exclusively by the Zenith Radio Corporation. It is NOT regenerative.

SUPER-ZENITH VII—Six tubes—2 stages tuned frequency amplification—detector and 3 stages audio frequency amplification. Installed in a beautifully finished cabinet of solid mahogany—44⅞ inches long, 16¾ inches wide, 10⅝ inches high. Compartments at either end for dry batteries. Price (exclusive of tubes and batteries)........... **$240**

SUPER-ZENITH VIII—Same as VII except—console type. Price (exclusive of tubes and batteries)........... **$260**

SUPER-ZENITH IX—Console model with additional compartments containing built-in Zenith loud speaker and generous storage battery space. Price (exclusive of tubes and batteries)........... **$355**

SUPER-ZENITH X—Contains built-in, patented, Super-Zenith Duo-Loud Speakers (harmonically synchronized *twin* speakers and horns), designed to reproduce both high and low pitch tones otherwise impossible with single-unit speakers. Price (exclusive of tubes and batteries) **$475**

All Prices F. O. B. Factory

Zenith Radio Corporation
Dept. H-8
310 S. Michigan Avenue, Chicago, Illinois
Gentlemen:
Please send me illustrated literature about Zenith Radio.

Name...

Address...

....

RADIO

Established 1917

Volume VII | AUGUST, 1925 | No. 8

Radiotorial Comment

THE practical applications of radio to telegraphic and telephonic communication are so useful as to cause its philosophic significance seemingly to be overlooked by most of us. As the speculative aspect is fully as interesting and certainly as inspiring as the operative, it is worth considering for a moment.

Radio represents the twenty-four lowest octaves in the great spectrum of light, employing this term to designate the electromagnetic radiations through space. Although these vibrations may have existed since the dawn of creation, it is but recently that their presence has been known.

As most of them could not be detected by our senses, we were unaware of their being. In fact, man is blind to fifty-two of the fifty-three octaves which science has located in this great spectrum. His eyes respond directly only to the single octave between 400 and 800 trillion vibrations per second which covers the seven primary colors from the red to the violet. He can feel as radiant heat a short ways into the infra-red, but all others require some artificial means of detection.

All these various forms of radiant energy differ from one another merely in their frequency. They all travel at the same speed and all can be reflected, refracted, diffused and absorbed. Through some form of frequency changer, usually a frequency reducer, they can be converted into a detectable form.

If all human beings were blind, some means, perhaps such as are employed in radio, would have to be devised for translating light into phenomena which could be detected by some of the other senses. Thus a totally blind person recognizes sun light only as sun heat and can sometimes determine color by touch. Much of the mystery which has surrounded radio has been due to the lack of a human sense organ for its direct detection. The ear requires the presence of some relatively dense medium in order to detect sound and is insensitive to the so-called ether waves.

By means of sensitive thermometers nine octaves of the infra-red can be measured. The next four below are unknown, and then come the radio vibrations which can be generated and detected by the vacuum tube. Two octaves beyond the violet can be detected by the aid of the fluorescent screen, the next ten octaves of the ultra-violet are unknown, and then come the three octaves of the X-rays. Beyond that all is dark to man.

The practical uses of the X-rays, visible light, and radio are well known. During the war, ultra-violet rays, which are also used for some chemical processes, were employed for signalling between ships. The infra-red rays are useful as radiant heat. It is quite probable that the development of the photo-electric cell now used in the electrical transmission of pictures will enable the detection and possible application of the other octaves to useful purposes.

A better understanding of these facts may be had by imagining a huge electric organ provided with an infinite number of stops, each producing some definite ether note. While the master player might be creating a great harmony, covering the gamut from low frequency electricity to the X-ray and beyond, we would be unaffected except for an occasional sensation of warmth and of color. All the other great notes would be silent or invisible to man.

Yet while we cannot feel, taste, smell, hear nor see them, they are known to exist either by the actual effects which they produce or by rational deduction. Nor is it beyond belief that we may be surrounded by other influences even more marvelous and powerful. It is no more reasonable to deny this than to have denied the possibility of radio thirty years ago.

No longer can we accept the implied dictate of the old maxim—"seeing is believing" and hold that non-seeing is a proper basis for non-believing. Throughout all Nature the wonders of the seen are dwarfed into insignificance when compared with the majesty and glory of the unseen.

Science has sharpened our ears with radio so that we can instantly hear speech that is uttered thousands of miles away. Just as the horse, the boat, the locomotive and the automobile have successively lengthened our legs, just as printing, the telegraph, the microscope and the moving pictures have increased the range of our eyes, so have the telegraph, the telephone, and radio enlarged the sphere of our ears and recently, also, of our eyes.

Thus the trend of progress has ever been toward the extension of man's primitive faculties of walking, seeing and hearing. The effect of these inventions has been to enlarge a person's neighborhood. They either take him to distant places or bring distant places to him in increasingly shorter time. "If the mountain won't come to Mahomet, Mahomet goes to the mountain." The product of length and time remains nearly constant, no matter how greatly the length is increased.

So radio, in addition to being a means of present enjoyment, is but another discovery to confirm our belief in the unseen, the unfelt and the unheard. It draws aside one more veil from the great unknown.

Short-Wave Work at Naval Research Laboratory

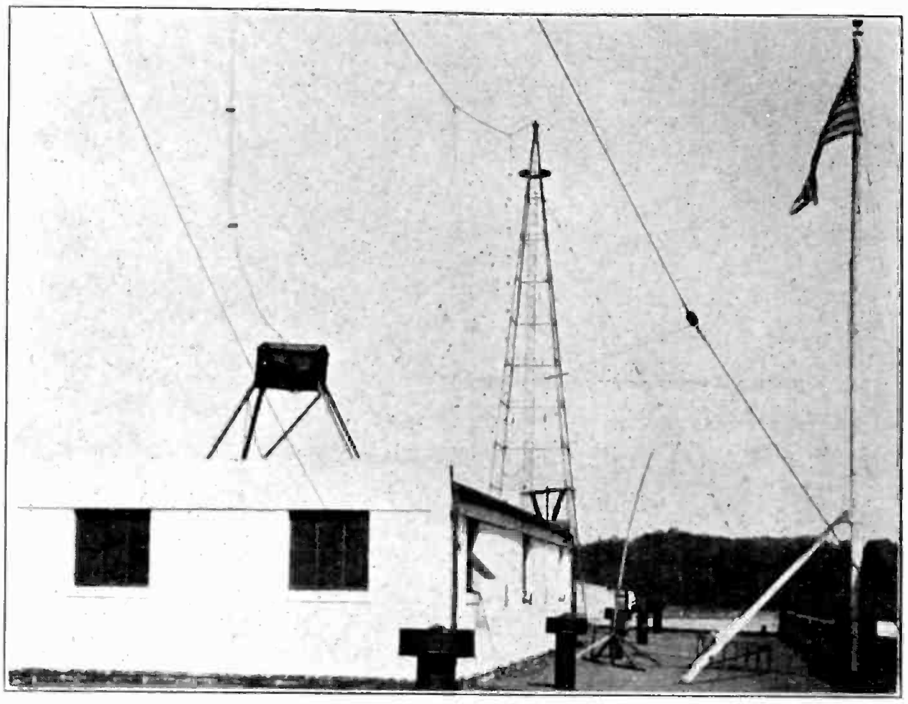
An Account of 20-Meter Daylight Work with England and Australia

By S. R. Winters

WHEN long-distance radio-receiving records are being made in such rapid succession that the feat of today is accepted as commonplace on the morrow, the public is no longer startled when informed that amateur station "2XM" picked up signals from Australia at 2 o'clock in the morning. This achievement, however, may be considered freakish because it happens only intermittently and under peculiarly favorable weather conditions.

Therefore, when we are told that a three-tube single-circuit, radio receiver at the Naval Research Laboratory, Bellevue, District of Columbia, intercepts radio signals from London, England, regularly for a week, this achievement can not be classified as a freakish performance. What is even more remarkable these signals were received at noon—12 o'clock Eastern Standard Time—each day for a period of one week. Of course, the sending and receiving were conducted by means of radio telegraphy, not radio telephony, and short waves were employed, on the order of 20 meters.

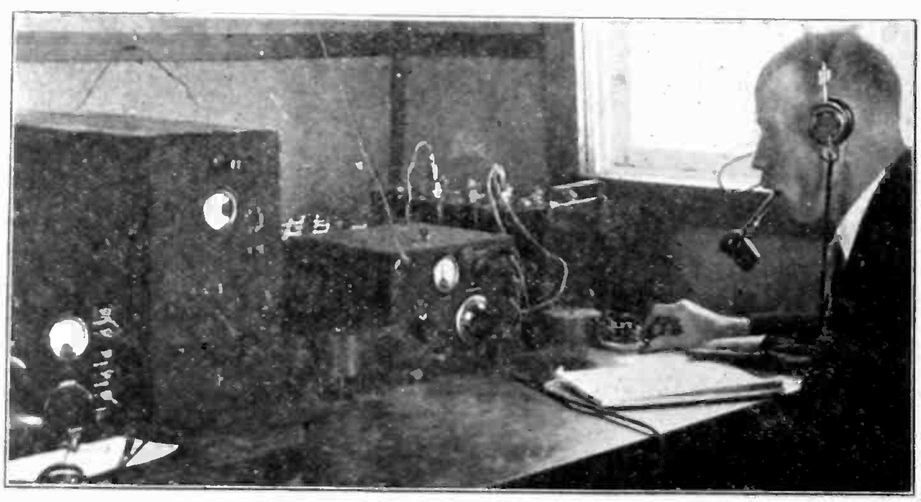
The radio receiving set, used in establishing this long-distance communication service, during daylight hours, is a modest appearing outfit. The cabinet resembles that used by many radiocast listeners, and the circuit employed does not differ greatly from that used by thousands of radio amateurs. However, the Naval Research Laboratory makes use of low-loss parts and means for effecting extremely fine adjustments. The latter are accomplished by a worm-gear mechanism, to which Dr. A. Hoyt Taylor, Superintendent of Radio, attributes much of the success in establishing the recent phenomenal radio-reception records.



Antenna System at Bellevue Naval Research Laboratory.

The antenna system employed in conjunction with this short-wave receiver takes the form of a 6-wire cage. This is suspended near one end of a wire extending about 180 feet between two masts. These masts, as well as both transmitting and receiving antennae, are planted atop the roof of the main building at the Bellevue Naval Research Laboratory. The masts or towers extend approximately 55 feet above the roof. At the opposite end of the 180-ft. wire, stretching across the roof of this building, is another cage antenna, used in operating an 87-meter radio set. The effectiveness of this antenna system is entitled to share liberally of the glory achieved in both transmitting and receiving radio signals.

20-Meter Transmitter Used in Working Australia, L. C. Young at the Panel.



Dr. A. Hoyt Taylor with Short-Wave Receiver

This same radio receiving set, of single circuit design and using three type "N," Western Electric Company make vacuum tubes, was employed in the two-way communication record established between 1:00 and 2:15 o'clock on the morning of April 20. Radio telegraphic messages were exchanged with 2CM, a radio amateur station at Sydney, Australia. The air line distance between these two points is approximately 10,000 miles, covering both land and water.

(Continued on Page 60)

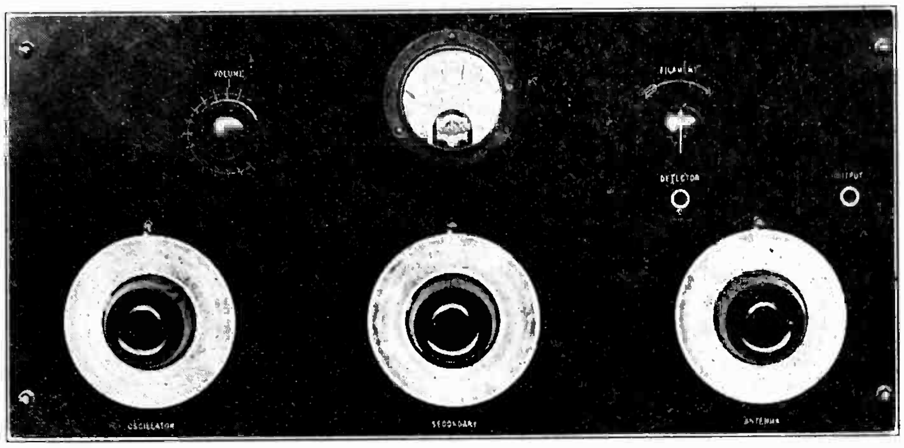
The Modified Best Superheterodyne

Part I--Shielded Model

An All-wave, Panel-mounted Set Using Seven Small Tubes and Adapted to an Outdoor Antenna

By Gerald M. Best

THE increasing number of radiocast stations operating on wavelengths below 250 meters together with the greater amateur use of the band from 40 to 100 meters, has created a demand for radio receivers capable of efficiently covering these shorter wavelengths as well as the higher waves from 250 to 550 meters. In previous models of the 45,000 cycle superheterodyne having a range from 200 to 580 meters, stations below 250 meters were crowded into a small space at the lower end of the oscillator condenser dial, especially where condensers of the semi-circular plate type were employed. Consequently the set has been re-designed so as to use different coils for different bands. This involves an improved oscillator system and new apparatus in other parts of the circuit.

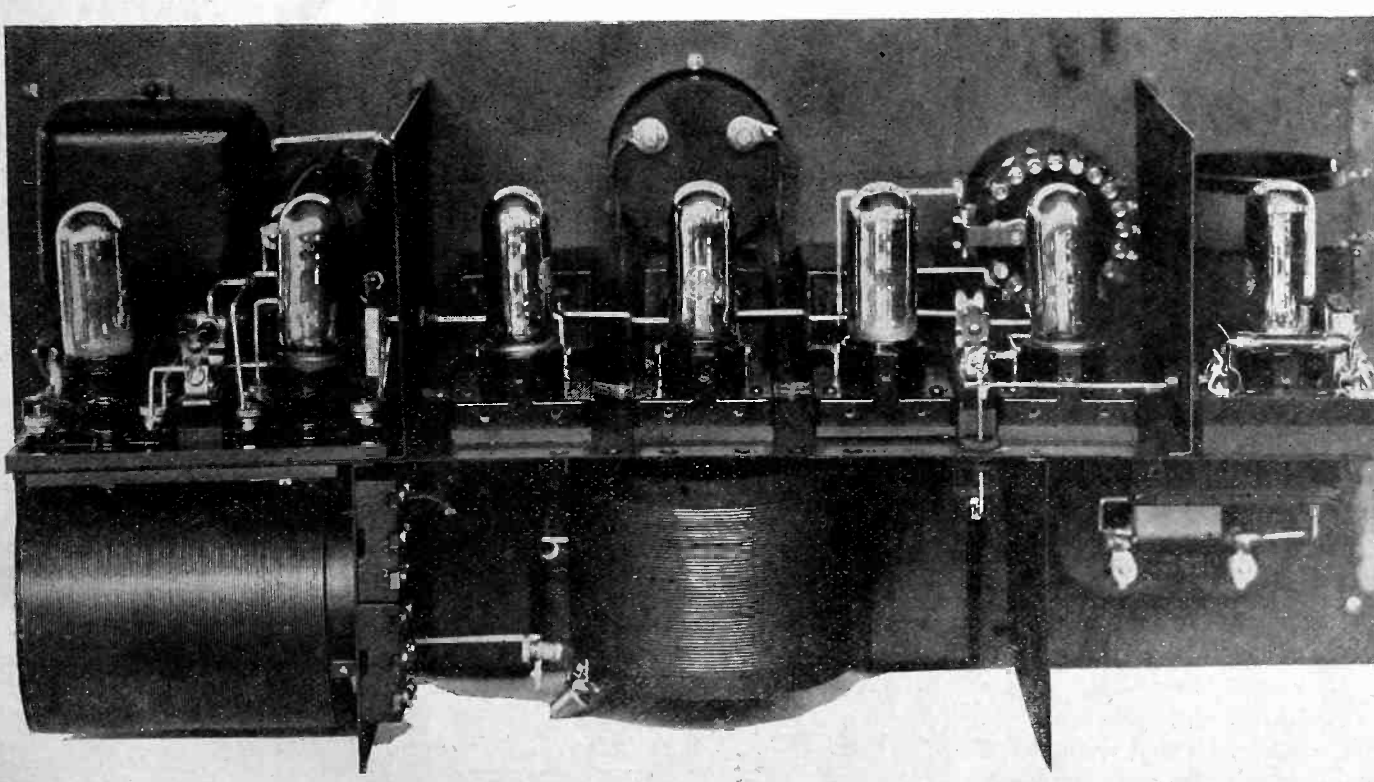


Front Panel View.

In order to include the desirable features of several types of construction, two models employing the same basic circuit will be described, one model being completely shielded, with all the apparatus mounted on the back of the panel, and using dry cell tubes and the other model comprising a baseboard layout, with storage battery tubes similar to the one described in January, 1925 RADIO, so that those who have already constructed that receiver may rearrange their equipment, and with a few additions may incorporate all the advantages of the new design. The shielded model described herein will particularly appeal to the advanced constructor. If the building of the shielded panel appears to be difficult for the novice, it would be advisable for him to construct the baseboard model, which will be described in the September issue.

From the illustrations, it will be seen that the apparatus is mounted on the back of the panel and on a brass shelf supported by the panel. The shielding is made in one piece by soldering the various parts together, or fastening with machine screws, and is held to the back of the panel by the mounting screws provided for holding the panel apparatus in place.

From the picture of the front panel layout, it is evident that there are three controls for tuning, the receiver being designed to operate with an outdoor antenna. By carefully shielding the antenna tuned circuit, and arranging the coil system so that critical coupling is



Rear View Showing Arrangement of Apparatus on Shelf.

obtained between the antenna and secondary tuned circuits, a degree of selectivity comparable favorably with an ordinary loop antenna is obtained, with greater signal strength and no radiation.

Fig. 1 shows the schematic circuit diagram, on which are plainly marked the identity of the various pieces of apparatus. The vacuum tubes are arranged in the following order: heterodyne oscillator, frequency changer (commonly called the 1st detector), three stages of intermediate frequency amplification, detector and one stage of transformer coupled audio frequency amplification. Seven dry cell tubes of the C-299 or UV-199 variety are required, the tubes being controlled by a filament rheostat, R_1 of 6 ohms resistance, mounted at the upper right-hand end of the panel. A voltmeter having a scale of 0-5 volts is provided for adjustment to the proper filament voltage. Storage battery tubes should not be used in this model due to almost insuperable trouble from coupling in the amplifier.

Beginning at the antenna end of the receiver, the antenna system consists of a variable condenser C_1 of .0005 mfd. capacity, a primary loading coil, and a coupling coil, placed in series between the antenna and ground terminals. The loading coil is wound on a 4-in. fibre tube, and consists of 94 turns of No. 20 bare copper wire, wound 20 turns to the inch in a groove cut in the tubing. This groove is best made by placing the tubing in a lathe and cutting with a sharp pointed Armstrong tool, using the screw cutting attachment of the lathe.

The coupling coil is the rotor of a conventional type of 180 degree variocoupler, on which are wound 8 turns of No. 20 bare wire, with the same spacing as for the loading coil. The latter is provided with a tap at the 15th turn, for use on the short waves. The secondary winding consists of 46 turns of No. 20 bare copper wire wound on the stator of the variocoupler, which is of 4 in. diameter and is tuned by condenser C_2, .0005 mfd. Taps are taken off at the 10th and 22nd turns, to provide adjustment for the short waves. These taps are brought up through holes in the brass shelf to a set of terminals so that the wavelength range of the secondary can be easily changed. In the experimental set, a coil mounting such as was used for the oscillator coil was mounted on the back of the shelf, and a flexible cord with a phone cord tip was employed for changing taps. The tap for the load coil was brought out in the same manner, since it was not desirable to have switches mounted on the panel for changing the connections.

From the picture of the under side of the shelf it can be seen that brass partitions are mounted so that the antenna series condenser and load coil are in one compartment, the secondary coil and

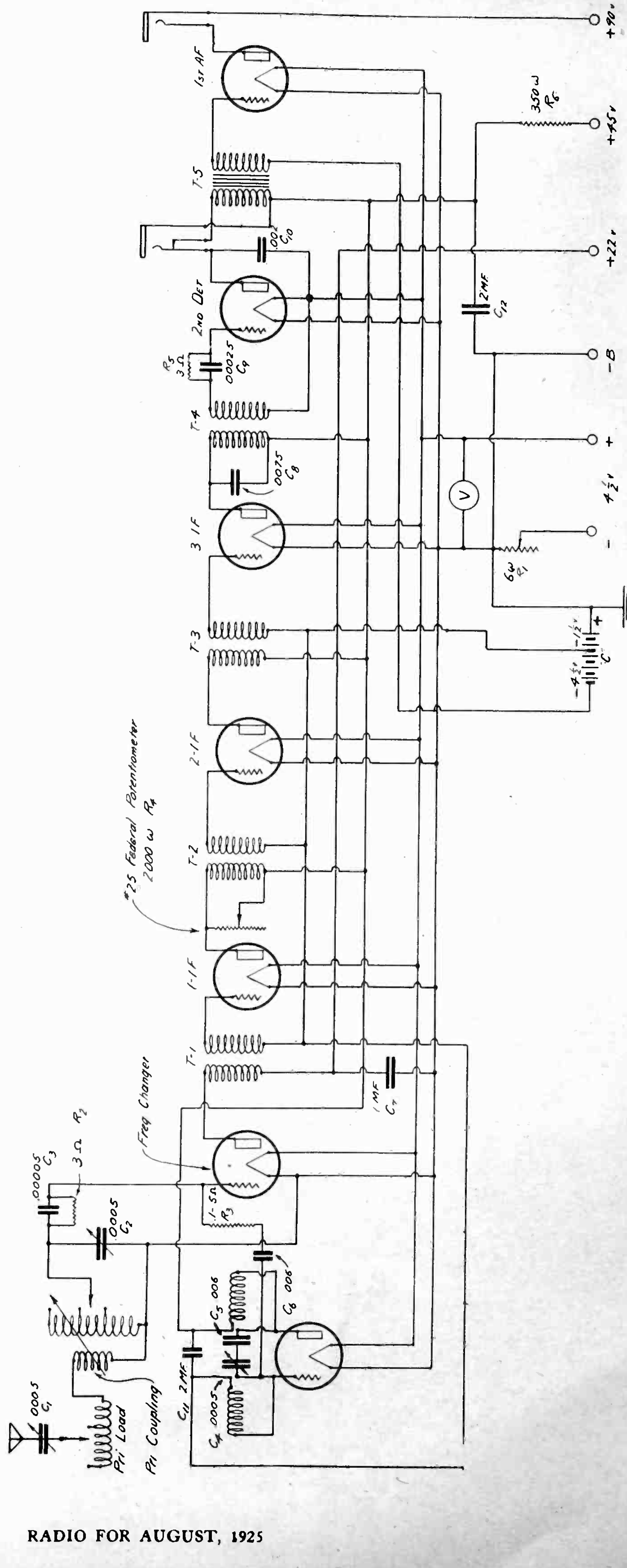
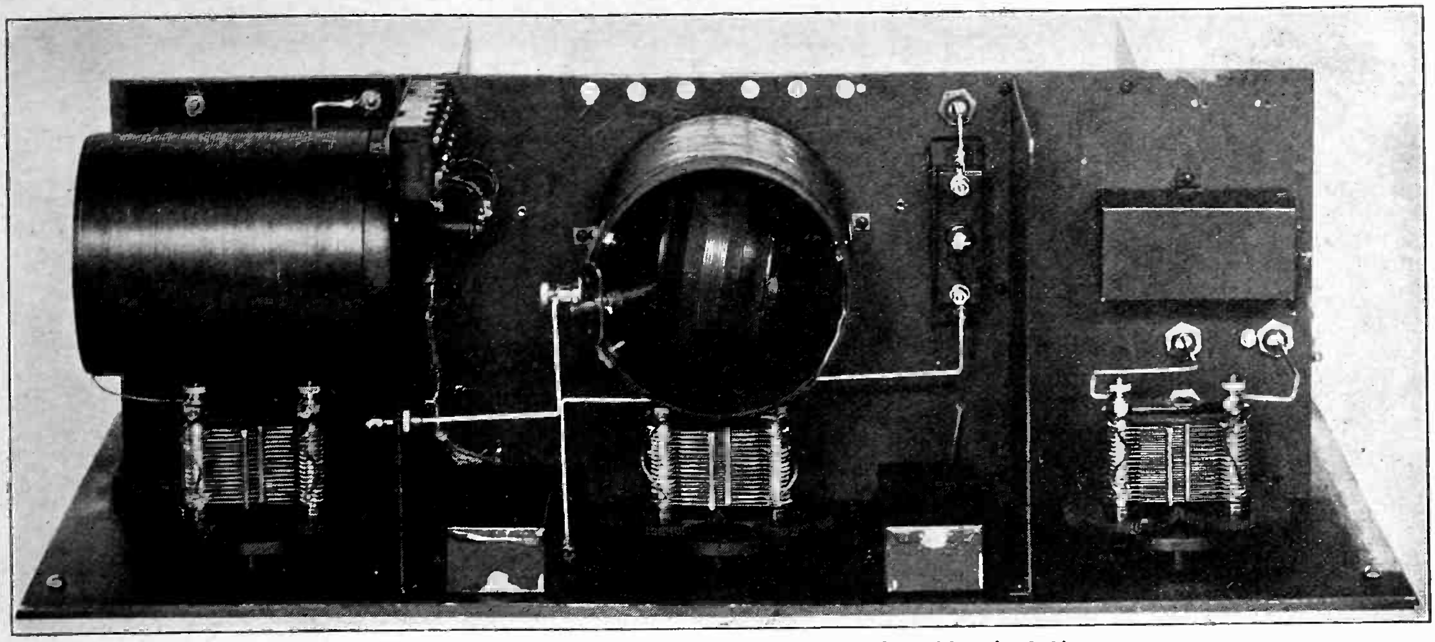


Fig. 1. Circuit Diagram.



View of Antenna Tuning Equipment on Under Side of Shelf.

condenser in another, and at the opposite end of the panel the oscillator condenser is provided with a compartment of its own. These partitions are necessary in order to prevent coupling between the antenna load coil and the secondary coil, and also any possible coupling between the oscillator circuit and the antenna system. Energy from the antenna tuned circuit is fed into the frequency changer by means of C_3, a grid condenser of .00005 mfd., shunted by a 3 megohm grid leak, R_2 the grid return being to the negative end of the filament in order that the entire negative filament circuit of the receiver may be grounded.

The oscillator system consists of an inductance coil having two windings of equal size wound on a 2¾ in. Bakelite tube, a variable condenser C_4 *of* .0005 mfd. capacity in series with a fixed mica condenser C_5 having a capacity of .006 mfd., a grid leak, R^3 of approximately .1 megohm, and a mica condenser C_6 of .006 mfd. The oscillator coil is arranged so that it can be removed from the set and coils of other inductance inserted in the same mounting. Four plugs are mounted on the bottom of the coil in such a manner that they will fit into a four plug mounting placed on the metal shelf. This coil can be seen in the picture of the back panel layout, at the extreme right-hand end. The oscillator tube, grid leak and mica condenser C_6 are mounted to the rear of the oscillator coil, and the bypass condenser C_{11} is placed underneath the shelf, a brass partition shielding the intermediate amplifier from the oscillator coil.

The method of feeding oscillator energy into the frequency changer is similar to that described in a recent issue of RADIO, the grid of the oscillator and frequency changer tubes being connected together by means of a .1 megohm resistance, condenser C_6 being provided to prevent the grid of the frequency changer from becoming negative with respect to its filament and being large enough to have no effect in the circuit. If the condenser were omitted, the C potential provided for the oscillator grid

PARTS FOR THE MODIFIED BEST SUPERHETERODYNE, SHIELDED MODEL

No. Required	Part	Circuit Designation	Makes That May Be Used
3	I. F. Transformer	T_1, T_2, T_3	General Radio No. 271, Jefferson No. 150, Silver 60 KC, Baldwin-Pacific Shielded.
1	Tuned Transformer	T_4	See Text
1	Audio Freq. Transf.	T_5	All-American, Dongan, General Radio, Jefferson, Karas-Harmonik, Pacent, Premier, Rauland Lyric, Stromberg-Carlson, Supertran, Thordarson 2:1.
2	Jack		Carter, Erla, Federal, Frost, Marco, Pacent.
3	Oscillator Coils		General Radio No. 277-A, B and C
2	Oscillator Coil Mtgs.		General Radio No. 274-B
1	Rheostat	R_1	Amsco, Bradleystat, Carter, Federal, Frost, General Instrument, General Radio, Pacent.
3	Variable Condensers	C_1, C_2, C_4	Acme, Bremer-Tully, Cardwell, Ensign, General Instrument, General Radio, Marco, National, N. Y. Coil, Phoenix, Remler, Signal, Silver-Marshall, U. S. Tool.
5	Tube Sockets, Plain		Amsco, Benjamin, Erla, Frost, General Radio, Kellogg, Marco, Remler, Silver-Marshall.
5	Tube Sockets, Cushioned		Benjamin, Frost
1	Voltmeter		Hoyt Model 17, Jewell Pattern 53, Western Model 301.
2	2 mfd. Fixed Cond.	C_{11}, C_{12}	Dubilier, Kellogg, N. Y. Coil
1	1 mfd. Fixed Cond.	C_7	Dubilier, Electrad, Kellogg, N. Y. Coil, Federal.
1	.0075 mfd. Fixed Cond.	C_8	Dubilier, Electrad, Federal, Kellogg, N. Y. Coil.
2	.006 mfd. Fixed Cond.	C_5, C_6	Dubilier, Electrad, Federal, Hilco, Kellogg, N. Y. Coil.
1	.002 mfd. Fixed Cond.	C_{10}	Dubilier, Electrad, Federal, Hilco, Kellogg, N. Y. Coil.
1	.00025 mfd. Fixed Cond. with G-L mtg.	C_9	Dubilier, Electrad, Federal, Hilco, Kellogg, N. Y. Coil, XL.
1	.00005 mfd. Fixed Cond.	C_3	Amplex, Continental, X-L Model G, Chelten.
2	Grid Leak-3 megohm	R_2, R_5	Aerovox, Amsco, Daven, Durham, Electrad, Filko, Freshman, Rogers.
1	Grid Leak-.1 megohm with mounting	R_3	Aerovox, Amsco, Daven, Durham, Electrad, Filko, Freshman, Rogers.
1	Potentiometer, 2000 ohms	R_4	Centralab, Federal
1	Variocoupler		Atwater-Kent, Hilco, Kellogg.
1	Protective Resistance	R_6	General Radio No. 283, Don Mac Protecto-tube.
7	Binding Posts		Amsco, Eby, General Insulate, General Radio.

would be effective on the grid of the frequency changer and would force it to operate on an inefficient point of its detector characteristic curve. If .1 megohm admits too much energy to the frequency changer, a grid leak of higher resistance should be used, the maximum being about .5 megohms.

The grid coupling coil used in former superheterodynes is abandoned and permits the substitution of different oscillator coils without the complicated connections required when a grid coil was used. The set radiates practically no energy into the antenna, due to the fact that the oscillator is well shielded, and high frequency currents generated by it must first pass through a .1 megohm resistance, then through the 50 micro-microfarad grid condenser in shunt with the 3 megohm leak, and through the very selective tuned circuit. As the output taken from the grid of the oscillator tube is very small,, it is obvious that radiation would be negligible.

The intermediate amplifier and frequency changer tubes are mounted in the center compartment, with the volume control rheostat R_4, intermediate frequency transformers and voltmeter. It is absolutely necessary to use intermediate transformers having shielded cases, such as the Jefferson No. 150, as unshielded coils will introduce complications which will be very difficult to remedy. The transformers are mounted between the panel and the tube sockets, so that the wiring will be as short as possible.

The volume control may be either a set of non-inductive resistances connected to an inductance switch, as is shown in the picture, or a high resistance potentiometer wound to at least 2000 ohms. The use of the latter presents the easiest method of volume control and the least expensive to install. Due to the fact that with the 2000 ohm potentiometer set at maximum resistance, the total amplification will still be below normal, one end of the potentiometer winding should be cut at the point where it is connected to the binding post terminal, so that when the potentiometer knob is set at the extreme clockwise position, the potentiometer will be open circuited.

For those who wish to construct their own potentiometer, the following values of fixed resistances will enable the assembling of a 15-step resistance giving approximately the same change in volume for each step: 12,000, 6000, 2600, 1900, 1120, 680, 440, 270, 170, 108, 68, 44, 27, 17 and 11 ohms. As such resistances cannot be purchased ready made, they should be wound by hand, by measuring the wire off in lengths according to its resistance, doubling the wire back on its center and bringing out the two ends to some form of tapped switch, such as the Carter inductance switch. No. 36 or No. 38 double silk

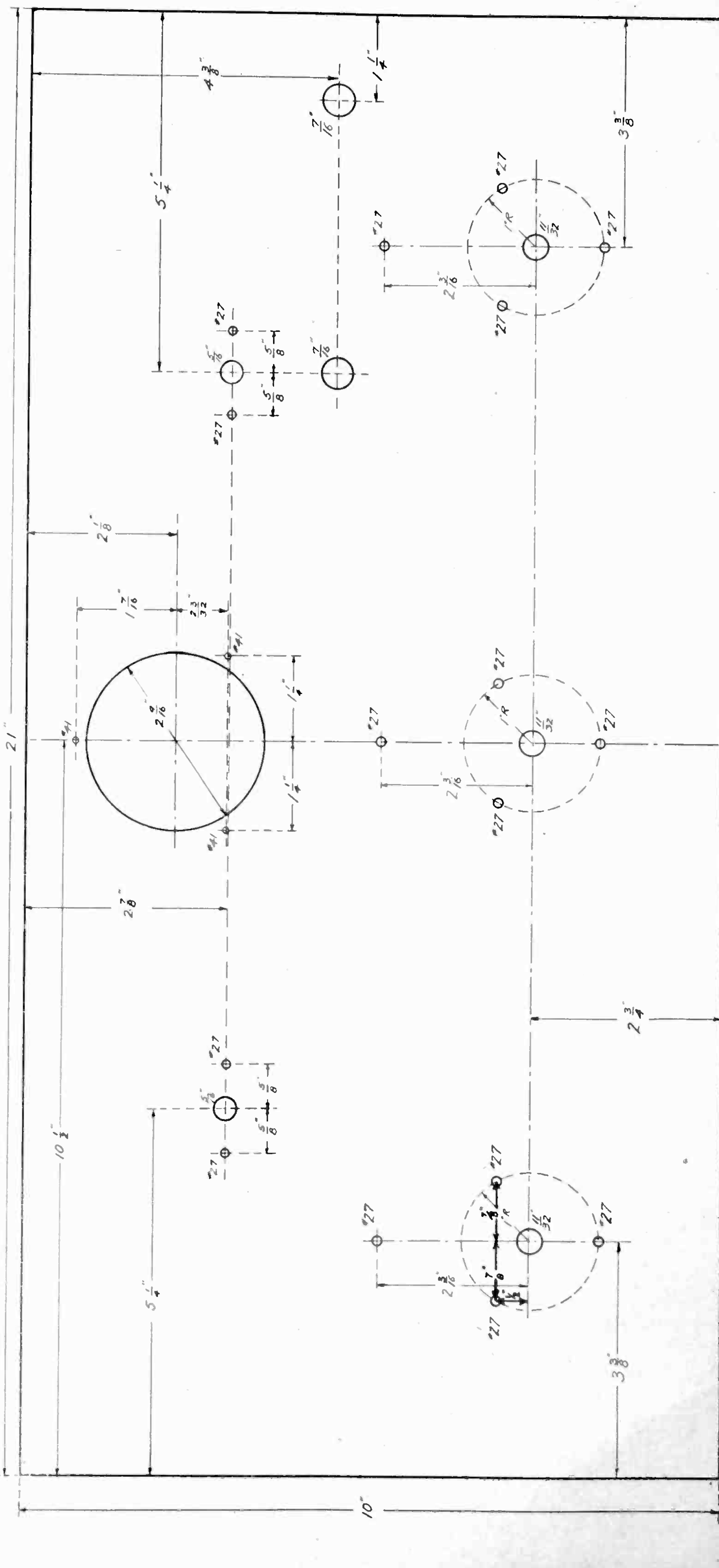


Fig. 2. Drilling Template for Panel.

resistance wire, or copper wire smaller than No. 40, such as is used for the coils in headphones, can be used to wind the resistances below 5000 ohms. The 12,000 ohm resistance can be a standard lavite resistance, and the 6000 ohm resistance can be made by placing two 12,000 ohm lavites in parallel.

The detector and audio amplifier are mounted in a separate compartment, but it has been found since the picture was taken that the partition between the intermediate amplifier and the detector was unnecessary and may be omitted. The tuned transformer was home-made and is tuned by means of condenser C_8, a fixed mica condenser of .0075 mfd. shunted across the primary winding. Any good filter transformer suitable for use with the particular intermediate frequency transformers selected will be satisfactory.

The battery terminals are mounted on the partition between the antenna loading coil and the coupler, but could be mounted on the back of the panel above the audio transformer if desired. By-pass condenser C_7 is mounted underneath the shelf in the secondary condenser compartment, the additional condenser shown in the illustration being C_{12}, in shunt across the 45 volt B battery line. C_9 is a grid condenser of .00025 mfd., R_5 a 3 megohm gridleak and C_{10} is a by-pass condenser of .002 mfd. shunted across both the primary of the audio transformer and the B battery, providing a short path for the high frequency from the plate to the filament in the detector tube.

Jacks are provided for the detector and audio amplifier, it being necessary to insulate the jacks from the metal shield on the back of the panel in order that no short circuit between the positive B battery and the shield be incurred. Three B battery voltages are employed, 22, 45 and 90 volts, the negative end of the B battery being connected to the negative end of the filament circuit, between the vacuum tubes and the filament rheostat.

Protective resistance R_6, 350 ohms is installed to prevent burning out the tubes due to short circuits in the 45 volt lead and condenser C_{12} is a by-pass around this resistance. Instead of including a second audio amplifier tube in the set, a separate power amplifier should be used, operated either from the 110 volt power line, or from a set of batteries. The Western Electric 25-A amplifier was used with the set illustrated, and in an early issue of RADIO, details will be given for the construction of a similar power amplifier operated entirely from the alternating current house lighting circuit.

For those who wish to operate a loud speaker from the superheterodyne without the use of the power amplifier, an audio frequency transformer having a 6 to 1 turns ratio should be installed, selecting a transformer which has a good low frequency characteristic. In Fig. 5 is shown the circuit of a single stage amplifier using a C-301-A tube, the filament being lighted from alternating current, by means of a small bell ringing transformer, so that the amplifier may be used as an adjunct to the main set.

Description of Parts

THE accompanying list of parts includes those which were used in the construction of the set and others which will be appropriate substitutes, as the use of the particular equipment shown in the pictures is not essential to the construction of the receiver. No specific recommendation of any of these parts is implied, much of the apparatus being selected because of the ease in obtaining it at the average radio store.

The panel template shown in Fig. 2 is given for the parts actually used and should be modified to meet the dimensions of any alternative parts which are selected in place of those used in the original set. Generally templates are furnished with air condensers or other panel type apparatus, so that it will be a simple matter to change the panel layout to suit the material at hand. With the most expensive material listed, the total cost of the receiver, without batteries or vacuum tubes, will be about $85.

After the panel is drilled, a piece of 16 gauge or 1/16 in. brass should be cut to the same size as the panel, to provide the back panel shield, holes being cut in the shield exactly as for the panel, except that in case air condensers having non-grounded end plates are used, the holes in the brass shield should be made sufficiently large to clear the metal supports of the condensers. The holes for the phone jacks should be 1/16 in. larger than those drilled through the panel, in order to prevent short circuiting the jacks to the shield, which is grounded.

The shelf is also made of 16 gauge brass, and is 7x19 in. The three partitions required are all the same size, of 16 gauge brass, cut 4⅝x7¼ in., so that a flange ¼ in. wide can be bent at one end and on one side, for mounting to the shelf and back panel shield.

The simplest method of fastening the shelf, partitions and back panel shield into one solid piece, as shown in Fig. 3, is to drill and tap the flanges of the partitions at several points for 6-32 machine

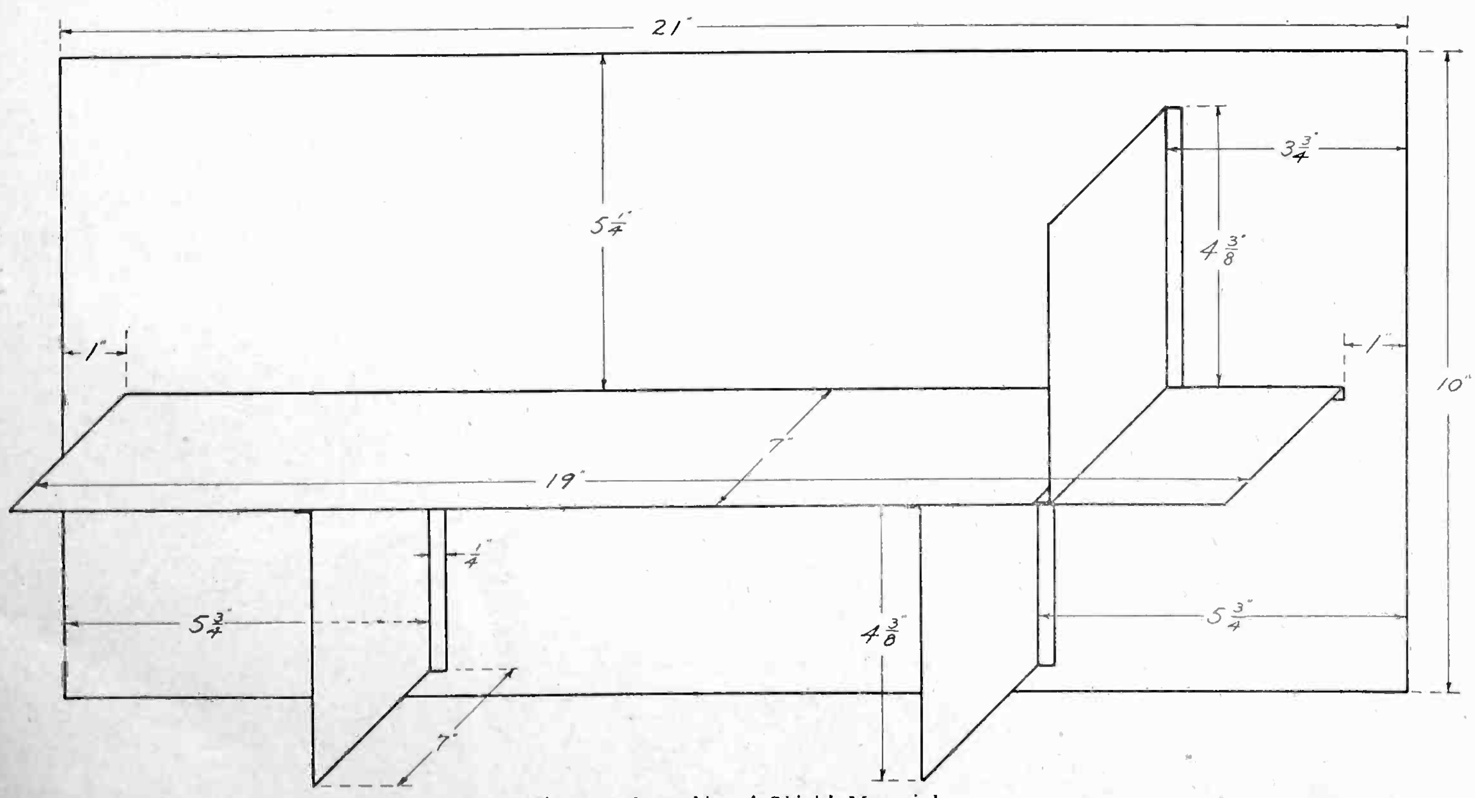


Fig. 3. Assembly of Shield Material.

screws, so that the partitions are made to act as the supporting medium for the shelf. If a blow torch is handy, the brass can be heated at strategic points and soldered securely in place with a little non-corrosive soldering paste and a liberal application of rosin core solder. After the shielding is all in one piece, it can be painted with insulating varnish or other non-conducting paint, or sprayed with Duco enamel such as is used in automobile finishing. This will cover up the scratches, spots of solder and other defects which would otherwise detract from the appearance of the set.

The oscillator coils are three in number, all wound on 2¾ in. tubing, 2¼ in. long. The coil for the wave band from 50 to 150 meters consists of two sections of 8 turns each of No. 22 double silk wire, the turns being spaced at least 1/16 in. apart. For 100 to 300 meters the coil should have two sections of 15 turns each and for 200 to 600 meters the coil consists of two sections of 30 turns each. These coils may be obtained already wound and provided with four plugs for connection to the coil mounting, which is fastened to the shelf. If the coils are home-made, phone tips can be used and four phone tip jacks mounted on a small strip of Bakelite for the coil mounting.

The intermediate frequency transformers should be such as to give good amplification at some point between 40 and 50 kilocycles, for tuned transformers having a peak at 45 kilocycles. If transformers operating at frequencies above or below the above limits are used, care must be taken in selecting the tuned transformer so that the latter will match the intermediate transformers at least approximately. The metal cases of the transformers should be grounded to the shield in order to prevent oscillation in the intermediate amplifier.

The tuned transformer used in the experimental layout is home-made, of the following dimensions: Support consists of spool made from a block of wood 2¼ in. square and ⅞ in. thick, a slot ⅜ in. wide being cut in the center, leaving ¼ in. flanges on the sides. A hub of 1 in. provides a base on which is wound 260 turns of No. 30 D. C. C. wire in a haphazard fashion. After placing a layer of insulating paper over the primary, 1500 turns of No. 36 D. S. wire is wound over the paper, for the secondary, the ends of the windings being brought out to terminals on the edge of the flanges. The inside winding of the primary should go to the plate of the last intermediate stage and the outside winding of the secondary to the grid of the detector tube.

The primary is tuned by a fixed mica condenser, C_8, .0075 mfd. and should preferably be of the guaranteed 5 per cent accuracy type, such as the Dubilier No. 640 Micadon. If this condenser is very much in error, a double hump will be noted for each side band setting of the oscillator condenser, with resultant loss of selectivity. Other tuned transformers can be used in place of the above coil in case it is not desired to construct it, in which case the tuning condenser specified by the manufacturer should be used. For providing *C* potential, a No. 751 Eveready Flashlight battery was mounted in the compartment with the audio amplifier, the 1½ volt tap being obtained by scraping away a small amount of the cardboard covering of the battery, on the end towards the positive terminal, thus exposing the zinc case of the last dry cell and permitting a tap to be soldered on the negative of the 1½ volt unit. The entire battery provides –4½ volts for the audio amplifier, the oscillator and intermediate stages requiring –1½ volts for best operation. No *C* battery is used on the frequency changer or detector tube, both employing grid condensers and leaks instead of a high negative grid potential. The reason for abandoning the high negative *C* potential on the grid of the frequency changer is because the new oscillator system will not permit the use of a C potential on the grid of the frequency changer, and in order to obtain the benefits of being able to change wavelengths at will, the slightly less desirable grid condenser was employed.

Assembly, Wiring and Testing

THE three variable condensers, voltmeter, volume control rheostat, filament rheostat and phone jacks should be fastened to the panel, the screws holding the shielding in place without difficulty. A small fiber insulating washer should be cut out for each jack, to prevent the frame of the jack from touching the metal shield at any point.

The sockets are mounted on small strips of scrap 3/16 in. bakelite, to keep the terminals and socket springs from accidentally touching the shelf. The detector and audio amplifier sockets should be of the cushioned type, as otherwise mechanical vibration of the vacuum tube elements may cause howling in the loud speaker.

The intermediate transformers are fastened to the brass shield on the back of the panel, as close to the shelf as is permissible. The tuned transformer should be mounted an inch or more away from the back panel shield, a small block of wood furnishing a convenient form of mounting. If desired, condenser C_8 and the grid condenser C_9 with grid leak mounting can be fastened to the sides of the tuned transformer, thus insuring short leads.

The audio transformer is mounted on the back panel shield adjacent to the audio amplifier tube. The battery terminals may be either a binding post strip with 7 binding posts, as conveniently made by several manufacturers, or a set of connecting blocks such as are obtainable at any telephone supply house may be selected. Practically all the material mentioned above must be fastened to the shielding at some point and this will require a No 33 machine drill and a 6-32 tap, in order to provide the mounting holes for each piece of apparatus.

In wiring the set, the *A* battery leads, negative *B* battery and other wires not carrying high frequency currents were run with flexible insulated wire closely bunched together, thus saving space and adding neatness to the appearance of the finished job. All high frequency wires, as well as the detector and audio amplifier grid and plate leads were run in No. 14 bare copper wire. Where there was danger of two bare wires touching each other, or some of the apparatus, spaghetti was used, but otherwise is not

(*Continued on Page* 58)

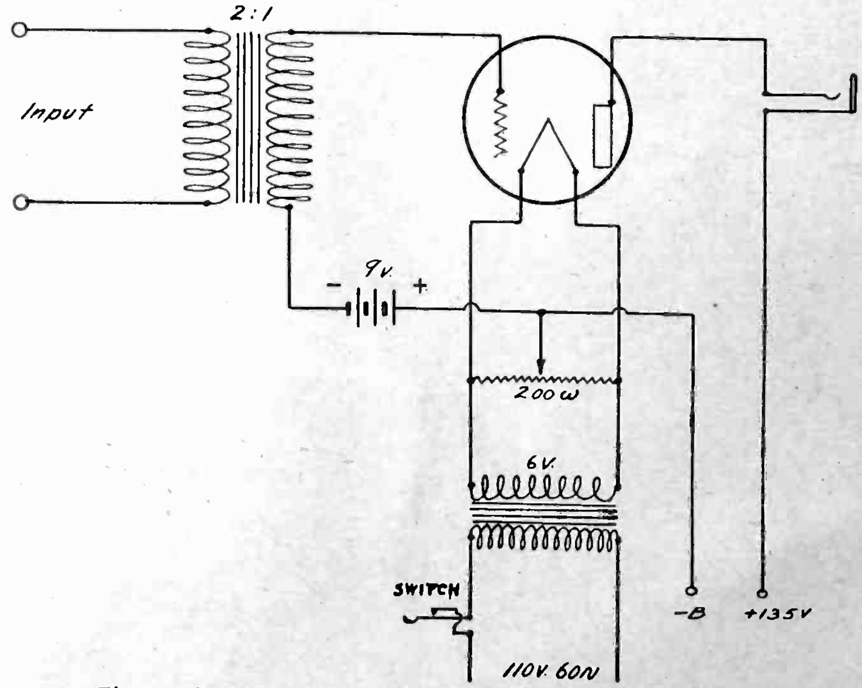


Fig. 5. One Stage Power Amplifier for Use With Receiver.

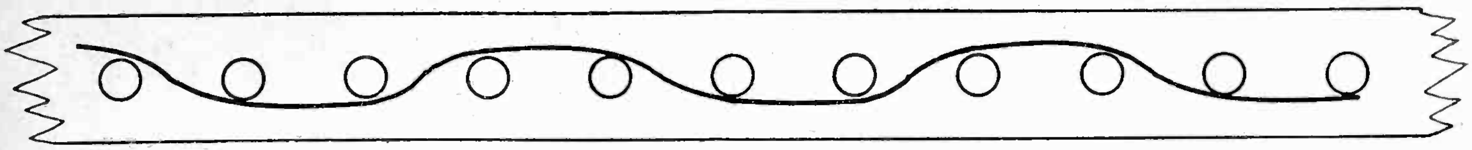


Fig. 3. Sketch Showing Method of Winding Wire on Form.

Next rip the wooden core into two parts with a thin-bladed jig saw, making two disks about ¾ in. thick. The two wooden disks are bolted together again with 8-32 or 10-32 machine-screws placed in the four holes already bored in the form, and a set of nails is then inserted in the holes that have been prepared for them.

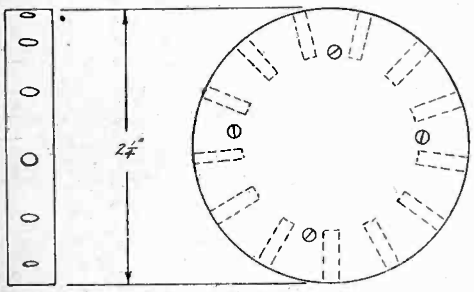


Fig. 2. Details of Coil Winding Form.

All four coils may be wound on this form; the antenna coil with 56 turns of No. 22 magnet wire, the primary coil with 24 turns of No. 28, the secondary with 70 turns of No. 22, tapped for neutralization at the 18th turn, and the tickler coil with 20 turns of No. 28—all double silk covered.

Fig. 3 shows a flat projection of the periphery of the coil-winding form and indicates how the magnet wire is to be passed through the supporting nails on the form. The wire should be wound tightly.

Upon winding the first coil, unbolt and remove the wooden core, leaving the coil upon the iron nails, in which position it may be sewed with white linen thread in the manner shown in Fig. 4. When the coil has been sewed, it will be self-supporting, and the nails may then be withdrawn. Sewed diamond-weave coils are quite strong and rigid without the aid of collodion or any similar cementing substance.

As is shown in the rear view of the receiver, the coils are mounted on a narrow Bakelite strip, 1in.x9 in. which is in turn bolted onto the rear ends of the two variable condensers used in the set. Each individual coil is supported upon two 3/16 in. round fibre pegs which are inserted into two adjoining coil interstices, as is shown in Fig. 4. These pegs are made by cutting 3/16 in. fibre or hard rubber rod into 1½ in. lengths, and tapping one end of each rod for a short 6-32 machine-screw. For the primary coil, two of these pegs are mounted 1⅛ in. apart on a small brass hinge, one leaf of which has been properly drilled to receive them, as is sketched in Fig. 5. In the case of the secondary coil, the two fibre pegs may be screwed directly onto the supporting Bakelite strip. The holes for the machine-screws should be so drilled that the top ends of each pair of fibre pegs will be tilted somewhat together, else the coils will not mount properly. (See Fig. 5-b). The antenna coil is mounted at the right-hand end of the Bakelite strip, and is placed in a horizontal plane, as may be seen in the rear view.

The two fibre pegs supporting the tickler-coil are screwed to a piece of thin brass ⅜ in.x1 in., which is soldered onto the side of a brass rod ¼ in.x5 in. This

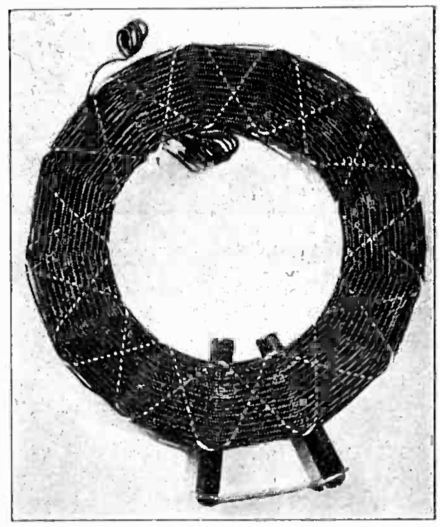
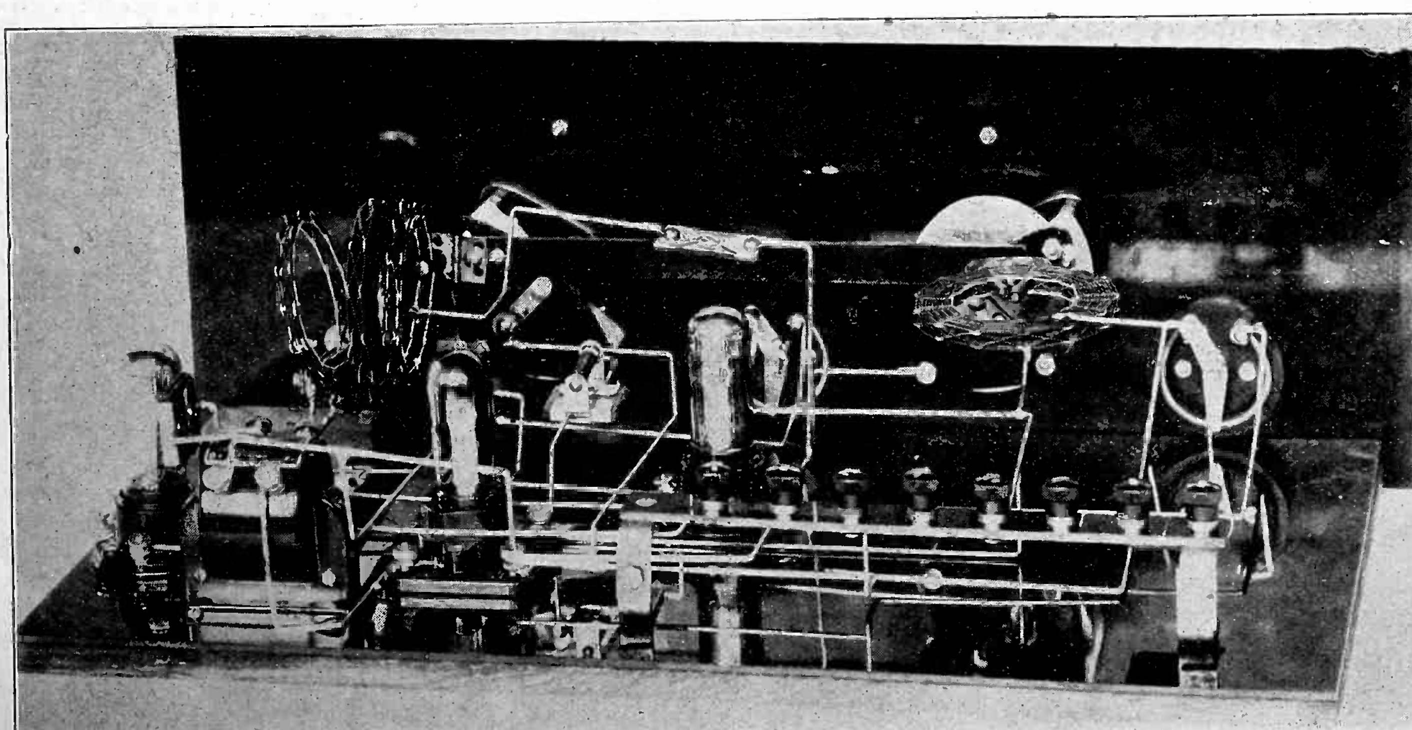


Fig. 4. Diamond Weave Coil.

rod is supported in a stiff brass bracket bent as shown in Fig. 5. Note that a groove is filed into the tickler-rod to receive the end of a set-screw—this prevents end play. The bracket should be sprung enough to give suitable tension on the tickler-rod.

It will be observed that no provision has been made to adjust the primary coil from the front of the panel; this coil has to be set only once, on a distant station, and then should be let alone.

As has already been stated, inexpensive parts will function successfully in this receiver. The following is a list of everything that was used, together with the approximate retail price. There is no preference indicated, as any good parts may be used with equal success. Fifteen-cent store parts, however, other than minor articles such as screws and



Rear View of Receiver, Showing Method of Apparatus Assembly.

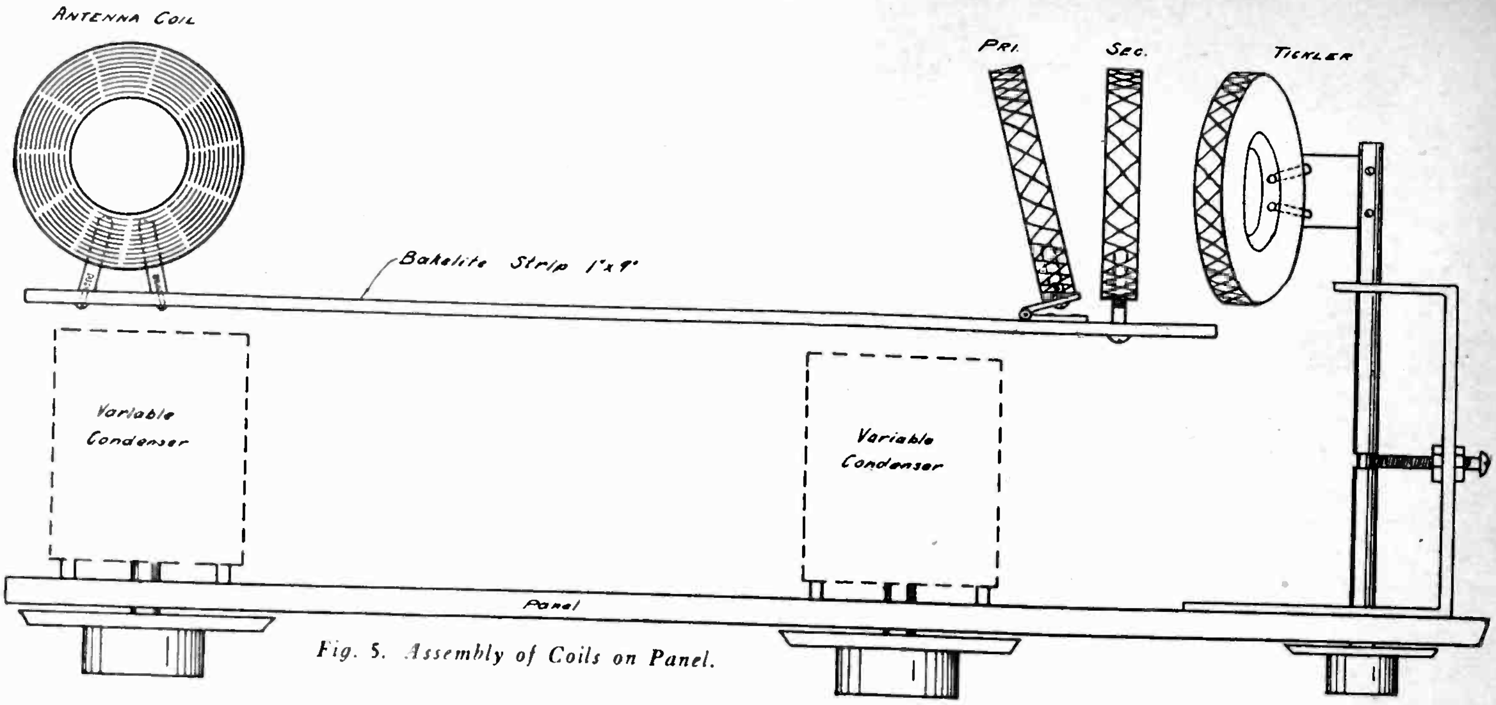
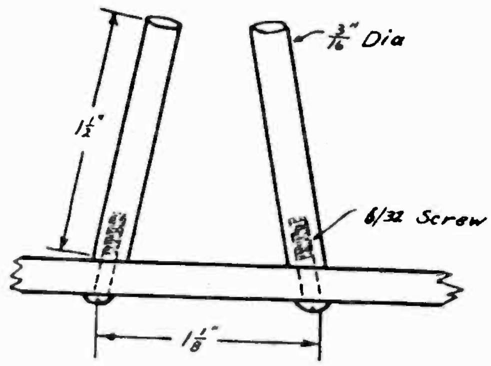


Fig. 5. Assembly of Coils on Panel.

binding-posts, are positively *not* recommended:

	Price each	
2 Variable Condensers, 21-plate;	$1.80	$3.60
2 Dials, 4-in.	.50	1.00
1 Neutralizing Condenser	.70	.70
3 Sockets	.50	1.50
2 Rheostats, 30-ohm	.70	1.40
1 Audio-frequency transformer 3-1		4.50
1 Fixed Condenser, .0001	.35	.35
1 Fixed Condenser, .00025	.35	.35
1 Fixed Condenser, .002	.40	.40
1 Grid-leak, 2 meg.		.20
7 Binding-posts	.05	.35
1 Ticker-rod dial		.15
1 Jack, single		.60
1 Baseboard, pine, 10x19x½ in.		.30
Coil-winding material, fibre rod, drill and tap for tapping fibre rod, brass hinges, brass rod and bracket for tickler, approximate cost		3.50
3 tubes, 199 type	3.00	9.00
2 B-Batteries, 45-volt	3.75	7.50
3 A-Batteries, 1½ volts	.50	1.50
Total, less cabinet and speaker		$36.90

One of the supreme advantages of this receiver is that the tubes do not have to be matched or specially selected, hence



Fibre Peg Support.

any good tubes will do. The operation of this receiver is quite similar to that of the soon-to-be-hoped-for-obsolete straight regenerative: Light the tubes and turn the dials. You will be astonished at the razor-sharp action on the local stations that have heretofore annoyed you. When pulling in distant stations, it is important to bear in mind that the condensers must be handled with extreme care; a motion of one-fiftieth of an inch often means the difference between loud-speaker volume and an almost total silence. A set of vernier dials, while not essential, are a great convenience. In trying to get distance, it is generally best to have the tickler coupling tight enough to cause the set to oscillate; then, when a station's carrier-wave is picked up, the coupling may be reduced and the music properly tuned in. This receiver does not radiate or "bloop" to any serious extent. Use any available aerial, from 50 to 120 ft. in length. Type 201-A tubes may be used if desired, except in the case of the first tube; this should be a type 199, as it is easier to neutralize than the larger tube. If 201-A tubes are used, the single 199-type tube should be controlled by a separate 30 or 50-ohm rheostat, which will enable it to operate safely with the 6-volt A-battery. A schematic circuit diagram for type 199 tubes is shown in Fig. 6.

As to results, I shall say briefly that this receiver, under the usual unfavorable conditions obtaining in every large city, has consistently brought in over a hun-

(*Continued on Page 60*)

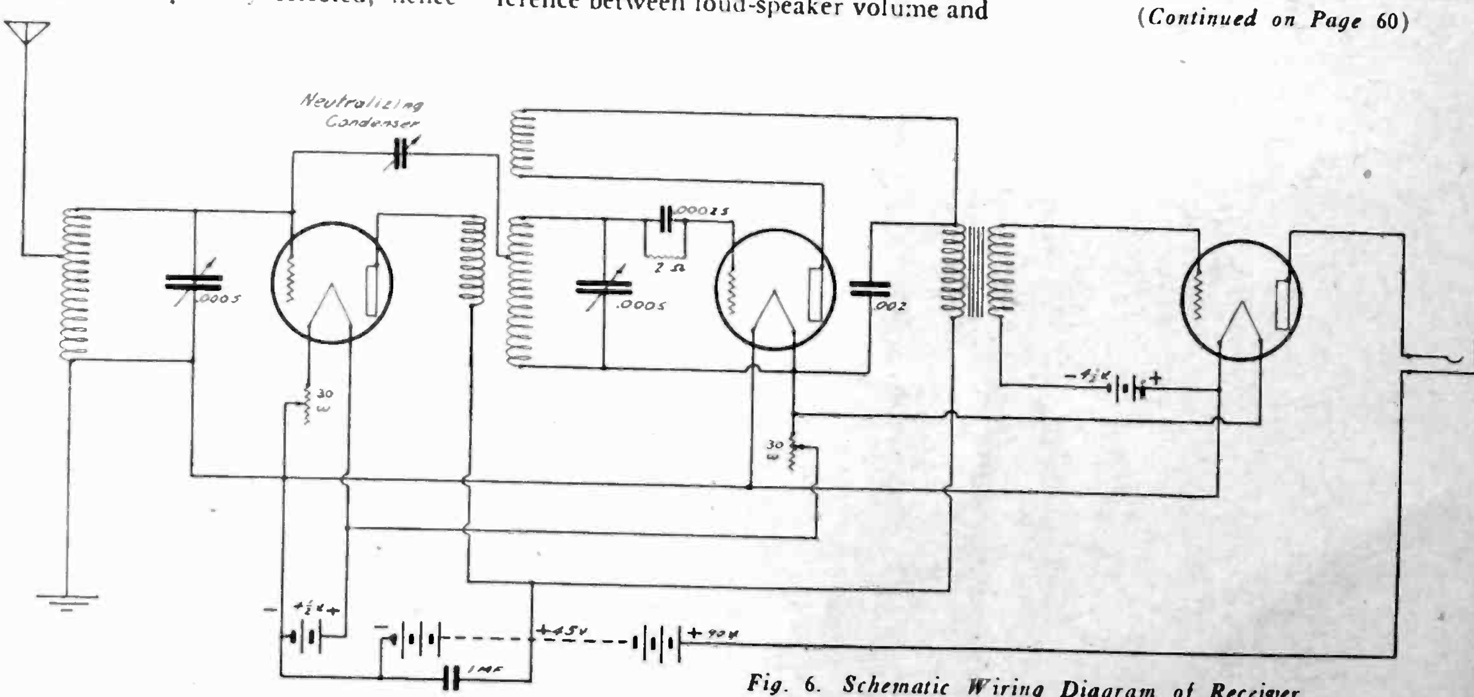


Fig. 6. Schematic Wiring Diagram of Receiver.

The Praying Jonah

By Earle Ennis

CAPTAIN AARON STARBUCK of the tramp freighter *Cassie S.*, was known from Pago-Pago to the Isthmus as the "Praying Jonah." But as Clancy Billings, his first mate, put it, "outside of that the old man was a balmy ol' wampus."

Billings, as might be expected, spoke with a somewhat colored viewpoint. He had once heard the term "wampus" applied to the meanest bar pilot on the Columbia River and it struck him as particularly appropriate to his own distinguished skipper. Which it probably was, when everything was taken into consideration.

Now all this has nothing to do with October 3, which is a date and therefore not concerned with human estimates. However, certain things took place on October 3, which had to do with Captain Starbuck, so that it is necessary to start this story with Jerry O'Malley, who climbed aboard the *Cassie S.*, about two o'clock of the above-named day, some two hours before the evil-smelling freighter set sail from Seattle. At the top of the gangplank he collided with Captain Starbuck.

"God bless us, what do you want?" demanded the captain belligerently.

"God bless us, not a damned thing except the location of the wireless room!" retorted Jerry O'Malley who was Irish and just as belligerent as the "Praying Jonah," who was a New Englander.

"Are you the new 'sparks'?" demanded the captain, not giving an inch.

"What's it to you?" retorted Jerry, not giving another inch.

"I'm the commander of this vessel," snapped the captain.

"Why didn't you say so?" Jerry replied. "The answer is 'yes!'"

The captain looked his new wireless operator over. Jerry looked the captain over. The dislike was mutual.

"You're making a mighty bad beginning, young man," said Captain Starbuck shortly.

"But I'm mighty good on finishes," said Jerry, giving the old man eye for eye.

"Hum!" said the skipper. "The wireless cabin is forward. We leave at four!"

Jerry made no reply. He trailed the antenna leads to their lair, kicked open the door and groaned.

"A pig could feel at home here, but it's going to be hard on a white man!" he remarked, and slammed the door behind him.

Captain Starbuck, who was standing directly behind him at the time, spat viciously over the rail.

"Oh Lord, I trust I will not forget Thy teachings!" he muttered into his scraggly red beard, and went ashore.

These details are merely to impress the reader with the fact that Jerry O'Malley's departure from Seattle was not under exactly pleasant surroundings. The natural question which arises is: why, if he was any kind of a radio operator and knew his business, did he go to sea in such a gol-busted old whangtoddle of a junkheap as the *Cassie S.*? The answer is: He was told to. Who told him? Ah—that is something else again. That question is never answered in this story. But before it is over, the reader will be able to make a darned good guess as to who sent him aboard!

The departure of the antediluvian freighter caused no particular flurry in Seattle harbor. The mayor did not go aboard nor did the police boat escort it outside the heads. It simply detached itself from the dock, got its rattly, clanky old engines under way, and see-sawed down the channel. In due time it ran into the Pacific Ocean—and there it was! Old, leaky, manned by a nondescript crew, and commanded by the "Praying Jonah," it was a jinks craft in every sense of the word. And it was headed for Pago Pago with a cargo of canned salmon.

This whole episode pivots on the canned salmon. As a rule canned salmon is not taken seriously on a freighter. The crew sticks it down below somewhere and forgets all about it. But this particular shipment of canned salmon caused Captain Starbuck a lot of worry. Hardly had the ship crossed the bar when he went below, accompanied by the mate and personally inspected the manner in which the cases were stacked in the hold.

Jerry O'Malley cleared the *Cassie S.*, after the manner of operators who know their brass and their service regulations. The freighter was equipped with an old obsolete spark set, vintage of 1915, and the switchboard was rusty from salt spray. But the generator acted like a debutante and the spark roared across the

(Continued on Page 50)

Ideal Tuning in Kilocycles

A Simple Explanation of What it Means, Why Desirable, and How Accomplished

By E. E. Griffin

OF late we hear much of standardization; of parts, material, price, of complete receivers. But standardization of tuning, seems to be temporarily overlooked. The Department of Commerce has set forth the advantages of the use of kilocycles instead of meters. The radio magazines have championed this change, but we seldom find even a mention of kilocycles in the many programs. The stations are allocated by kilocycles, which accounts for our programs listing them in fractions of meters. Whether the public, through the press, will have meters or kilocycles in their programs is of relatively small importance; the main fact to bear in mind is, that home-constructors and many manufacturers are still building receivers and appliances on a wavelength basis, when the stations that they wish to receive are designated and separated on a kilocycle basis.

The Department of Commerce uses kilocycles instead of meters because the necessary separation of stations to prevent interference is always the same in kilocycles, no matter at what portion of the complete scale, while in terms of wavelength in meters this separation would be quite confusing and misleading. Likewise, we cannot determine the degree of selectivity of a receiver in terms of meters. In order to apply to the complete range of its tuning, selectivity must be designated in kilocycles.

The foregoing statements may seem somewhat broad to those who have entered the radio field of late, so we will avail of simple explanation. In this regard, let us first consider the conditions at a transmitting station. Let us assume that its assigned wavelength is 300 meters, and that it is running idle; that is, no sound is being picked up by the microphone. Under these conditions, waves of but a single length and frequency would be radiated, and in this case their length would be 300 meters.

Since they are assumed to travel at the same velocity as light, their frequency per second would be 1,000,000, since the velocity of light and electrical disturbances is 300,000,000 meters per second. In other words, when receiving from this transmitter, one million electromagnetic waves, each 300 meters in length, would pass our antenna in each second of time. The radiating circuit at the transmitter would have an electrical length of 300 meters, and the current oscillating in this circuit would have a frequency of 1,000,000 cycles per second, since it produces such waves; the frequency of the oscillating current and that of the radiated wave being one and the same. Kilo is the prefix meaning thousands, so it is much more convenient to express the frequency of 1,000,000 cycles as 1,000 kilocycles, and our formula becomes 300,000 divided by wavelength in meters equals frequency in kilocycles, and vice-versa.

These conditions exist so long as the transmitter is running idle, as during a silent period. When music or speech is sent out there is a great change, as will be evident.

Sound is simply air in vibration, the rapidity of vibration of the air determining the note or pitch, and we find that speech or music are confined to a range of from about 50 to 10,000 vibrations per second. When these vibrations are picked up by a microphone and converted into electrical impulses of corresponding rates of vibration, we can express them as audio frequency currents in cycles per second. When these audio frequency currents are combined or superimposed through suitable apparatus with the oscillating current causing our 300 meter wave, we find that it no longer oscillates at exactly 1,000,000 cycles per second.

The result is that frequencies differing from the normal are present in the circuit, radiating other than the normal waves. These other frequencies are found to differ from the normal by the value of the superimposed frequency. Thus, when our audio frequency is 10,000 and our oscillating 1,000,000 cycles, we find we have three radiated frequencies; the normal of 1,000,000, one lower of 990,000, and one upper or higher, of 1,010,000. Likewise, when the audio frequency is 500 cycles we have three oscillating frequencies, one of 999,500, the normal of 1,000,000, and one of 1,000,500. For each individual audio frequency there is a separate set of three oscillating frequencies, with their corresponding three radiated waves, and some faint idea of the num- from any transmitter can be gained when you consider the multitude of audio frequencies present when a full orchestra is being radiocasted. These side frequencies, differing from the fundamental or normal, are called the side bands, and their greatest difference is in the high pitch and high notes in music, and in the letter "s" and the sound "th" in speech.

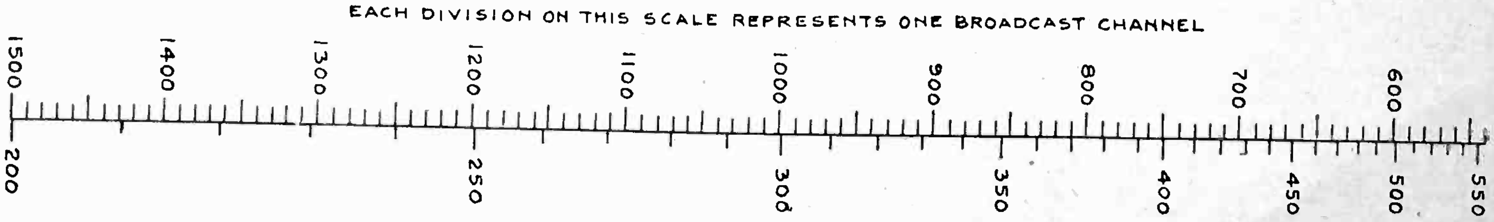
Quite obviously, therefore, any station transmitting speech or music is radiating a multitude of frequencies, extending over a band or channel at least 20,000 cycles wide, 10,000 on each side of the assigned frequency. Also, obviously, different stations must be separated by at least 20,000, or 20 kilocycles in order that the limits of the separate side bands or frequencies do not overlap and cause interference.

Applying the same idea to reception, a receiver should not have greater selectivity than to exclude any of these side bands, or otherwise distortion will result in the cutting off of the higher audible tones. Therefore the Department of Commerce uses kilocycles instead of meters in assignments to radiocast stations. Since audio frequencies cannot be correctly expressed in terms of wavelengths and since they are the governing factor in the separation and allocation of transmitting stations, why should we cling to meters?

The frequencies allotted to radiocast use are from 1,500 to 550 kilocycles, or in terms of wavelengths, from 200 to

FREQUENCY IN KILOCYCLES.

EACH DIVISION ON THIS SCALE REPRESENTS ONE BROADCAST CHANNEL



WAVELENGTH-METERS.

Fig. 1. Graphic Relation of Wavelengths to Frequencies.

545 meters, and graphically illustrated in Fig. 1. Since transmitting stations should be separated by at least 20 kilocycles, theoretically we have only a possible 48 channels. However, we find that there are over 575 stations in operation. Quite an impossible task of allocation at first thought, stupendous at least, but still there are more potential stations clamoring for licenses.

By a judicious consideration of power, frequency, distance, geographical location, and division of time, the necessary separation has been cut from the theoretical 20 kilocycles to 10, thereby doubling the available channels, and these some 575 individual stations quite successfully allotted. So our faith in the radio personnel of the Department is not unfounded. We find that in using a present day receiver of average selectivity and sensitivity, we seldom find two transmitting stations within the range of good reception, actually interfering with each other.

Upon further investigation, we find that in any particular locality, there will be on an average of about twenty radiocast stations within the range of good reception; and further, that the average separation of these some twenty stations in any specified locality will be somewhere around 50 kilocycles. Now, if we were to average the selectivity of all receivers in present day use, we would find, in all probability, that their average would be near 50 kilocycles. If so, would such be a coincidence? Not at all, at least most of us will give the Department credit for foresight.

It will be noticed that selectivity is here expressed in terms of kilocycles. Since definite principles determine the broadness of the frequencies radiated by a transmitting station, these same principles should be made to apply in receiving. Selectivity is necessarily a degree of comparison, wherein the perfect set receives any one station to the exclusion of all others. The suggested method of comparison is by using terms of kilocycles, and designating each receiver by how far off tune a signal becomes inaudible.

For instance, let us take five examples, in each case receiving from one particular station; that is, testing from one definite frequency and strength. First, one receiver can be off-tuned 120 kilocycles from the station's assigned frequency before the sound is inaudible. This is very poor selectivity, corresponding to a single circuit crystal set; in fact so poor that it would be difficult or impossible to differentiate between two nearby local stations.

The second receiver, say, can be off-tuned 80 kilocycles before the signal becomes inaudible. This is fair selectivity, corresponding to a two circuit crystal set, a non-regenerating single tube receiver. Such a receiver would differentiate between two locals at some sacrifice in signal strength.

The third, let us assume, can be off-tuned only 40 kilocycles before the signal becomes inaudible. This is good selectivity, corresponding to a three circuit regenerative set, or a stage of tuned radio and regenerative detector. Such a receiver would not only differentiate between locals, but would enable cutting through and picking up distance, to quite an extent.

The fourth receiver, say, only off-tunes 10 kilocycles before losing the transmitter. This is excellent selectivity, in fact the limit of selectivity if we are going to take advantage of the transmitter's full signal strength by intercepting its complete side bands. Such a receiver would completely differentiate between locals and quite distant stations, even when the separation was very small.

The fifth let us assume, can be off-tuned only 5 kilocycles before the signal becomes inaudible. This is not only excellent selectivity, but the practical limit, beyond which we cannot go; as further increase in selectivity would cut off the higher frequencies of side bands and our tone quality would be lost. Such a degree of selectivity would correspond to the best superheterodyne. Such a receiver would have to be doubly sensitive, also, as it would take advantage of only one half of a transmitting station's radiated frequencies. (In this last example, it is assumed that perfect reception may be obtained from a station's main frequency and one side band only, i. e., a channel 10 kilocycles wide.)

If we express degrees of selectivity in meters wavelength, such expression would be only applicable to one definite setting or wavelength; while if expressed in terms of kilocycles, it would be applicable to the entire range of tuning, as is obvious from foregoing explanations.

It will be noted in Fig. 1 that at only one point in the complete scale are meters and kilocycles numerically equal, i. e., at the point of the square root of 300,000, since kilocycles equals 300,000 divided by meters. As now assigned in divisions of channels, each channel separated by 10 kilocycles, each graduation on the kilocycle scale represents a channel, and if we had a receiver of nth selectivity and ultra sensitivity, in tuning from 1,500 kilocycles up the scale we would hear a separate group of stations at each 10 kilocycle division. In terms of meters wavelength, these groups or stations on the lower part of the scale would be separated by about one meter, while at the upper portion the separation would be over ten meters, with varying differences in between. Such a theoretical receiver as this is impracticable, so let us analyze just how the existing conditions affect our present day set.

In this discussion, all theory and methods of obtaining selectivity and sensitivity in receiving sets, is purposely neglected, as many excellent articles on these subjects appear in the various issues of this publication. Decrement of transmitters is not considered, as not of interest, and not bearing directly on this subject. The points to bear in mind are the methods of tuning.

In order that we may select any station at will, the constants of the circuits in our receiving sets must be variable, either variable inductance, variable capacity, or both. We find, however, that most receiving sets use a fixed inductance and a variable capacity, in the form of a variable condenser. We are therefore interested in the various forms and characteristics of variable condensers.

The semi-circular plate type is widely used and well known, being generally designated in different sizes by its maximum capacity. Unless specially constructed, this type usually has a high

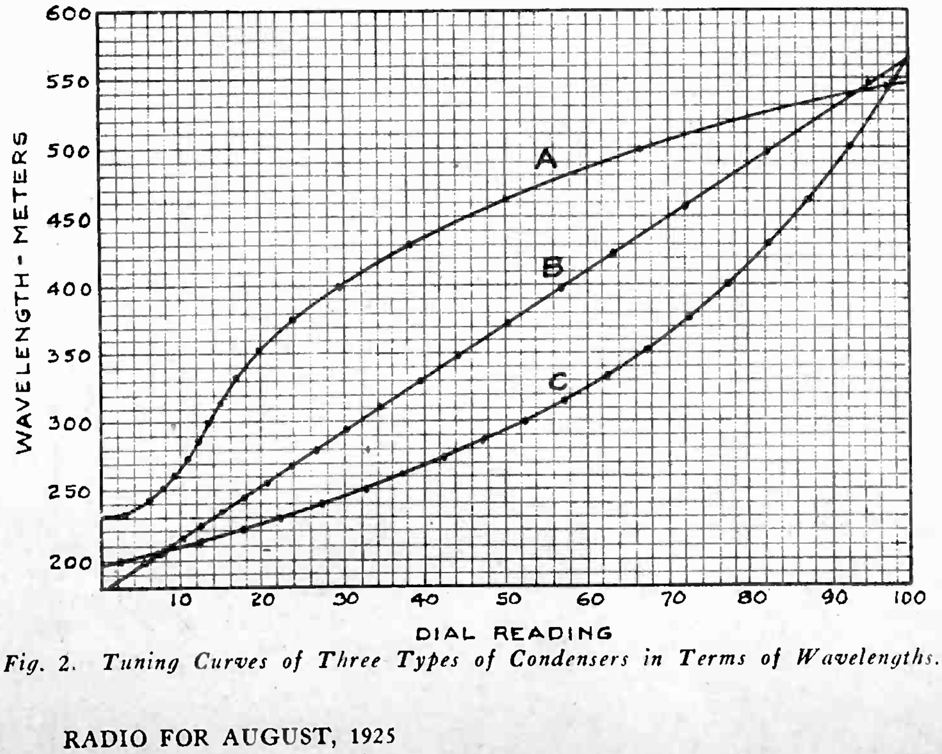


Fig. 2. Tuning Curves of Three Types of Condensers in Terms of Wavelengths.

minimum capacity. In rotating the movable plates in and out of the fixed, the effective capacity is varied proportionally to the angle of rotation, so when fitted with a dial and marker, the effective capacity is proportional to the settings of the dial. If a curve is plotted showing relations of settings to capacity, such curve will be close to a straight line, and such condensers are therefore said to have "straight line capacity." Now the wavelength of a circuit varies as the square root of the capacity, so when such a condenser is used with a fixed value of inductance, the wavelength curve would not be a straight line, but would have the shape of A as in Fig. 2. At this point observe that a straight line

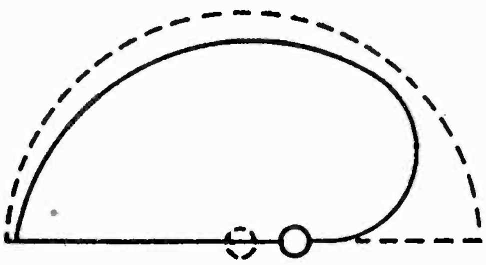


Fig. 4. Comparison of Semicircular and Straight Line Wavelength Condenser Plates.

capacity condenser does not give a "straight line wavelength" as has been implied by some advertisers.

The straight line wavelength type of condenser has its plates so shaped that the capacity varies as the *square* of the angle of rotation, and since the wavelength of a circuit is proportional to the *square root* of the capacity, such a condenser gives a straight line wavelength curve, as in *B*, of Fig. 2. This effect is gained in various ways; by cutting away a portion of the plates, by specially shaped plates as in Fig. 4, and by special construction, such as is evident in the many new models now on the market.

These two types give quite different results in tuning. The tuning curve of a receiver using semicircular plate condensers will be typically represented in curve *A* of Fig 2, the dots on the curve giving the dial settings and wavelengths for each particular station. Owing to this condenser's relative high minimum capacity, the receiver generally fails to cover the lower wavelengths; and owing to the shape of its curve, stations are badly bunched together between 5 and 15 degrees on the dial, making tuning to any one quite difficult; while at the higher settings stations are too widely spaced. The actual dial settings of this typical example are given in Fig. 5 *A*.

If we supplant this semicircular plate condenser by a straight line wavelength type, we obtain a tuning curve as in *B*, Fig. 2; giving actual dial settings as in Fig. 5 *B*. Owing to this condenser's lower minimum capacity we are able to tune the entire range of the radiocast band, and owing to the better shape of its curve the formerly bunched stations are now fairly well spread out. The straight line wavelength type is evidently superior to the semicircular.

However, we note that stations are still somewhat closer together at the lower settings than they are at the higher, with equally varying amounts of separation as we go up the scale. This straight line wavelength condenser was designed for tuning on a meter basis; and if our radiocast stations were separated on a wavelength meter basis, it would give the ideal tuning conditions. Our stations, however, are separated and assigned on a kilocycle basis; so the correct relations of tuning can be shown only on a kilocycle scale, as in Fig. 3. The disadvantages of the semicircular plate type become more apparent, when considered in the light of kilocycles.

What we should have for ideal tuning is a condenser whose plates are as exaggerated in shape from the straight line wavelength type, as the straight line type is from the semicircular; giving what we shall term a "straight line frequency" curve. The actual dial settings of a receiver using such a condenser are illustrated in Fig. 5 C; and given in the curves *C* of Figs. 2 and 3. In such a receiver the dial settings would bear the same definite relation to the frequency at any part of the scale, and thus could be graduated directly in radiocast channels, or 10 kilocycle divisions. On this ideal tuning receiver, from 0 to 20 of the scale we would be able to select one fifth of the available stations, from 20 to 40 another fifth, and so on throughout the complete band, all evenly spaced throughout the range of tuning. Also, using receivers of such calibration, tuning instructions to the novice would be unnecessary, provided, of course that our organs of publicity abandon the custom of listing stations by wavelengths in meters. To the writer's limited knowledge, there is no such condenser yet available.

While the semicircular plate condenser, by the standards of ideals, falls quite short when used in radiocast tuning, it still has its proper place. Since its capacity varies as the angle of rotation, it is ideal in capacity measurements, testing, etc., and any place in a receiver where not used for frequency selection.

(*Continued on Page* 61)

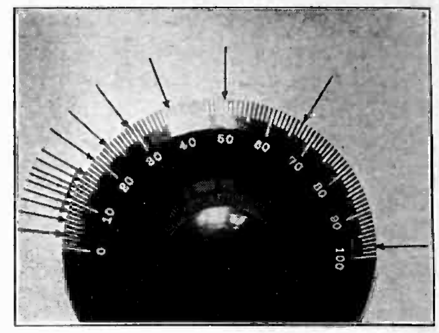


Fig. 5A. Dial Settings with Semicircular Plate Condensers.

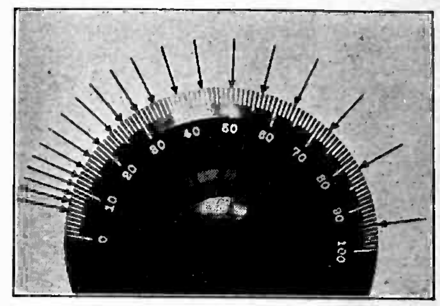


Fig. 5B. Dial Settings with Straight Line Wavelength Condensers.

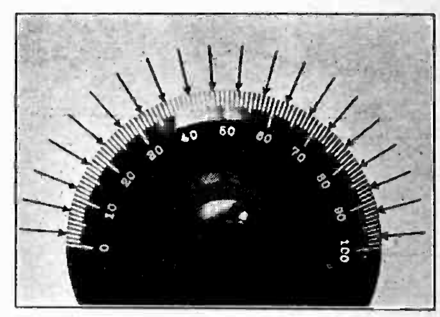


Fig. 5C. Dial Settings with Straight Line Frequency Condensers.

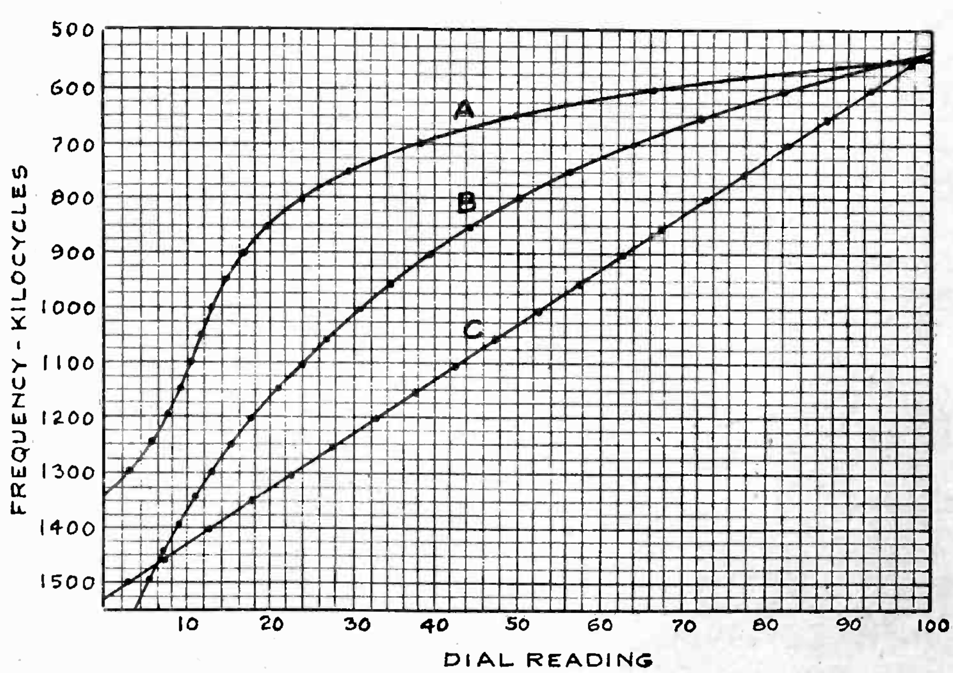


Fig. 3. Tuning Curves of Three Types of Condensers in Terms of Kilocycles.

Selectivity Versus Distortion in a Superheterodyne

A Continuation of Last Month's Discussion with Suggestions for Compensation by A. F. Transformers

By J. E. Anderson

In the superheterodyne there are two sets of frequency ratios, one being the same as that in the ordinary receiver, and the other having ratios differing from unity by a much higher percentage. Since the degree to which two interfering frequencies may be separated by the tuned circuits depends on the amount by which the frequency ratio differs from unity, it may be expected that the intermediate frequency tuner in the superheterodyne will be much more effective in suppressing an interfering carrier than a tuner of similar selectivity in the high frequency level; and it also may be expected for the same reason that the amount of distortion will be much greater. The lower the intermediate frequency, the lower will be the frequency ratio between it and an interfering carrier, or between it and a given side band frequency, and hence both the effective selectivity and the distortion will be greater. For this reason it is not practical to use tuned circuits in the intermediate frequency filter having a very high selectivity.

Consider briefly the interference suppression in the intermediate frequency filter alone. Assume an I. F. of 50,000 cycles per second. Suppose it is desired to separate stations operating on the two lowest frequencies in the radiocast band, 550 and 560 kilocycles. If the local oscillator is set at 500 kilocycles it will cause a beat frequency of 50,000 cycles with the 550 kc. frequency, permitting this to pass through the filter. But it will cause a beat of 60,000 cycles with the interfering wave. The filter then must separate 50,000 from 60,000 cycles per second. These two make a frequency ratio of 5/6, or about .833, a value much lower than those considered in July Radio. A value of $Q=33$ will reduce the interference to less than one per cent. If the oscillator is set 600 kc it will also cause a beat of 50,000 cycles with the desired signal, and a beat of 40,000 with the interfering wave. The frequency ratio is .8, and hence it is somewhat easier to separate the two if the local oscillator is set at the 600 mark.

Now suppose it is desired to separate two adjacent channels at the upper limit of the radiocast range, 1490 from 1500 kilocycles, using the same intermediate frequency filter. The local oscillator is set either at 1450 or at 1550 kilocycles to cause a beat of 50,000 cycles with the 1500 kc. carrier. The beat frequencies with the interfering wave will be 40,000 or 60,000 cycles as in the previous case and the separation of the two channels is just as easy at this end of the scale as at the lower. Hence as far as the intermediate frequency filter is concerned it separates the high and the low carriers with equal ease for any given absolute difference between the two radio frequency carriers.

Now take a case in which the absolute difference is greater than 10,000 kilocycles. Suppose it is desired to separate WEAF from WJZ or vice versa. Their frequencies are, respectively, 610 and 660 kilocycles. If the oscillator is set at 560 kc. the beat with WEAF will be 50,000 cycles and this signal will be brought in. The beat with WJZ will be 100,000 cycles per second, and the frequency ratio will be 1/2. If the oscillator is set at 660 kc., WEAF will again be brought in and the beat frequency with WJZ will be zero (for the carrier only). The frequency ratio in this case will be zero. The interference in the first case will be the greater since the frequency ratio is greater. It requires a selectivity of about 13 to reduce the interference to one per cent.

Now let us apply the equations given in the July Radio to the determination

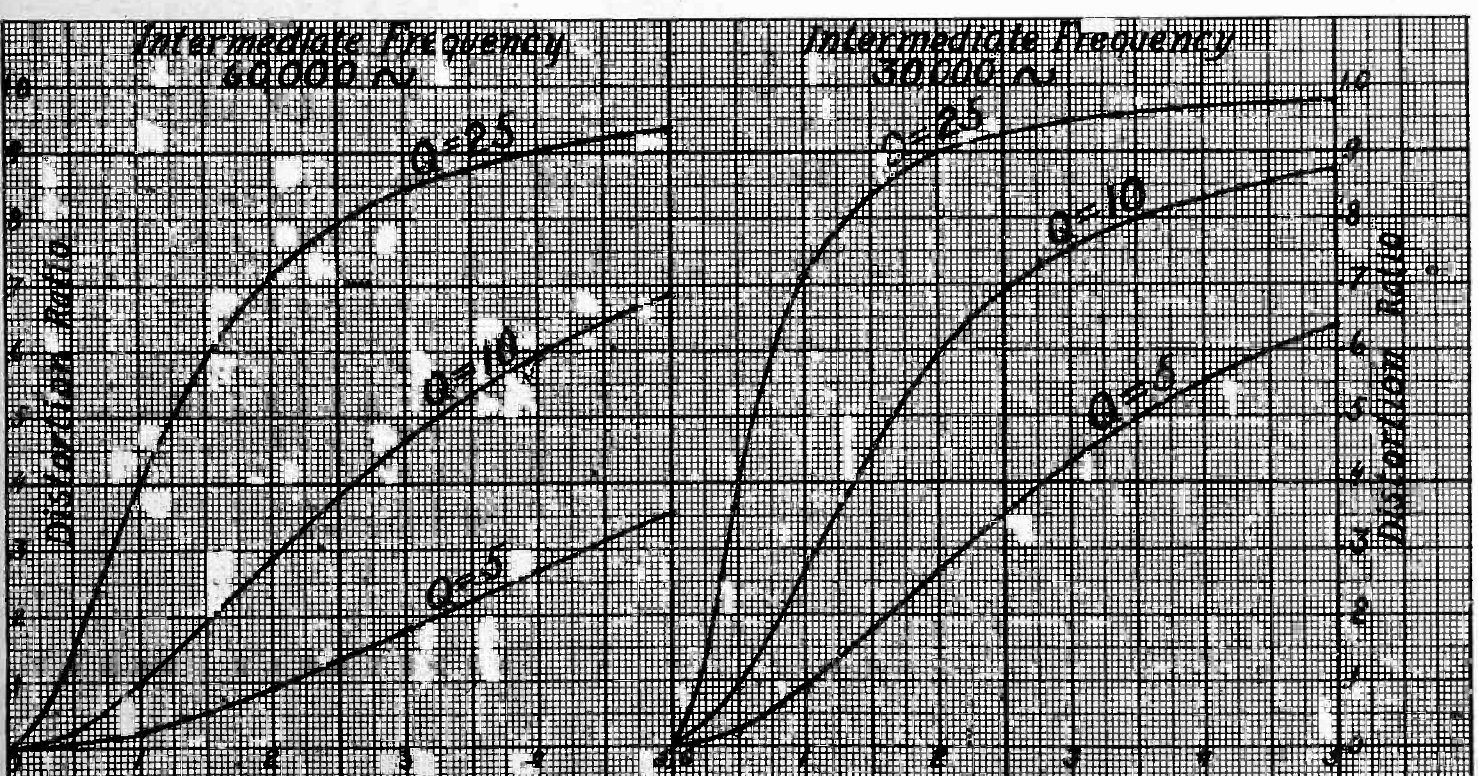


Fig. 1. Distortion Curves for Superheterodyne.

of the amount of distortion that may be expected in a superheterodyne filter for different values of selectivity and for two values of intermediate frequency. The intermediate frequency may vary from 15,000 to 100,000 cycles per second, but due to practical limitations it is not customary to go below 30,000 cycles or above 60,000 cycles per second. Hence these two values have been chosen. As in the discussion of the ordinary receiver the side bands will be considered to extend 5,000 cycles on either side of the intermediate frequency carrier. The distortion ratio is the difference between the transmission ratio and unity as previously defined.

The results of the calculations are shown in Fig. 1. To the left is shown the curves for the 60,000 cycle intermediate frequency, and to the right the curves for the 30,000 frequency. From these curves it will be seen that the distortion is quite considerable for both intermediate frequencies, and that it is very much greater for the 30,000 cycle frequency, even for such low values of selectivity as 5, 10, and 25. For the lower carrier it would not be advisable to use a Q higher than 5, and for the higher not greater than 10. For a Q as high as 25 the essential musical frequencies would be seriously suppressed. It will be seen that for a frequency as low as 1000 cycles the suppression is over 70 per cent for the lower carrier and about 40 per cent for the higher.

Now let's consider an actual superheterodyne, combining the effects of the tuned circuits of the two different frequency levels. As a basis of calculation a circuit designed by the writer and built by himself and a number of radio enthusiasts was taken. This circuit differs from the usual run of superheterodynes in that it employs two high frequency tuners of identical design aside from the oscillator tuner, and three identical intermediate frequency tuned circuits. The intermediate frequency filter was designed for 45,000, but the various receivers built differed considerably in this respect. Here the frequency will be taken as 50,000 for convenience in calculation.

The selectivity of each of the two high frequency circuits is assumed to be 50, a value which is probably too high in wet weather but is about correct when the humidity is low. The selectivity of each of the intermediate frequency coils is assumed to be 5. This value is probably low, especially if the three circuits are accurately tuned to the same frequency, but it is a convenient value for calculation and not far from the correct average value.

Since the two high frequency tuners are assumed to be identical, the current ratio produced by them will be given by the square of the expression given in equation (8). The signals will then be impressed on the intermediate frequency filter in this ratio. This is not upset by the frequency changer because the first "detector" is not a detector at all. The output of the frequency changer is proportional to the amplitude of the local oscillations, to the amplitude of the incoming oscillations, and to the detecting efficiency of the first "detector." Hence the input to the intermediate frequency filter and amplifier will be in the ratio stated above.

$$\left(\frac{I}{I_\lambda}\right)^2 = \frac{1}{1+Q^2(1-\rho^2)^2} \quad (8)$$

$$\left(\frac{I}{I_\lambda}\right)^2 = \frac{1}{[1+Q_1^2(1-\rho_1^2)^2]^2\,[1+Q_2^2(1-\rho_2^2)^2]^3} \quad (13)$$

$$\left(\frac{I}{I_\lambda}\right)^2 = \frac{1}{[1+50^2(1-\rho_1^2)^2]^2\,[1+5^2(1-\rho_2^2)^2]^3} \quad (14)$$

Now the intermediate frequency filter has three identical tuned circuits and the current ratio produced by it independently of the first two tuners will be given by the cube of the expression given by equation (8). The final current ratio as it appears in the output of the detector, or at the input terminals of the first audio frequency transformer, will be obtained by multiplying the current ratios obtained for the two frequency levels. This final result is given by equation (13). In applying this equation it will, of course, be necessary to use different frequency ratios for the two frequency levels.

The first application of the equation will be to the determination of interference for the three cases previously considered, namely, that between 550 and 560 kc. between 1490 and 1500 kc. and between 610 and 660 kilocycles. In each case the local oscillator will be set so that the interference is the greater of the two possibilities; that is, the interference on the side which makes the higher frequency ratio will be considered.

For the first case the frequency ratio is 55 to 56, or .982, for the high frequency level, and 5 to 6, or .833, for the lower level. These values are put into equation (14) and results calculated. This shows that the first tuner reduces the ratio to .0583 and the second reduces this by .027, so that the final current ratio will be .001575. That is, the strength of the interfering signal will be .16 per cent of the desired signal. These are the easiest two adjacent channels in the broadcast range to separate.

In the second case the frequency ratio in the high level is 149 to 150, or .9933, and in the lower level 5 to 6, as in the previous case. Hence the first tuner reduces the relative strengths of the two signals to .481 and the second to .027 of this value, so that the final ratio is .01298. The interference, therefore, will be 1.3 per cent as strong as the desired signal, for equal strength at the antenna and for equal modulation of the two carriers. This is the most severe test of the selectivity of the circuit in the radiocast range, because the two frequencies are most nearly equal.

The third case will be that of the interference between WEAF and WJZ, or between any other two stations operating on the same frequencies and frequency difference. The frequency ratio in the high level is 61 to 66, or .924, and in the second level the ratio is just one-half. When these values are substituted in the factors of equation (14) we find that the first tuner reduces the current ratio to .000343, and the second tuner by .000294 more; and that the final current ratio is 1.006 ten millionths, or the desired signal is ten million times as strong as the interfering signal. This means that if the desired station is located 316 times as far away as the interfering station, and if the two stations are of the same power and equal modulation, the signals from the distant station will be 100 times as strong as the interfering signals. That is sufficient to separate the stations for all practical purposes unless the receiver is located almost within the shadow of the interfering transmitter antenna.

Now for a few comments on the distortion introduced by this special receiver. The distortion has been calculated for the upper and the lower frequency limits of the radiocast range, where it is least and greatest, respectively. The value of the distortion is the difference between the transmission ratio as obtained by applying equation (14) and unity, as has been defined previously. The results have been plotted in Fig. 2. The distortion is given along the ordinates and the frequency along the abscissas. The two sets of curves have been plotted in opposite directions in order that the relative amounts of distortion at the two frequency limits may be more directly compared. Points were calculated for side band frequencies corresponding to all integral kilocycle audio frequencies and in addition the first half kilocycle frequency, that is, 500.

The two A curves in the graph represent the distortion introduced by the tuner in the high frequency level. It will be observed that this is practically negligible at the upper frequency limit, being less than 20 per cent, but that it is quite considerable at the lower limit, amounting to almost 70 per cent.

The two B curves represent the distortion introduced by the intermediate frequency filter. This is the same for both the higher and the lower frequency limits, as well as for all other frequencies, since this distortion depends only on the selectivity of the separate tuned circuits in the filter and on the frequency to which these are tuned. Hence the B curves are identical and meet at the point

How to Build a Cone Type Loud Speaker

Details for Its Construction from Odds and Ends in the Ordinary Work Shop

By William Hawk

Cone Type of Speaker as Decorated by Artist.

I HAVE a radio receiver that satisfies me as a distance getter, and as my amplifier is a good one, the quality from the local stations is all that could be desired. Until recently, while the reproduction of speech and music from the loud speaker was as good as was possible with a horn type loud speaker, I was not satisfied. I knew where the trouble was, but knew of no way of overcoming it. Realizing that the horn is inherently a music destroyer, I tolerated it because there was nothing else to take its place, and many were the experiments tried with both the speaker and the amplifier, to correct the distortion introduced by the horn.

Recently, however, there has been placed on the market a device known as the cone type loud speaker and those of you who have heard it working must have been impressed by its wonderful reproduction, especially of the low notes of the piano or drums and the high notes of the violin. I almost mortgaged the wife's piano and bought one, but the price asked was a little more than I was accustomed to spend on a loud speaker, and my impression tended to depression until I remembered the panacea for all radio ills, i. e., "If you can't buy it—make it." So I did just that and here is how:

First I kidded the supply clerk into giving me two of those large green desk blotters and a small tube of glue. From each blotter I cut a disc 18 in. in diameter with the center of each accurately located. Then I cut a sector 2 in. wide from each disc as shown in Fig. 1, and

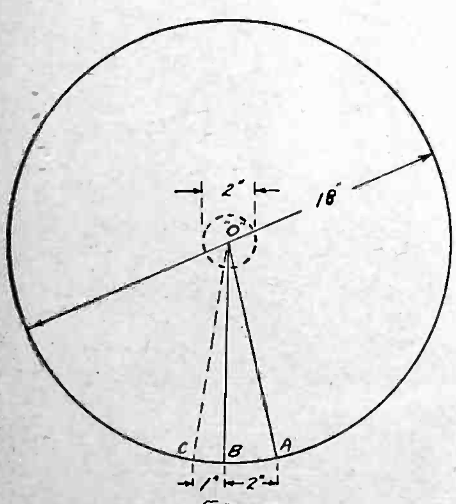


Fig. 1. Segment for Front of Cone.

feather edged the under surface along *OA* and the upper surface along *OB* with a safety razor blade to keep from making the seam too thick when the sides are glued together. A thin coat of glue was applied on *OCB* and *OA* was brought over to coincide with *OC*, being held firmly in place until a good joint was had. In making the back cone I lapped the edges over a little more so that when the peripheries of the two cones were placed together the back one fitted about ¼ in. inside the front one, forming a sort of ledge along the edges for the glue to take hold of. Use plenty of glue in here so as to make the whole structure rigid.

Before glueing the cones together I cut a disc from the scraps of the blotter 2 in. in diameter, cut out a small segment and glued the disc in the inside of the front cone up in the apex as shown by the dotted circle around *O* in Fig. 1. This gave added strength to the apex of the cone at which point the vibrations from the driving element are to be applied. I also cut a hole in the back cone 6 in. in diameter and glued a ¾ in. reinforcing ring around the inside as shown in Fig. 2. This ring was made

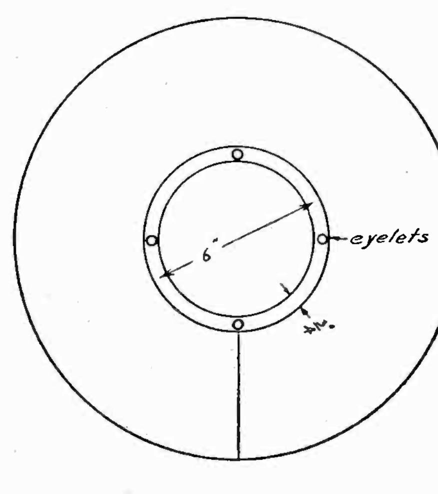


Fig. 2. Segment for Rear of Cone.

of stiff fibre-board and carefully glued around the hole cut in the back cone. At four equally spaced points I punched holes and inserted eyelets such as used in offices for fastening papers together, these receiving the supporting screws. The two cones were then glued together, using plenty of glue along the inside edge of the front cone, and the double cone thus formed was set aside until the glue hardened.

Coupling the driving element to the cone was a problem that took some little time to solve satisfactorily. I finally made up one consisting of a piece of 1/4 in. brass rod 3/8 in. long with a hole the size of a No. 16 wire drilled lengthwise through it and another drilled crosswise and tapped to receive a small thumb screw. To one end of this rod was soldered a four point star made of thin brass sheet, the details being shown in Fig. 3_a and 3_b. A hole was cut in the apex of the cone large enough to let the rod be pushed through. The brass star was then bent to conform to the shape of the cone and glued in place. Care was taken to make the hole at right angles to the plane of the cone.

While the glue was hardening I took an old Baldwin type C loud speaker unit and after removing the cap and back, carefully unsoldered the pin which connects the diaphragm to the armature. This allowed the diaphragm and pin to be slipped out and discarded. I next soldered an ordinary brass pin in the place of the pin removed, but extended it toward the back of the receiver instead of the front. A small piece of spring brass was cut as shown in Fig. 3_c and drilled at *A* 1/4 in. and at *B* just large enough to allow the pin to go through. The brass strip was then fastened to the loud speaker element by one of the screws already in the permanent magnets, and bent so that the pin on the armature fitted loosely through the hole *B*. The pin was then soldered to the spring, toothpicks being stuck under both sides of the armature to keep it in the center until the pin was soldered fast. The spring should be stiff enough to hold the armature in the center of its slot. Care was taken to see that soldering flux did not run under the armature or behind the pin.

A piece of bus wire a few inches long was inserted in the hole in the coupling in the apex of the cone and the thumb screw tightened. A station was tuned in on the set and the loud speaking receiver connected to last stage of the amplifier. By holding the receiver close to my ear I could faintly hear the music. I then started experimenting and by touching the brass spring to the piece of bus wire on the cone I got the surprise of my young life. The music appeared to jump from nowhere right at me and it was real music. By moving the bus wire around on the brass spring I found a place where I got the best reproduction. If it was too close to the pin it had a thin quality and if too near the bend it was too deep and muffled, like being in a barrel. The point finally selected was about two-thirds the distance from the bend to the pin and a piece of straight No. 16 bus wire about 6 in. long was soldered at the point selected.

It only remained to mount the element and cone on a suitable standard to complete the job. This was done by cutting a piece of wood as shown in Fig. 3_e and fastening it to a suitable base, also of wood, holes being drilled corresponding to the eyelets in the back of the cone.

Take time to do a good job and do not expect good results if you have not put your best into the work. Be especially careful not to get excess solder on the moving parts of the receiver element or let rosin run under the armature or collect on the pin. Be sure the armature is in the center of the slot provided for it and is free to move without touching anything in its movements. An objectionable rattle will be developed if any of the moving parts come into contact with any object such as a loose piece of paper or a tiny ball of hardened glue.

In adjusting for the point at which to attach the bus wire connecting the apex of the cone to the receiver be sure you have the best point, as your results will depend largely on this one feature. If the voice is thin and stringy it is a sign that you are too close to the pin and if too deep and muffled you are too close to the bend in the spring. At the proper point all frequencies will come through with equal clearness. A good plan is to adjust it to a speaking voice and when the words are clear and distinct you probably have the right spot. Do not be surprised if this point seems to give a lower pitch than your old loud speaker, for it is not really lower pitched but appears so because the low notes are suppressed by a horn but come through with full volume on the cone.

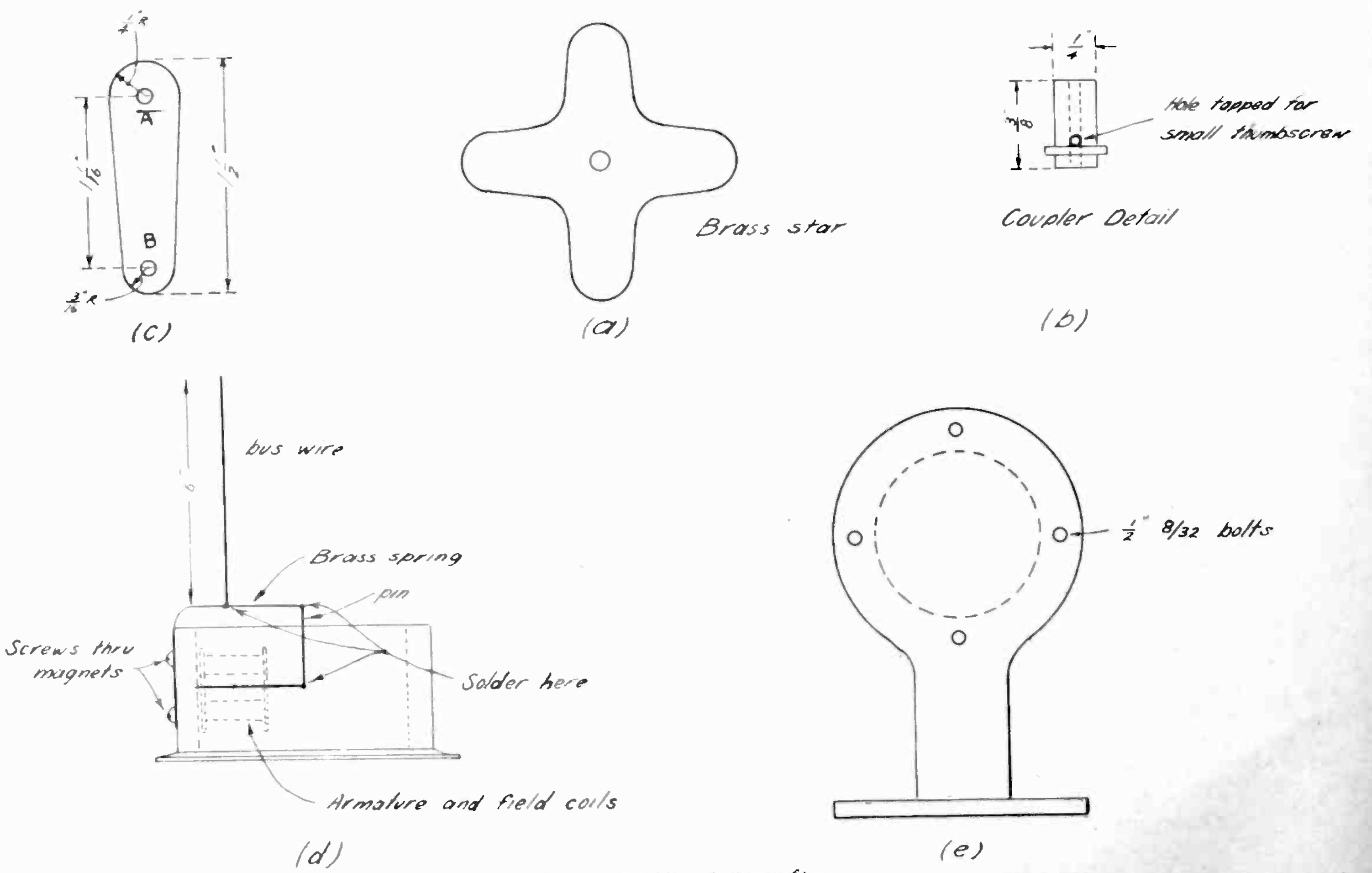
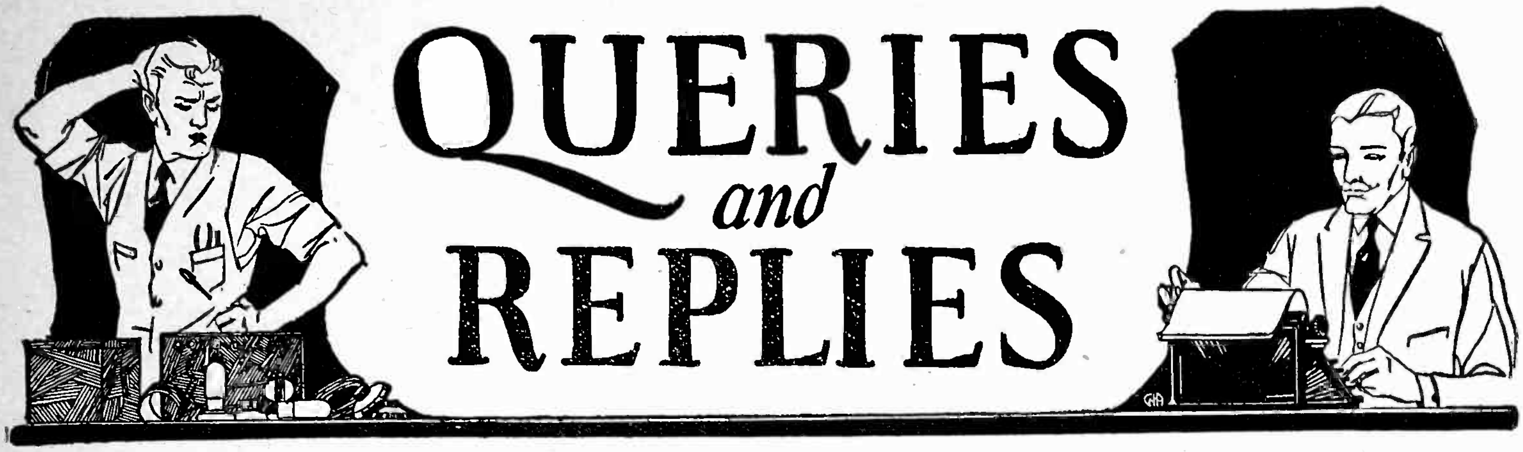


Fig. 3. Details of Assembly.

QUERIES and REPLIES



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 25c per question should be forwarded when personal answer by mail is wanted.

Have difficulty in tuning to the lower wavelength stations with my two tube Harkness Reflex set. With 23 plate condenser across the secondary of the antenna coil, a station on 509 meters comes in at 40 degrees on the dial. How may I change the wavelength range to tune down to 200 meters?—E. W. H., Oakland, Calif.

Undoubtedly your antenna tuner has a secondary with too many turns. Try removing 1/3 of the total number of turns and you will probably find that the 509 meter station appears at about 70 degrees on the dial, which is the best point.

Please publish the circuit of the one tube super-regenerator which was described some time ago in RADIO.—A. K., San Francisco, Calif.

A modified circuit of this type is shown in Fig. 1, it being found that the original

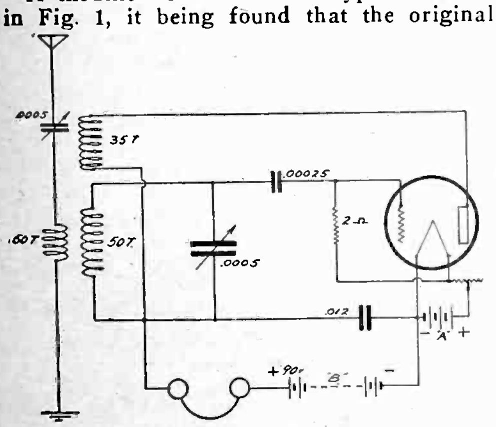


Fig. 1. One-tube super-regenerator.

circuit published two years ago is somewhat of an offender due to radiating energy, and the more selective tuned circuit is necessary to eliminate this as much as possible. The tuner may be an ordinary 180 degree variocoupler, the rotor being tuned with a variable condenser of .0005 mfd.

Would like to obtain a circuit diagram for an "A" battery charger using a 201-A tube as rectifier.—H. E. C., Whittier, Calif.

The total output of a 201-A type tube, or for that matter, any other available receiving tube, is not over 25 milliamperes at 100 volts, when used as a rectifier, and would be of no use to you as an *A* battery charger. The smallest *A* battery in use takes an average charge of 1 ampere, and you will require either an electrolytic charger, vibrating rectifier or tungar bulb charger in order to obtain the proper charging current.

Please publish a circuit for a 5 watt radiophone transmitter, using a 32 volt D. C. source. It is desired to cover a wavelength range from 150 to 200 meters. —W. S. A., West Palm Beach, Fla.

In Fig. 2 we have shown a transmitting circuit for two 5-watt tubes, using a legal antenna tuned circuit, and with a 32-volt D. C. supply operating a motor generator set for the plate supply. The filaments of the two vacuum tubes are in series, and it will be necessary to obtain Ward Leonard resistances capable of carrying at least 3 amperes, to limit the current to the proper value, which is 2.5 amperes. If the filament current of the tubes is of a different value, the resistances will have to be computed, using the well-known Ohms Law $E=I\ R$, where E is the voltage, I is the current and R is the resistance.

In the January issue of RADIO you recommend a Chelten No. 860 condenser for the feedback condenser, and I find that the Chelten Company does not furnish this condenser for panel mounting. The Remler coupling unit was marked No. 631. Is not this a mistake?—F. G. N., Athol, Mass.

The Chelten No. 860 condenser, called he Microfarad Junior, was recommended because it had exactly the right number of plates. Unfortunately, the condenser is now being furnished without the necessary mounting nut, and so it will be necessary for you to either use a Chelten No. 850 Midget condenser and remove several of the rotor plates, or else purchase some other suitable condenser having a maximum capacity of not over .00005 mfd. The Remler coupling unit should be No. 620.

Have heard the advantage of using copper tubing as antenna wire for reception. Some claim that the use of the tubing brings about an increase in signal strength of 15 to 20 per cent besides reducing the capacity to earth considerably. Would appreciate your opinion on the subject.—E. J. M., Waterbury, Conn.

The use of copper tubing will increase the surface of the antenna wire over that obtainable with a solid copper wire having the same amount of copper per unit length. This would increase the capacity to ground rather than reduce it, and might permit receiving over greater distances with a given antenna length. It would all depend upon the size of the tubing.

In Mr. Volney G. Hurd's article on the Browning-Drake receiver in April RADIO the position of the tickler coil is not plainly shown. How close should the tickler be to the secondary coil?—J. A. D., Detroit, Mich.

The tickler coil is mounted at the end of the secondary which is opposite from the primary coil. It is arranged so that when the tickler windings are parallel to the secondary winding, the plane of the former is directly underneath the last turn of the latter.

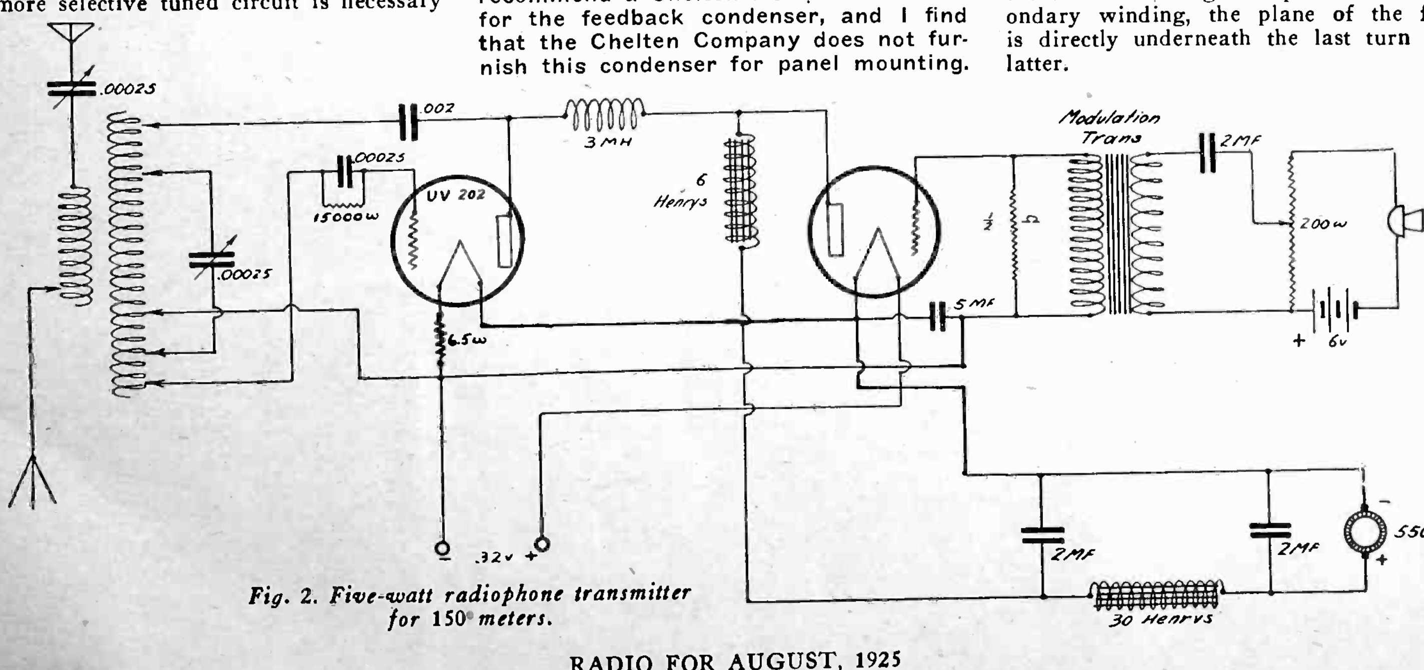


Fig. 2. Five-watt radiophone transmitter for 150 meters.

Please furnish me with the latest circuit diagrams of the Best Super-Heterodyne, for use with wet "A" batteries as well as dry cells.—B. L. S., Mitchell, Nebraska.

Complete details for the construction of improved superheterodyne receivers for both storage and dry cell *A* batteries will appear in the August and September issues of RADIO.

The minimum wavelength to which my set will tune is 270 meters and the maximum somewhere around 800 meters. I don't wish to remove turns from the inductance coils, which are tuned with .0005 mfd. condensers, nor do I wish to either wreck the condensers or change them for new ones. I have an idea that a small series condenser will remedy the trouble and would like to know the correct value.—A. H. V., Toledo, Ohio.

A series fixed condenser of .001 mfd. will cut the minimum capacity somewhat and yet will enable you to tune to at least 550 meters. It would be best to substitute several fixed condensers in turn, ranging from .0005 to .0015 mfd. in order to have the most efficient combination.

Please print a diagram for a three or four tube reflex receiver in which resistance coupled amplification is employed. Also one using a loop antenna suitable for a portable set. What difference in volume is there between three stages of resistance coupled amplification and three stages of transformer coupling?—J. B. C., Seattle, Wash.

A reflex receiver employing resistance coupling would be very inefficient and you would not be satisfied with it. It is far better to use transformers in that case, although the resistance coupling is useful in many other circuits. A three stage transformer coupled audio amplifier will give greater amplification than a like number of resistance coupled stages, but if the same vacuum tube and C battery were used in the last tube of each type of amplifier, the volume would be practically the same in each amplifier, and the quality of the resistance coupled amplifier would probably be superior, provided, of course, that the resistance coupled amplifier had a *C* battery. We are showing in Fig. 3 the circuit similar to the DeForest Type D-17 Reflex receiver, as many of our readers have requested this circuit, and it will be suitable for your requirements.

RESUME OF THE PRESENT RELATIONS OF RADIO AND ESPERANTO

At the recent International Amateur Radio Conference held in Paris, twenty-two countries were represented including United States, Great Britain, Canada, France, Germany, Italy, Spain, Japan. The resolutions passed recommended the study and use of Esperanto as the auxiliary language of international radio-telephonic and telegraphic communications and transmissions. The Congress also adopted Esperanto as its own auxiliary language besides the national languages in use. At this conference was born the "International Amateur Radio Union," As the result of this congress a European Committee for Continental Tests has been founded in Paris. The object is to organize the amateurs' spread over the continent into four land groups and to arrange experiments, using the results for the benefits of the science.

The number of stations regularly broadcasting in Esperanto in the following countries is: Austria 1; Denmark 1; France 2; Germany 7; Italy 1; Switzerland 1; Spain 1; Russia 1; Canada 1; Australia 1.

LOS ANGELES AMATEUR RADIO SHOW

Great interest was shown in a radio show recently conducted at Los Angeles, Calif., under the auspices of the National Automotive and Electrical School to foster the interests of the man "who builds his own." The exhibit consisted of parts from 37 manufacturers and of assembled sets from radio clubs and amateur constructors. These included short-wave transmitters as well as receivers and also equipment for the radio transmission of photographs.

Over 400 home-built sets were entered in the prize contest, of which 83 were superheterodynes, thus showing the trend toward this type. The first prize of $300 was awarded to Robert Haig for his seven-tube Silver-Marshall. The second prize was won by Donald Kean for his 45,000 cycle Best Superheterodyne. Prizes totaling $12,000 were given for the best sets in various classes. A similar show is planned for June, 1926.

NAVY SHORT-WAVE TESTS SUCCESSFUL

Remarkable records of continued efficiency have marked the experimental work of Lieut. F. H. Schnell, U. S. N. R. F., Traffic Manager of the American Radio Relay League, on duty with the Pacific Fleet at Hawaii, testing out short wave radio work for the Navy. Lieutenant Schnell has communicated with over 100 amateurs in all corners of the country and has been heard with his 40 and 54 meters sending sets as far from Honolulu as Paris.

The experimental work, undertaken under the joint auspices of the American Radio Relay League and the United States Navy, has further demonstrated the value of short wave work on remarkably lower power than had before been thought possible.

The 40-meter set at NRRL, most notable of the group, was constructed to Lieutenant Schnell's own plans and is operated with four 50-watt tubes with sufficient strength to make it heard almost half way around the earth; all of this accomplished with slightly more power than is consumed by the average household electric iron.

Lieutenant Schnell, with the assistance of a Pacific Coast amateur, is holding to daily schedule of communication between NRRL and the two mainland stations, NPG at Mare Island, California, and NKF at Bellevue, D. C. The work with NPG has been practically 100 per cent perfect, while a percentage of 75 marks the efficiency of the schedule work between NKF and NRRL, despite the 6000 or more miles separating the stations.

The 20-meter signals from NRRL have been picked up by stations in eastern Canada, Pennsylvania, the Mississippi Valley and on the Pacific Coast in broad daylight at hours when both stations were handicapped by the sun.

Among the towns where NRRL is listed on the logs of radio stations are St. Michaels, Md.; Denver, Colo.; Northfield, Minn.; New York City; Yates Center, Kan.; Oberlin, O.; Cedar Rapids, Ia.; Columbus, O.; Pasadena, Calif.; Dennison, Tex.; Boston, Mass.; Amity, Mo., and Vincennes, Ind.

The small tin pans with several small depressions sold in hardware stores as "muffin-pans" make fine holders for small screws and parts, when assembling radio sets; they are very cheap, and keep the parts well separated.

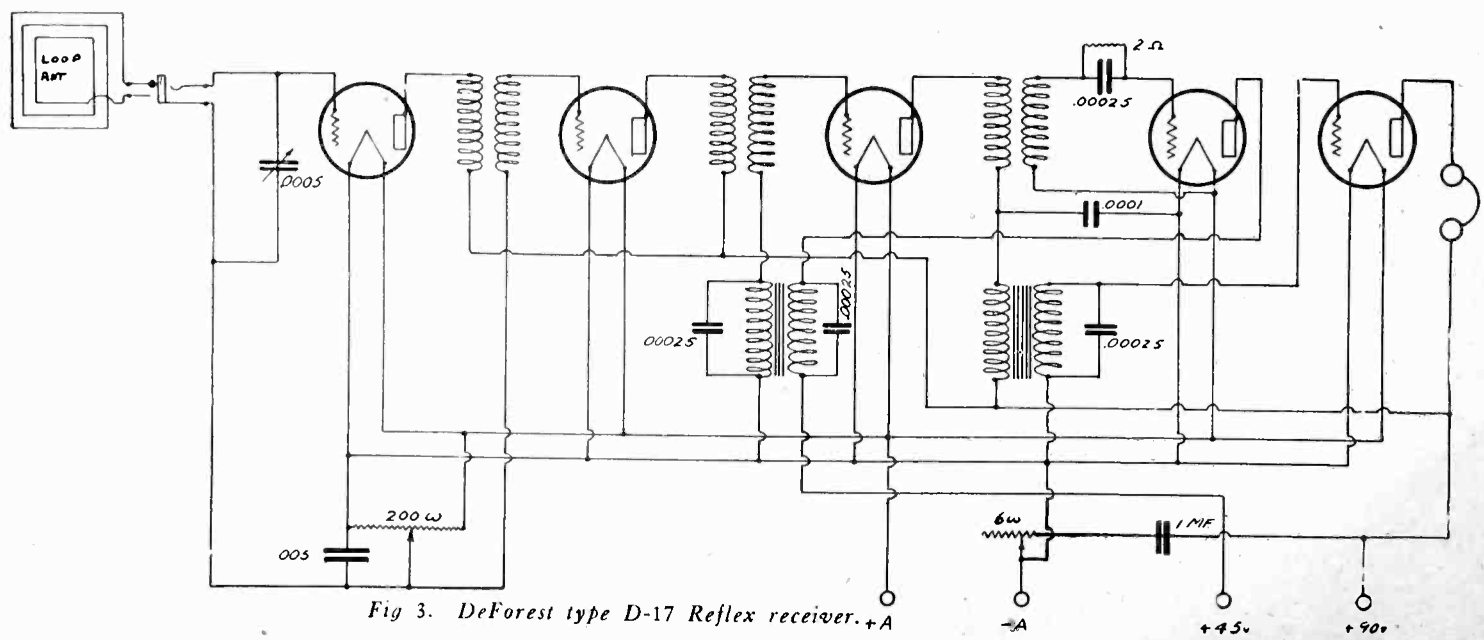


Fig 3. DeForest type D-17 Reflex receiver.

With The Amateur Operators

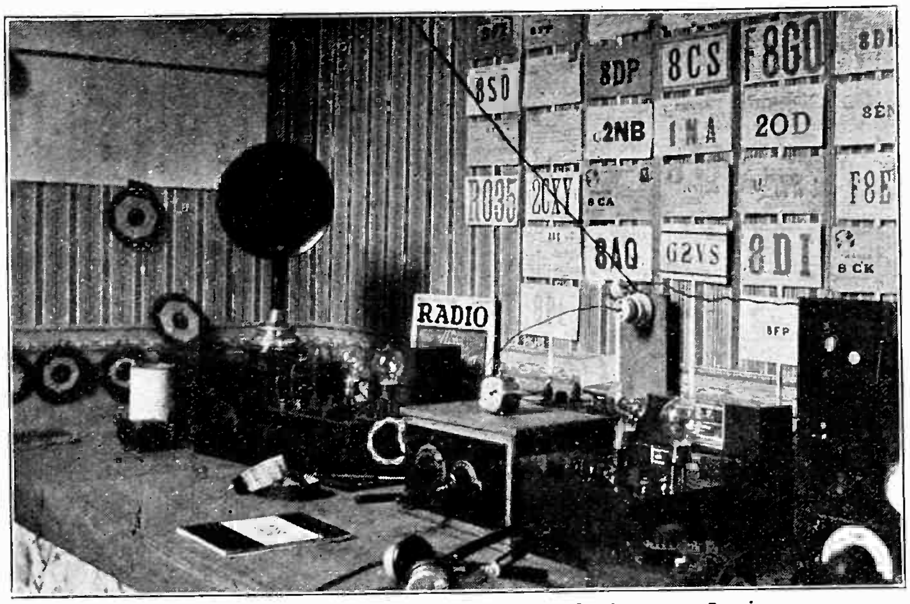
AN EXCELLENT FRENCH AMATEUR RECEIVER

The remarkable results obtained by R-049, owned by Jean Jolly, 105 Rue Lesage, Reims, France, on wavelengths below 100 meters will be of interest to all amateurs. As R-049 is licensed only for receiving, Mr. Jolly has spent his time in perfecting his short-wave receiver, which is shown in the picture. Note the large number of American "ham" cards adorning the walls, as well as many cards from foreign countries.

As shown in the diagram, the receiver consists of the usual regenerative detector and one-stage audio frequency amplifier, designed to work between 20 and 120 meters. For the wavelengths between 20 and 40 meters, the primary, which is of the aperiodic type, consists of 3 turns of No. 14 D. C. C. wire wound Lorentz fashion, the secondary is wound in the same manner with 5 turns and the tickler with 10 turns. All three coils are equipped with mounting plugs so that they may be removed from the receiver.

For the waves from 40 to 120 meters the primary has 5 turns, the secondary 15 turns and the tickler 10 turns. The secondary is tuned with a .00025 mfd. condenser equipped with a long anti-capacity handle, a favorite with French amateurs. A liberal use of by-pass condensers keeps the high frequency currents where they belong and the use of a high ratio audio frequency transformer makes the amplifier resonant at one particular audio frequency, a handy arrangement for preventing interference.

The antenna system consists of a 5 wire cage 2 ft. in diameter, 45 ft. long and 60 ft. high, being supported at one end by a mast. A counterpoise of somewhat similar dimensions is suspended underneath the antenna, a few feet from the ground. Mr. Jolly has been successful in hearing amateurs in every district in the U. S. A. and stations in New Zealand, Mexico, South America and most of the European countries.



Receiving Equipment at R-049, a French Amateur Station.

INTERNATIONAL AMATEUR CALL LETTERS

Call letters to be used as a prefix in designating the nationality of transmitting amateurs were officially adopted at the recent International Conference of Amateurs at Paris. The list is as follows:

A—Australia; *B*—Belgium; *C*—Canada and Newfoundland; D——————; *E*—Spain; *F*—France; *G*—Great Britain; *H*—Switzerland; *I*—Italy; *J*—Japan; *K*—Germany; *L*—Luxembourg; *N*—Holland; *O*—South Africa; *P*—Portugal; *Q*—Cuba; *R*—Russia; *S*—Scandinavian Countries; *T*—Poland, Esthonia, Lithuania; *U*—U. S. A.; *V*—Tuning Letter; *W*—Hungary; *X*—Portable Stations, Ships; *Y*—India; *Z*—New Zealand; *C S*—Czecho-Slovakia; *é*—Egypt; *ö*—Austria.

The letter *S* for Scandinavian countries is to be followed by a different letter or number (not yet selected) for Sweden, Denmark, Norway and Finland. It was proposed that Central and South American countries, excepting Mexico and Cuba, should use the letter *A* followed by the first letter of the country, *AA* for Argentine, *A B* for Brazil, etc., likewise for the Balkan countries, *B A* for Albania, *B R* for Roumania, etc.

European nationality numbers recommended were *1* Italy; *2, 5, 6;* Great Britain; *3* Finland; *4* Germany; *7* Denmark; *8* France; *9* Switzerland.

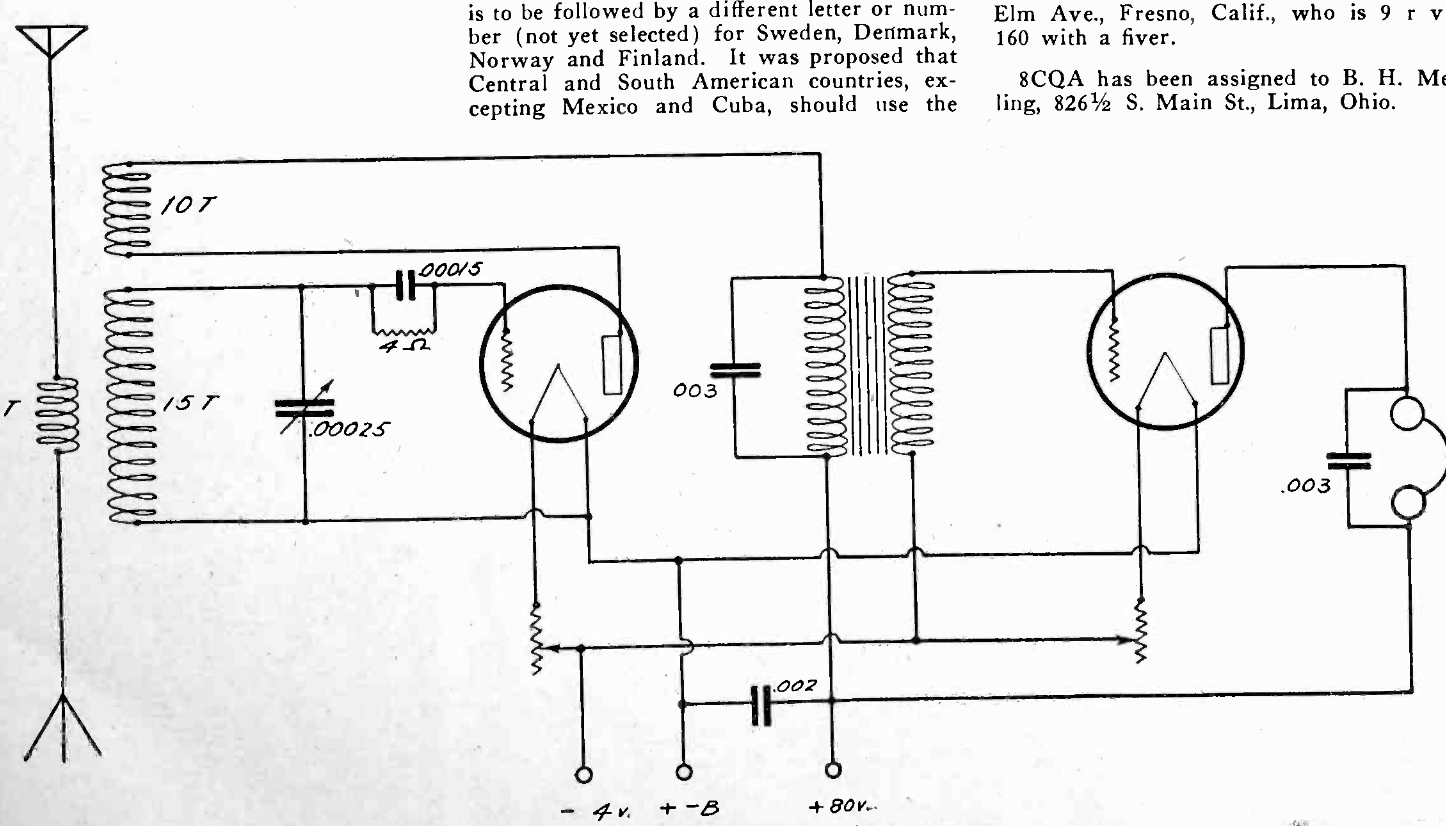
NEWS OF THE AMATEUR OPERATORS

The QRA of 2LR is G. L. Graveson, 266 46th St., Brooklyn, N. Y.

8DIN has been issued to George Morrow, 34 N. Howard St., Salem, Ohio, 5 watts I. C. W., C. W. and phone.

The QRA of 6BVM is Don Rinaldi, 2226 Elm Ave., Fresno, Calif., who is 9 r v on 160 with a fiver.

8CQA has been assigned to B. H. Mechling, 826½ S. Main St., Lima, Ohio.



Circuit Diagram of Short-Wave Receiver at R-049.

RADIO STATION 6-OI
BRANDON WENTWORTH
Stanford University, Calif.

By F. J. QUEMENT
District Superintendent ARRL

6OI, the station of Brandon Wentworth, before shutting down for the summer performed better than any station on the Pacific Coast and showed what can be done with a medium powered set properly handled. Wentworth's radio experience dates back to the days of 4 in. spark coils in 1914. Later he ran pre-war 1DY of Boston. After the war he was at 6AIK. Later he was at 6AAK and combined with Lopez to make a greater noise with that 1 kw spark. And it did, as many will remember. Then later he ran 7VZ up in Montana. Next winter was spent working 1AZL and 1BAN and the CW from these stations was heard in England, France and Panama. That was in 1923. In 1924 the present 6OI was started.

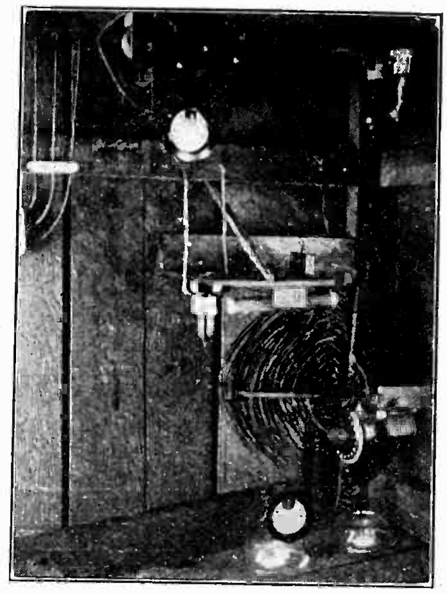
The following is the DX worked at this station using 80 meters and 40:—Worked all states but Delaware; all Canadian Districts including CJCE at Ft. Norman, Northwest Territory; Mexico, Porto Rico; First to QSO WJS in Brazil; Was QSO the following "A" and "NZ" numerous times during the winter—2AC, 2AP, 1AO, 4AA, 4AK, 4AG, 2CM, 2DS, 2BK, 2ME, 3BD, 2YI, 3JU, 2YG, 5DG. Was third station to QSO HVA. Worked 1HK in Manila. Worked J1AA on 80, 40 and 20 meters (20 meters was daylight both ends). Worked 7QS on SS West Jena during her entire trip across the Pacific until she reached Shanghai, Kobe and Yokohama. 7QS was using a fiver with 35 watts input and was sure QRZ at 6OI. This boat was worked every a. m. Has been working KFUH in Tahiti nightly. Previous to this for several months was sending press to this boat (KFUH had no low wave set at that time). Working NRRL all the time. Worked NQW, NERK and also 6ZAC out in Samoa. And messages have not been forgotten in this work.

6OI has been heard in India, Argentina, France, England, Tahiti, Macao, China, Alaska, Java. A large number of reports has also been received from ships in all parts of the Pacific.

The receiver used at 6OI is the usual three circuit regenerative and has proven very satisfactory.

6OI describes his set as follows: "80 meter aerial consists of a semi-vertical double 4 wire cage 55 ft. high and 85 ft. long. 40 and 20 meter aerial consists of one 30 ft. No. 12 enamel vertical and same for CP aerial and CP are brought through two Pyrex bowls and the antenna coil is suspended from these bowls. This coil is in series with a condenser and an ammeter. The Meissner circuit is used and the three coils are made of spirally wound 3/8 in. brass ribbon and are 4 in. in diameter. The fifty watter hangs in oil just below these coils. Tuning is accomplished with a double spaced variable condenser across the plate and grid coils and of course the aerial condenser. The plate power comes from a 4400 volt center tapped transformer. Four "S" tubes are used for rectification without filter. Filament current is from separate transformer. The receiver is the three circuit regenerative with one step of audio. The detector tube is a baseless Magnavox tube. The secondary tuning condenser is by super remote controlled vernier. Three sets of coils are necessary to cover the bands. A separate aerial and ground is used for the receiver. No grid corona has been experienced as some of the amateurs have had on 20 meters."

6OI is located on a fairly high hill back of Stanford University and the set is housed in a small shed especially constructed. This may be the reason for the wonderful work at this station. The only QRM is from cows which like to romp around among the guy wires and counterpoise.



50-*Watt Transmitter at* 6OI.

By R. W. Mintrom
62 Barton St.
Woolston, Ch. Ch., N. Z.

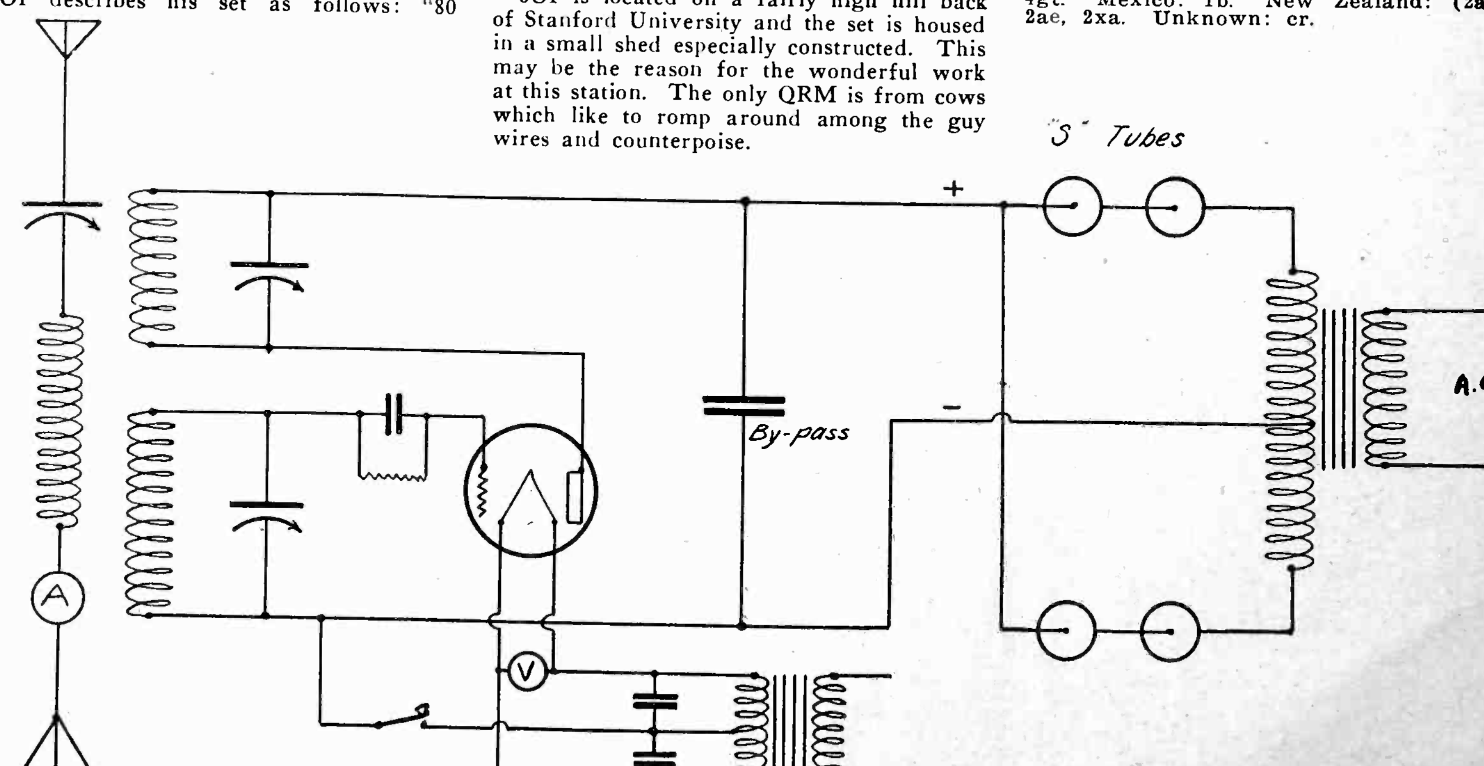
U. S.: 1ow, 1aao, 1all, 1ajo, 1bdh, 1bcr, 2rb, 2er, 2rk, 2le, 2xi, 2aan, 2ctf, 3ab, 3oe, 3bnu, 3ccx, 4dm, 4io, 5ox, 5in, 5ph, 5lu, 5qy, 5aiu, 5alr, 5akn, 5aql, 5zai, 6bh, 6tl, 6oa, 6ow, 6rn, 6cc, 6eb, 6lv, 6ts, 6ac, 6oi, 6ea, 6pl, 6fh, 6rv, 6xg, 6xi, 6adt, 6agk, 6aji, 6asv, 6aao, 6aro, 6awt, 6ahp, 6ary, 6apw, 6afg, 6cub, 6cqe, 6cct, 6chl, 6cto, 6cso, 6cor, 6czx, 6cgw, 6cmu, 6cbb, 6ctc, 6css, 6ctt, 6csw, 6bbv, 6bes, 6bql, 6bra, 6bmw, 6bur, 7gt, 7df, 7mf, 7sf, 7lh, 7ls, 7gb 7qd, 7afo, 8ba, 8vq, 8bnh, 8cjp, 8doo, 8bau, 9og, 9hp, 9ck, 9ek, 9co, 9bm, 9mm, 9xe, 9zy, 9zt, 9eli, 9dqr, 9cbf, 9ado, 9dwx, 9daw, 9cso, 9dmj, 9bji, 9cvo, 9cgn, 9xax. Canada: 3bp, 4cr, 5go, 5ba, 9al. Mexico: bx. Chile: 9tc. England: 2od. Porto Rico: 4sa. Hawaii: 6als. Tutuila: 6zac. Argentina: di, ???? q. r. a. Special: kio, kel, wgh, nkf, kdka (music q. s. a.) All hrd on 1 tube. All crds Q. S. L. ed.

By 6BNM, Ex-8CIK, W. E. Battison
3259 Madison St.
Alameda, Calif.

1aap, 1b?, 2my, 2no, 4ar, 5ew, 5za, 5ge, 5aiv, 5vm, 5ai, 5zas, 5ck, (6btx), 7afo, 7abb, 7sl, 7nh, 7gq, 7aha, 7ao, 7vp, 7aif, 7gdr, (7gy), (7wu), 7bj, 7df, 7ry, 7jh, 7uj, 7agz, 8jq, 8dfo, 81? 9dvl, 9dav, 9dad, 9hp, 9bno, 9cvn, 9bib, 9awu, 9co, (9aon), 9avv, 9caw, 9by, 9caa, 9ct, 9bin, 9dt. Can: c5hp, c5bm.

By 6CIX, 317 N. Friends Ave.,
Whittier, Calif.
(On 40 meter band only.)

1abf, 1aff, 1are, (1aww), 1axa), (1bs), (1bcc), 1boq, (1cmp), (1cmx), 1er, (1gv), (1ii), 1ow, (1pm), (1py), 1te, 1xz, 1yb, 1za, 2acp, (2aey), (2agq), (2bo), 2bee, 2brb, 2cty, 2cwx, 2gk, (2gx), 2ls, 2mu, 2qh, 2rk, 2rm, (2ud), (2wb), 2wr, 3apv, 3jk, 3ll, 3rc, 4fu, (4jr), (4pu), 4rm, 4sa, 4sl, 4xe, (6cst), 6zac, 8aa, (8aly), (8avl), 8apw, (8bgn), 8buq, (8byn), 8chk, 8dem, (8dgp), (8drs), (8ex), (8gi), (8jj), 8ks, 8to, 8xl, (8ze), 8zg, (nkf), npg, npu, nrrl, wiz, kfuh. Argentina: cb8. Australia: 2bk, (2cm), 2ds, (2ij). Canada: (3bq), (3qs), 4gt. Mexico: 1b. New Zealand: (2ac), 2ae, 2xa. Unknown: cr.



Circuit Used at 6OI.

By 1BHM, 224 St. Ronan St. New Haven, Conn.
(40 meter band.)

6age, 6agk, 6awt, 6cgw, 6cig, 6csr, 6css, 6ji, 6ml, 6qb, (6ql), 6ts, 6ur, 6cto, 7gs. English (2kf), 2od, 5nn, (6ym), 2oc. French 8sm, 2qs, 8udi, 8fg. New Zealand (2ae), 2ac. Australian 2bk, 2ds. Nrrl.

By 7UJ, Motor Route "C" Eugene, Ore.

1akz, 1avx, 1avq, 1bcr, 1bcb, 1bzp, 1cab, 1cme, 1ban, 1cmp, 1cmx, 1er, 1ga, 1qm, 1py, 2acs, 2ajp, 2awf, 2axf, 2brb, 2bgl, 2bee, 2cjb, 2cpa, 2cxy, 2cje, 2cvf, 2cnk, 2chk, 2cel, 2cpo, 2czr, 2ctf, 2cwj, 2clq, 2by, 2ds, 2io, 2le, 2pd, 2qs, 2wr, 3adv, 4awa, 3ava, 3avk, 3bnu, 3bel, 3bmt, 3bpm, 3bwj, 3cbl, 3chc, 3cjn, 3hh, 3mf, 3oq, 3wb, 3ub, 3te, 3zo, 4bl, 4fz, 4fj, 4rm, 4jr, 4uc, 5aky, 5acl, 5atx, 5afu, 5apz, 5atf, 5aiy, 5ash, 5aom, 5acf, 5aph, 5amk, 5akj, 5adz, 5kc, 5sd, 5mz, 5ox, 5jf, 5xa, 5ps, 5dm, 5lr, 5pi, 5ka, 5ov, 5qx, 5qk, sixes and sevens too numerous, 8aes, 8aly, 8axk, 8acm, 8axg, 8aru, 8afs, 8apz, 8ahm, 8avo, 8bau, 8bbi, 8blc, 8byn, 8bsv, 8baj, 8bcp, 8bkh, 8bhj, 8bqa, 8bpu, 8cqg, 8czy, 8ctk, 8cta, 8cnw, 8cpc, 8dfk, 8ded, 8dkw, 8dcb, 8dbm, 8dem, 8uf, 8fy, 8es, 8xe, 8pl, 8kc, 8ev, 8iq, 8ah, 8jj, 8gp, 8zu, 8jq, 8aqr, 9abf, 9auw, 9aoo, 9azp, 9aot, 9ach, 9afp, 9aks, 9aab, 9bvo, 9bdf, 9bfp, 9bwb, 9bjl, 9bwx, 9beu, 9blb, 9bpf, 9bkk, 9bfx, 9bta, 9bcn, 9bnk, 9coc, 9cjs, 9cju, 9cap, 9cvr, 9cgn, 9cit, 9cvl, 9ccm, 9cov, 9ctg, 9ctd, 9czq, 9cur, 9cow, -hl, 9cfs, 9cko, 9cuv, 9col, 9cuc, 9cvn, 9caw, 9cek, 9ckh, 9dac, 9dng, 4daw, 4dyt, 9dhq, 9dad, 9drj, 9dga, 9dpx, 9dhf, 9dpc, 9drs, 9dun, 9dpl, 9dbz, 9dge, 9dvl, 9dte, 9deq, 9eiq, 9ejy, 9eak, 9ekx, 9eih, 9eji, 9eam, 9xi, 9oa, 9mn, 9mm, 9mc, 9ry, 9sr, 9na, 9lg, 9se, 9no, 9ce, 9on, 9co, hp, 9be, 9hb. Canadian: 4cr, 4dq, 4fn, 4br, 4fv, 4er, 4al, 4io, 5af, 5cp, 5bn, 5fi, 5ds, 5bl, 5hs, 5cu, 5hp, 5hh, 5go, 5bm. Australian: 2yi. New Zealand 2ac, 7qs in harbor at Yokohama, Japan. Hawaiian: 6ceu, 6cst. Naval: nkf, nqg, npg, nrrl. All stations listed above have been worked from this station, which employs a single UV-202 (5-watt) tube.

All reports on mi sigs, appreciated and all cards answered. TWX.

By 8RY, Sullivan, Ohio QRH41

A—zay, 2bb, 2bk, 2cm, 2ds, 2ij, 2yi, c—4av, 4gt, f—8sm, ain, r—cb8, z—2ac, 2ae, 2xa. Unknown qra? afe, dil, gce, u—6zac, kfuh, nrrl, 6ac, 6bh, 6cc, 6ex, 6fz, 6hm, 6hu, 6hv, 6ji, 6jp, 6no, 6qd, 6rw, 6ts, 6vc, 6xg, 6xh, 6aak, 6afg, 6age, 6agk, 6ahq, 6ajm, 6alf, 6alw, 6aws, 6awt, 6bgz, 6bjd, 6bmw, 6bsn, 6can, 6caq, 6cej, 6cgw, 6cgo, 6chs, 6cig, 6clp, 6cls, 6cms, 6css, 6csw, 6cub, 7ay, 7nt, 7ny, 7uz, 7aca. Following please confirm. qso, 8ry, c2be, m1k, u4rl, 6kb, 6bhz, 6bil, 6bnr, 6bur, 6chl, 6cso, 6cto. Save every state but Nevada. Qsl u Nev hams!

By U3VX, C. Jenkins, Audubon, N. J.
(On 40 meters)

1acl, 1alq, 1als, 1ams, 1asf, 1atj, 1axi, 1bcc, 1bcr, 1big, 1bnl, 1bqk, 1ccp, 1cmx, 1ga, 1hn, 1rd, 1so, 1vd, 1zt, 2acl, 2aey, 2bgl, 2cla, 2cpa, 2xi, 4bl, 4jr, 4rr, 4ua, 5aah, 5aau, 5abn, 5ac, 5aeq, 5alj, 5am, 5apu, 5apv, 5aqv, 5in, 5ka, 5ls, 5nw, 5ox, 6aoi, 6avj, 6bes, 6bur, 6cgw, 6cjj, 6cnl, 6ji, 6ui, 6ts, 6xag, 6xbb, 7bc, 7mf, 7nx, 7uz, 8aa, 8alf, 8anl, 8aub, 8auj, 8avk, 8bof, 8boy, 8brc, 8byn, 8eyk, 8cid, 8ccr, 8dem, 8ex, 8kw, 8pl, 8rv, 8vx, 9aia, 9aud, 9ayi, 9ayk, 9bht, 9bnf, 9bol, 9bqe, 9bzg, 9bzj, 9cip, 9cxx, 9dfh, 9dpx, 9dqu, 9eak, 9nv, 9xax, 9xi, 9xn, 9za. Canadian: c3en, c3ms, c3qs, c4cr. New Zealand: z4ag worked. Others: ors, qgk, qra?, pse, qsl, my, sigs. All cards answered.

By 6DAP-6ATP, EX-5ACB, Otto Groff Nogales, Ariz.

2buy, 3auv, 4ll, 5aan, (5by), 5acb, (5ade), (5afx), (5agp), (5ak), 5amh, 5anl, 5apu, 5aqw, (5arh), 5asb, (5asd), 5ati, (6acn), (6ajp), (6ano), (6auz), (6bcn), (6bku), (6cjd), (6crz), (6cuw), (6vg), 7aha, (7ahs), (7fb), 8ccl, 8cpy, (8czy), (8or), 9aks, 9amx, (9aoi), (9aon), (9aqs), (9avv), 9bpn, (9bsc), 9bsp, (9caj), (9cdw), (9ciu), 9cvn, (9cxy), 9cyd, (9dp), (9eak), (9eaw), 9zt. Fone: 5acb, 9bsp, 7sl. Mexican: 1aa, 1k, in. Canadian: 3co, 5bz. Navy: nkf. Army: (wzl). Gustomas mucho recibir cartas del sur. Especialamente de Mexico. Hemos recibido siginals del sur, y debimos estar oida de alli. Gracias y adios.

By 6ALV, Alameda, Calif.

1af, cc, xae, 2cel, cvu, cvj, 3ad, (ash), 4si, (5add), (ew), rq, (6cst, Hawaii), (7qs, "near Japan"), 8aal, 8cyi, 8gz, 8qs, 8dgf, 8le, (8dia). Canada: 1ei, 3ws, 5ef. Mexican: 1aa, 1af, 1k, (9a). New Zealand: 1dz?, 2ac, 4ag. Australian: (2ay), (2bk), (2cm), (2yg), 2yi, 3bd, 3ef?, (5bg), 5bm?. France: 8bn?. Java: ane. Indo-China: hva, nirx, qra?. All cards appreciated. 225 watts input on 82 meters qrk?

At 6BUH, Salt Lake City, Utah.

1aa, 1aac, 1af, 1agl, 1ajt, 1ajx, 1any, 1asf, 1ay, 1ban, 1bdx, 1cmp, 1li, 1kc, 1oa, 1rd, 1se, 1sw, 1tf, 1vd, 1xav, 1xu, 1xz, 1yb, 1yd, 2agw, 2big, 2blk, 2bsc, 2btq, 2cty, 2cgm, 1cpd, 2cth, 2ctq, 2ew, 2gx, 2ku, 2mu, 2qh, 2rk, 2wb, 2wc, 2ww, 2xam, 3cdv, 3cjn, 3lw, 3sm, 4bl, 4fz, 4ke, 4mw, 4tj, 4xe, 5aah, 5acl, 5ado, 5aec, 5aej, 5afh, 5agn, 5agy, 5aiu, 5alr, 5apy, 5asb, 5asv, 5asz, 5atf, 5atx, 5ct, 5cwr, 5ew, 5fh, 5fv, 5lg, 5ls, 5lu, 5nj, 5ox, 5sd, 5se, 5ue, 5vf, 5vk, 5vv, 5zav, 8acm, 8af, 8ald, 8apn, 8apz, 8aub, 8ave, 8avl, 8by, 8bzk, 8cbp, 8cjb, 8cpb, 8cpf, 8cyp, 8crk, 8cdl, 8dal, 8do, 8dme, 8fq, 8mo, 8sy, 8xa, 9afr, 9aim, 9aks, 9al, 9alt, 9ap, 9aud, 9ayc, 9ayp, 9bdu, 9be, 9bhd, 9blb, 9bjl, 9bjz, 9blb, 9bmx, 9bnk, 9bnf, 9bou, 9bbc, 9bpf, 9bpn, 9bwt, 9bxq, 9ca, 9caw, 9cbf, 9cbf, 9cgn, 9cgq, 9cjs, 9cjt, 9cpm, 9cpu, 9csg, 9cuc, 9cul, 9cyg, 9dat, 9dbz, 9dct, 9del, 9dkv, 9dlj, 9dlt, 9dps, 9dqu, 9duo, 9dyi, 9dzf, 9eak, 9eep, 9ek, 9ev, 9hp, 9lg, 9kd, 9lc, 9na, 9sr, 9wo, 9xi, 9xn, 9xx, 9zd, 9zt. Foreign, etc.: C2ec, c5bf, c5bz, c5go, f8fq?, f8sm, m1b, r5ow, z4ag, kdka, lpz, nerkl, nkf, nqw, npg, wgh, wiz, ket.

2CEP, C. Koerner, 20 Murray Place, Stapleton, N. Y. City.

G.—(2cc), (2jf), qra?, 2kf, 2kg, 2kw, (2lz), 2nb, 2nm, 2od, 2sz, 5pz, 5rz, (5sz), 6gh, (6nf).

F.—8ab, 8ct. N.—oba, oll, D.—7ec. I.—1mt. R.—lpx. Q.—2lc. M.—1aa. Naval: ncg, nekz, nerk, nkf, nrg.

QRK my ten watts? All crds welcome and QSLed.

At 9DNG, University Heights, Lawrence, Kansas.

1af, 1ary, 1aqm, 1asy, 1pl, 1awy, 1aye, 1er, 1ckx, 1da, 1bvb, 1crq, 1aak, 1aff, 1vk, 1adb, 1ga, 1zz, 1kx, 1apc, 1gn, 1dd, 1wm, 1aao, 1bkq, 1akz, 1my, 1aki, 6rg, 6uo, 6uz, 6cto, 6cc, 6ab, 6ji, 6chl, 6auf, 6cla, 6ajq, 6no, 6bjx, 6cso, 6anq, 6cpf, 6nx, 6vc, 6bgc, 6ank, 6adt, 6bhz, 6xi, 6yb, 6aij, 6baj, 6buq, 6aib, 6baa, 7vu, 7fr, 7cw, 7wgh, nad, can, 1ar, 4nc, 4tf, 5ct, 5ct. P. R.: 4sa. Mex.: 1aa, bx, 1k.

By 3ABH, Clarence Wolf, Jr., 1521 North 16th St., Philadelphia, Pa.

(1anx), (1bdf), (1cpc), (1crz), (1af), (1dd), (1nt), (1vk), (1zz), (2aan), (2aey), (2afc), (2afn), (2agq), (2aij), (2amj), (2bwm), (2cel), (2clg), (2cft), (2cpd) (2crp), (2cxw), (2eq), (2kx), (2kz), (2va), 4sx, 4tv, (4uk), 4vq, 4wn, (5add), 5agn, 5ajn, 5akz, 5apg, (5arb), 5zai, 5bp, 5er, (5lh), 5lr, 5ox, 5rz, 6bhz, 6cmd, 6cng, 6ea, 6xg, 7bc, 7mf, (8alo), (8amh), (8avj), (8bpl), (8bvt), (8dae), (8don), (8jq), (8jz), (8rj), (8vy), 9aaw, 9aay, 9adk, 9afr, (9aif), (9aot), 9bfx, 9bjl, (9bmk), (9bmu), (9bsc), 9cvf, 9cyd, (9del), 9eet, 9eji, 9elb, 9ell, 9cd, (9il), 9mn. Canadian: (1ar), (2ft), (3ka), 3uy, 9al. (NFV). QRK mi 20 watts cw? A card goes out for every one that comes in.

By J. G. Tinney, 74 Kainui Road, Hataitai, New Zealand.

Detector and one audio and using a 20-ft. bi-metallic back stay as aerial. All calls heard over 1200 miles range.

U. S. A.: 1ka, 1kc, 1pl, 1rd, 1wl, 1xm, 1aao, 1ajx, 1ajy, 1alw, 1apc, 1ary, 1atj, 1beg, 1beh, 1ben, 1bes, 1cme, 1cmp, 1crl, 1xav, 2ag, 2bm, 2br, 2dd, 2er, 2gk, 2gl, 2le, 2pd, 2rk, 2xk, 2xg, 2zb, 2aay, 2acs, 2abd, 2adk, 2ale, 2axf, 2azy, 2bgi, 2brc, 2bqa, 2bqb, 2cib, 2cgj, 2cnk, 2cns, 1cwu, 2cgz, 2cwj, 2gma, 2mcu, 3hg, 3hh, 2hj, 3im, 3lw, 3mf, 3mh, 3ot, 3te, 3yo, 3bfe, 2bnu, 3bwj, 4by, 4do, 4eg, 4fm, 4gw, 4fz, 4io, 4jy, 4kl, 4ku, 4rg, 4rk, 4oi, 4ti, 4tj, 5ua, 4fml, 4oft, 5cc, 5ce, 5aw, 5cn, 5ct, 5cv, 5dw, 5gf, 5gj, 5go, 5hi, 5hl, 5jg, 5kl, 5lh, 5lu, 5lr, 5lv, 5nw, 5ox, 5ph, 5ps, 5rh, 5sd, 5qy, 5uk, 5bk,, 5ws, 5adz, 5acl, 5afu, 5aic, 5ajh, 5akn, 5ajj, 5alz, 5apm, 5atx, 5apq, 5bkq, 5asb, 5asv, 5asz, 5mlg, 5zai, 6ab, 6ac, 6ai, 6ar, 6ay, 6bh, 6cc, 6ea, 6eb, 6ew, 6fh, 6gg, 6gt, 6gu, 6ih, 6il, 6ji, 6km, 6rw, 6uo, 6vq, 6vr, 6xg, 6xo, 6zd, 6aak, 6aam, 6aao, 6abe, 6abk, 6add, 6adt, 6adw, 6adm, 6adx, 6aea, 6afg, 6afh, 6afm, 6afo, 6age, 6agk, 6agu, 6agn, 6agw, 6ahp, 6ahq, 6ahs, 6aib, 6ajc, 6aiv, 6ajh, 6aji, 6ajj, 6akq, 6akw, 6aqd, 6alg, 6alj, 6alv, 6alw, 6ame, 6amf, 6amm, 6anb, 6anl, 6ank, 6any, 6aoa, 6apw, 6arb, 6ary, 6asg, 6asv, 6asw, 6avj, 6avv, 6awt, 6axw, 6bah, 6bap, 6bau, 6bbq, 6bcl, 6bcp, 6bdh, 6ben, 6beu, 6bfw, 6bgc, 6bgv, 6bho, 6bhz, 6bil, 6bip, 6bir, 6bjj, 6bjv, 6bjx, 6bka, 6blh, 6blw, 6bmo, 6bmw, 6bnr, 6bot, 6bpf, 6bqb, 6bql, 6bra, 6brf, 6bsc, 6bsg, 6bsn, 6bso, 6buh, 6bur, 6buw, 6bvd, 6bve, 6bvf, 6bwl, 6cae, 6caq, 6cbb, 6cbe, 6ccf, 6cch, 6ccr, 6cct, 6ccy, 6cdb, 6cdg, 6cef, 6cek, 6cej, 6cev, 6cfc, 6cfi, 6cfs, 6cft, 6cgc, 6cgo, 6cgs, 6cgw, 6cgx, 6cha, 6chl, 6chs, 6chx, 6cix, 6cjj, 6cka, 6ckf, 6clv, 6cmd, 6cmu, 6cnf, 6cng, 6cnk, 6cnl, 6cnr, 6cqe, 6crw, 6cso, 6css, 6csw, 6ctc, 6cto, 6cty, 6cvi, 6cvp, 6cwi, 6cwp, 6dah, 6dat 6dao, 6dhl, 6guk, 6ils, 6kjb, 6ja, 6tp, 6kt, 6lam, 6lj, 6mp, 6ms, 6ne, 6no, 6nx, 6oa, 6of, 6ol, 6pl, 6ql, 6rn, 6tl, 6ts, 6ua, 6ul, 6ur, 6ut, 6uy, 6vch, 6vo, 6vo, 6wp, 6xu, 6xi, 6zh, 6zp, 6xad, 6xbq, 6zac, 6zbt, 7ar, 7bn, 7cu, 7cy, 7dc, 7dd, 7df, 7dj, 7eo, 7fr, 7fq, 7hm, 7ho, 7ij, 7jp, 7kf, 7ku, 7lr, 7ls, 7lw, 7ly, 7mf, 7mj, 7nh, 7no, 7ok, 7op, 7qc, 7qd, 7qr, 7ry, 7sf, 7sy, 7uj, 7un, 7uq, 7ur, 7vn, 7wm, 7wq, 7zz, 7acp, 7adp, 7afo, 7akk, 7ald, 8aa, 8bb, 8bk, 8cw, 8do, 8er, 8fy, 8ks, 8ol, 8rj, 8uf, 8ug, 8vq, 8wa, 8xe, 8acy, 8afs, 8afn, 8aly, 8avd, 8bau, 8bch, 8bcy, 8ben, 8bit, 8brc, 8btl, 8bvt, 8bzt, 8czy, 8cbp, 8cgy, 8chk, 8cud, 8dal, 8dst, 8xaf, 8zad, 9bk, 9bm, 9es, 9ev, 9gq, 9ig, 9jn, 9lt, 9mm, 9na, 9nn, 9no, 9su, 9ts, 9xa, 9xe, 9xi, 9za, 9zb, 9zt, 9zw, 9zy, 9ado, 9aib, 9aim, 9alo, 9akd, 9alc, 9and, 9ano, 9aot, 9ato, 9auy, 9axb, 9axq, 9ayo, 9azg, 9azh, 9azp, 9azy, 9bcb, 9bcd, 9bcj, 9bco, 9bcy, 9bdf, 9bdu, 9bfl, 9bhx, 9bhy, 9biz, 9bji, 9bjl, 9bkk, 9bnk, 9bpb, 9bpn, 9bpy, 9cbz, 9cea, 9cfl, 9cft, 9cgn, 9cjn, 9csq, 9cvo, 9cyd, 9daw, 9dfz, 9dmj, 9dpx, 9dqr, 9dqu, 9dsn, 9dvr, 9dun, 9dwx, 9dxy, 9efz, 9eht, 9eji, 9elb, 9erb, 9izk, 9nmp. Hawaii: 6asr, 37d. Canada: 1cpc, 3ms, 3ws, 3acu, 4cr, 4gt, 5an, 5ba, 5bz, 5ct, 5ef, 5gf, 5go, 5gw, 9al. Mexico: bx, 1x. England: 2nm. Cuba: 2by. Argentine: dl. Chile: 9tc. Japan: 1aa. Miscellaneous: abc, ags, b8, bki, bxi, kel, ket, kgl, kio, ur, ocy, wgh, wjs. Australia: 2ay, 2bh, 2bk, 2bl, 2bv, 2cm, 2cdm, 2ch, 2cl, 2ck, 2cr, 2cs, 2ds, 2gm, 2gq, 2jm, 2jr, 2jt, 2kc, 2kd, 2kt, 2lo, 2mr, 2rj, 2vx, 2ws, 2ya, 2yg, 2yi, 2zf, 2zn, 2zr, 2zz, 3af, 3al, 3ap, 3as, 3bd, 3bm, 3bp, 3bq, 3cb, 3dd, 3ef, 3hh, 3jh, 3ju, 3um, 3ot, 3tm, 3xf, 3xo, 3yy, 4an, 4ap, 4ck, 4cm, 5ac, 5ah, 5bf, 5bg, 5bn, 5bq, 5dc, 5jc, 5lo. Will gladly give report on sigs., etc. Will qsl card for card.

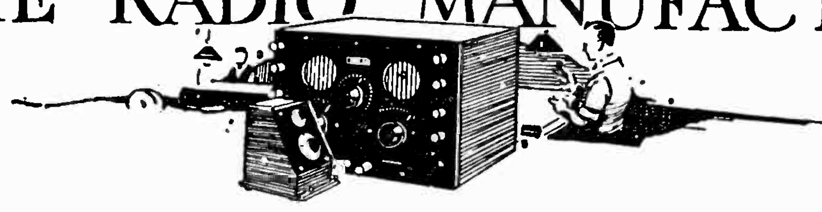
By U6EA, H. C. Seefred, 343 South Fremont Avenue, Los Angeles, Calif.

5am, 5bj, 5cc, 5ce, (5dm), 5dw, (5ew), 5gu, 5hd, 5hl, 5hl, 5hp, 5hs, 5in, 5jb, 5jf, 5ka, 5kc, 5kq, 5lg, (5lh), 5lr, 5ls, 5lu, 5ml, 5mz, 5nw, 5ot, 5ov, 5ox, 5ph, 5pn, 5ps, 5qy, 5rg, 5rh, 5sd, 5se, 5tq, 5ue, 5uj, (5uk), 5vf, (5vs), 5xa, 5za, 5zu, 5aal, (5aaq), (5abn), 5acm, 5ade, 5adz, 5aeq, 5aex, 5afb, 5afn, 5afq, 5afu, 5agj, 5agl, 5agq, (5ahd), 5aic, 5aij, 5ail, 5aiu, 5ajh, 5ajn, 5akn, (5aky), 5akz, 5alj, 5air, 5alz, 5amw, (5aom), 5apm, 5apy, 5aqa, (5aql), 5arb, 5are, 5arj, 5asd, 5atf, (5ath), 5atx, (5aul), 5xau, 5zai, 5zas, (5zav), 7ao, 7au, 7av, 7ax, 7bj, 7cd, 7cy, (7dc), 7dd, 7df, 7dj, 7ec, (7fd), 7fl, 7fn, (7fq), 7fr, 7ft, 7gb, 7gj, 7gm, 7gq, 7gr, 7gs, 7gv, 7gy, 7ho, 7ij, (7iu), 7iw, 7jf, 7jp, (7jq), 7jr, 7ku, 7lh, (7lj), (7lq), 7lr, 7ls, 7ly, 7mf, 7mg, 7mx, 7ng, 7ob, 7ot, 7oz, 7pf, 7pz, 7qd, 7rk, 7rm, 7sb, 7sl, 7sp, (7sy), 7to, 7ub, 7uj, 7un, (7uq), 7uw, 7vn, 7vq, 7vu, (7wm), 7wq, 7zm, 7zn, (7zz), 7abb, 7acl, 7acy, 7adf, 7adm, 7afn, 7afo, 7ago, 7agz, 7aha, 7ahl, 7alb, 7aif, 7ajv, 7ajy, 7akh, 7akk, 7ald, 9ap, 9bm, 9ca, 9cg, 9ck, 9cv, 9dp, 9er, (9fe), 9hk, 9hn, 9ix, 9jz, 9mf, (9mm), 9mo, 9na, 9nv, 9oa, (9on), 9pb, 9qw, 9rg, 9rt, (9rw), 9sr, 9ss, 9ti, 9ud, 9ui, 9vc, (9xi), 9xw, 9zb, 9zd, (9zt), 9aau, 9abf, 9abr, 9abw, 9aby, 9ach, (9acq), 9adm, 9ado, 9ady, 9aeg, (9afr), 9agl, (9ahq), 9aif, (9aim), 9aju, 9alt, 9aog, 9aoi, 9aoo, 9asl, 9ato, (9aud), 9aur, 9auw, (9auy), 9avv, 9avy, 9axs, 9azp, 9bbr, 9bcd, 9bch, (9bdf), 9bdj, (9bdu), 9beu, 9bht, 9bib, (9bje), 9bji, 9bjl, 9bjp, 9bkk, 9bmb, 9bna, 9bnf, 9bnk, 9bof, 9bpb, 9bpy, 9bqj, 9brk, 9brx, 9bsp, 9bsz, 9buh, 9bwp, 9bwu, 9bwx, 9byt, 9byv, 9caj, 9cap, 9cbz, 9ccq, 9cdo, 9cea, 9cee, 9cej, 9cfl, 9cfs, 9cfu, 9cfy, (9cgn), 9cil, 9cip, 9cjc, 9cjs, 9cju, 9cjy, 9cks, 9cku, 9cld, 9clt, 9cpc, 9cpm, 9cpo, 9cro, (9csg), 9csp, 9ctf, 9ctg, 9ctr, 9cuc, 9cvo, 9cvr, 9cvs, 9cwg, 9cwx, 9cxg, 9cxx, 9cyl, 9cyk, 9cyx, 9czq, 9daw, 9dbp, 9dbr, 9dcw, 9ddg, 9ddp, 9ded, 9dfh, (9dfq), 9dge, 9dhb, 9dhl, 9dhw, 9dkc, 9dkl, 9dlf, (9dmj), 9dmz, 9dng, 9dpr, 9dpx, 9dqu, 9dqy, 9dtk, 9duj, 9dun, 9dvr, 9dwx, (9dwz), 9dxl, 9dyt, (9dyz), 9eae, (9eak), (9eam), 9ebh, 9ecr, 9eep, 9ees, 9eet, 9efy, 9eht, 9eih, (9eiq), (9eji), 9eky, 9eld, 9eil, 9ell, 9xbg, 9xbp, ket, nke, npg, nqg, 86a kfon, kfkx, kzy, Canada: (5ak), (5an), (5ba), 5bc, (5bz), 5cn, 5ct, 5ef, 5gf, (5go), 5hc, (5hs). The operator at 6Ea is transmitting on the 40 meter band during this summer. He has worked NRRL and NKF. DX reports on this QRH will be greatly appreciated.

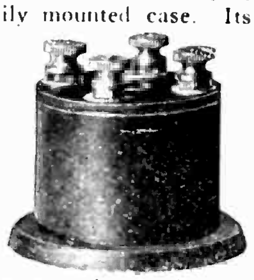
By 8ZE-8GX, E. W. Thatcher, Oberlin College, Oberlin, Ohio.

Heard and worked on 40 meter band. 6agk, 6alj, (6ajj), (6ahp), 6awt, 6bjd, (6bsc), 6bur, 6cgo, (6cgw), (6cig), (6clx), (6clr), 6css, 6cto, 6cc, (6jl), 6lj, 6kb, 6no, (6ol), 6ui, (6ur), 6ut, 6ts, 6xag, 7abb, (7gb), 7mf, 7pz. Foreign: a2bk, a2cm, a2ds, c2ax, ac4cr, g2kf, g6ym, z2ac, nrrl, npm, npg, (nkf), (nfv), nerk, kfuh, P.R. 4sa, 5gos, (qra?)

FROM THE RADIO MANUFACTURERS

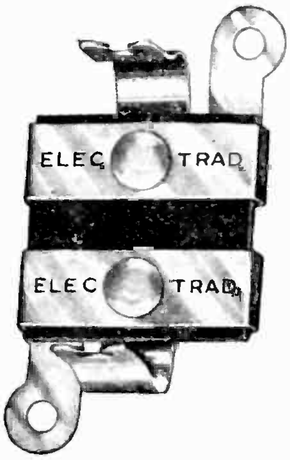


The Anylite King Cole reactance amplifier consists of a coil, high resistance leak, and fixed condenser contained in a small, easily mounted case. Its purpose is



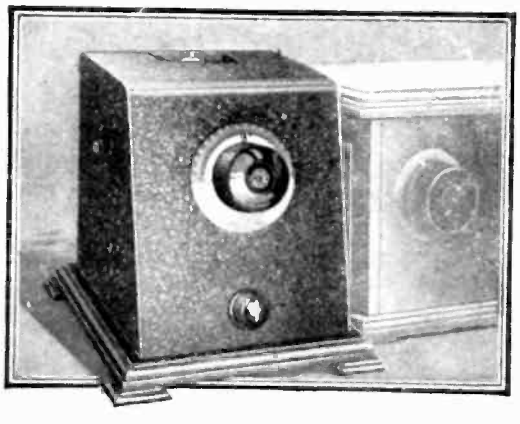
to give greater volume after two stages of audio frequency amplification, without distortion or without the additional *B* batteries required for resistance amplifiers.

Electrad certified mica condensers, licensed under the Van Deventer patents, are calibrated to within 10 per cent of the marked capacity. Several unique constructional features have been incorporated to



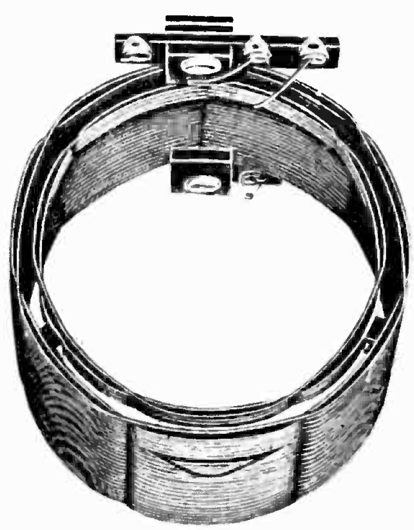
provide constancy under extreme temperatures and moisture changes. They are made in three types: with soldering lugs, with grid-leak brackets, and with punched connecting lugs, as illustrated herewith.

The Walbert Penetrola is an auxiliary unit intended for connection ahead of any standard receiving set so as to increase selectivity, range and volume and to prevent radiation. It is claimed that the increased



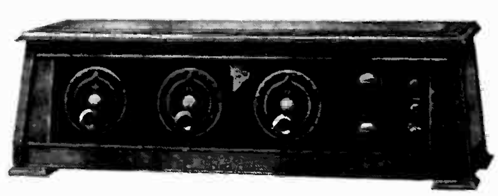
signal intensity permits the use of a shorter aerial so as to reduce static. It is also said to be effective in excluding all undesirable stations. It operates with any type of tube and adds but one control to the set.

Benjamin tuned radio frequency transformers have a minimum distributed capacity and maximum inductance, obtained because of a special space winding and the elimination of supporting material, the turns being fastened together by means of anti-



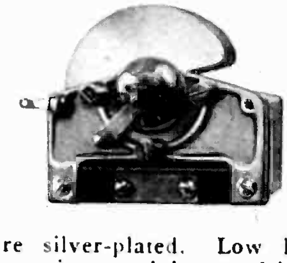
capacity cement. Efficient coupling between the primary and secondary coils is obtained by mounting the primary at one end of the secondary, thus insuring a minimum of capacity coupling.

The Valleytone Receiver is a 5-tube tuned radio frequency receiver licensed under and incorporating the "potential balance" method. It is the first complete receiving instrument employing Toroidal coils. There



are two rheostat dials on the panel. One governs the radio frequency and the other the detector. A pre-determined fixed resistance is employed for control of both stages of audio frequency.

The Silver-Marshall straight-line wavelength condenser has especially shaped plates to give a straight line curve for radiocast wavelengths as well as a very low minimum capacity and a high capacity ratio. All current-carrying surfaces, including the

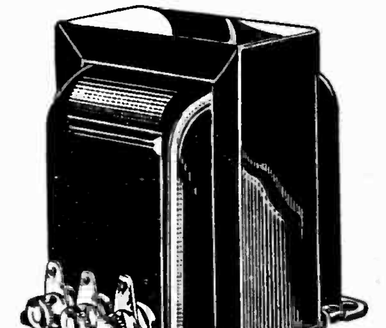


plates, are silver-plated. Low losses are secured by using a minimum of high-grade insulation. It is of the single-bearing type, equipped with a long cone adjustable brass bearing, and an effective tension adjustment.

Aerovox By-pass Condensers are announced as a complete line of standard sizes from .05 to 4 mfd., higher capacities being made to order. They are made from linen condenser paper and tin foil, being tested to

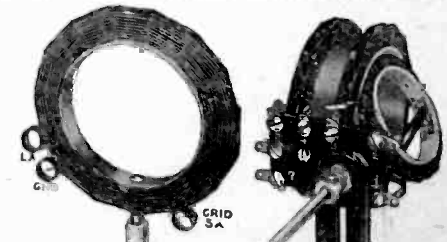
withstand 500 volts d.c. For protection against moisture they are vacuum impregnated and sealed in a metal container. Their capacity is claimed to be within 10 per cent of the marked values.

The Thordarson autoformer all frequency amplifier is a new audio frequency transformer that is claimed to give the same amplification to the low notes of the organ, base vial, tuba, English horn and other instruments below 100 cycles as to the high



notes. Its balance of capacity inductance and resistance is similar in principle to the line amplifiers used by the more recently installed high power radiocast stations. Perfect amplification is reported with as many as three stages.

Sickles Diamond-weave Coils are of low loss design and construction and a set has recently been combined for use in the Brown-

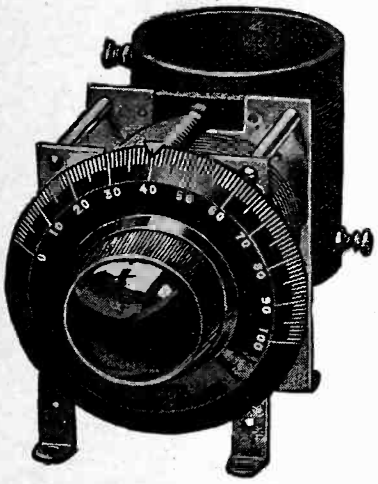


ing-Drake circuit. The regenerative radio frequency unit is provided with a universal mounting lug, making it possible to mount the unit on any make of variable condenser, *Everywhere--an amazing success!*

THE BROWNING-DRAKE TRANSFORMER

Takes the Coast by Storm

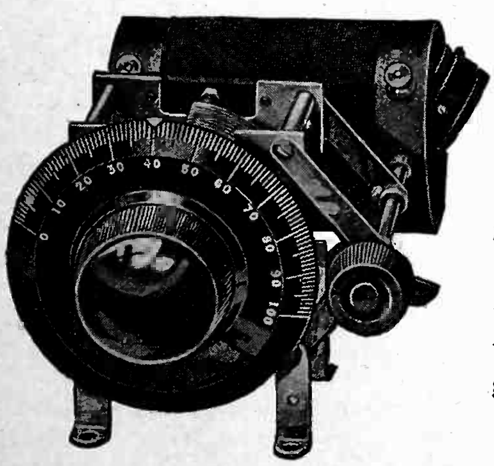
STARTING last season in New England it has won nation-wide preference. The reason for its huge following is simple--it gives RADIO SATISFACTION!



NATIONAL ANTENNA COIL
With National Velvet Vernier Dial and Condenser

The NATIONAL ANTENNA COIL *and* *The* NATIONAL REGENAFORMER

---two units that are unexcelled for wave filter, wave meter or tuned radio frequency



NATIONAL REGENAFORMER
With National Velvet Vernier Dial and Condenser

THE *National* Regenaformer, designed by Browning and Drake of Harvard Research Laboratories, is a tuned radio frequency transformer of highest efficiency. Combined with the *National* Condenser and the *National* Velvet Vernier Dial, the result is a well balanced unit that gives *radio satisfaction.*

See Our Exhibit at the San Francisco Radio Show, Space No. 69A

Dealers supplied by the following distributors:

SAN FRANCISCO — Alexander & Lavenson, 926 Howard St.; Coast Radio Supply Co., 648 Howard St.

LOS ANGELES—The Electric Corporation, 1050 Santee St.; Yale Radio & Electric Co., 1111 Wall St.; Western Radio, Inc., 1224 Wall St.

SAN DIEGO—Coast Electric Co., 744 G St.

SEATTLE—Electric Corporation, 321 Occidental Ave.; L. C. Warner Co., 301 Occidental Ave.

SPOKANE, WASH. — Pacific Telegraph Institute, 906½ West Sprague Ave.

PORTLAND — Stubbs Electric Co., Sixth and Oak Sts.; L. C. Warner Co., 307½ Pine St.

PHOENIX, ARIZONA—Nielson Radio Co., 311 North Central Ave.

SALT LAKE CITY, UTAH — Inter-Mountain Electric Co.

VANCOUVER, B. C.—Radio Specialties Ltd., 179 Pender St.

NATIONAL COMPANY, Inc.

110 BROOKLINE ST. ENGINEERS AND MANUFACTURERS CAMBRIDGE, MASS.

Sole Licensees for the manufacture of the genuine and justly famous Browning-Drake Transformer. Patents pending

SELECTIVITY VERSUS DISTORTION

(*Continued from page* 29.)

had a fairly good characteristic below 1,000 cycles. A better choice could possibly have been made for the low frequencies, but the transformer chosen met the requirements best over the entire scale out of a large number of available instruments.

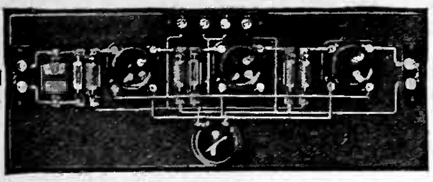
The *B* curves represent the transmission of the superheterodyne receiver as taken directly from the distortion curves *C* in the previous graph. The scale is magnified 10 times as compared with the others in Fig. 3. The *C* curves represent the transmission as modified by one of the audio frequency transformers, and the *D* curves represent the transmission as modified by two of the audio frequency transformers.

It will be observed that both *C* curves and *D* curves have marked maxima near the 900 cycle frequency. (And this is the point where many people insist on matching every piece of apparatus that is to be used for amplifying and reproducing audio frequencies!) The peaks are less sharp for the *C* curves than for the *D* curves, and less for the 1,500 kc. carrier than for the 500 kc. carrier. The transmission is also slightly greater for the 1,500 kc. carrier than for the lower, but the difference is slight.

On the *D* curves, especially for the 550 carrier, the distortion seems to be very great, above the maxima as compared with the distortion for the same range on the *C* curves. This, however, is only apparent. The distortion is actually greater for this range on the *C* curves, which may be checked by taking current ratios. The reason is that for the *D* curves the rising slope of the audio transformer has operated twice in raising the curves, while in the *C* curves it has only operated once.

On the inferior side of the peaks the quality is all in favor of the single transformer, as shown by the *C* curves. The slopes have been decreased and this was one of the objects sought in choosing the transformer. If the latter had been less "good" by itself, from 1,000 cycles down, the result of the combined effects would have been much better quality. As the *C* curves are now, however, the difference between the transmission at the peaks and at 100 cycles does not introduce serious distortion. Since the lower frequencies are of greater importance in speech and music than the higher, better quality will result if only one transformer like the above is used.

The above discussion is not an excuse for a bad audio frequency transformer. A good transformer was selected because it had certain desirable characteristics which are usually considered as defects, and these defects were desirable because they were of the opposite sign from those introduced by a very selective circuit.



NEW!

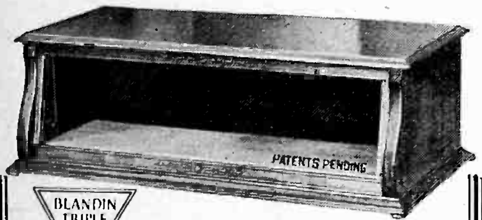
Resistance-Coupled Amplifier Kit for only.................................. $5.00

"Electrad" 3 Stage Resistance Coupled Amplifier Kit No. 1—

PRICE, $5.00

Write for free diagram and instructions

ELECTRAD, Inc.
428 Broadway, New York City



You'll Like This Duplex

One cabinet—
Any panel size, 7x26, 7x24, 7x21 or 7x18". Depth, 11".
Either straight or sloping panel—grooves, no screws.
Built of solid Honduras mahogany. Lacquer hand-rubbed piano finish. Entire lid raises. Full length piano hinge. Folding lid supports. Felt covered feet. Extra mounting board.

Write for Duplex price list.
Dealers, write your jobber.

PACIFIC COAST DISTRIBUTORS:
L. D. Read & Staff, 518 Grant Bldg., Los Angeles, and 222 Chronicle Bldg., San Francisco.

Blandin Built by Blandin 1900 16th St., Racine, Wis.
Triple A *Radio Cabinets*

Yours-free!

WRS 80-PAGE RADIO GUIDE BOOK
Profusely illustrated, 'chockful' of data for the radio fan:
Trouble Shooting Chart. Complete, New List of Broadcasting Stations, Log Chart —and details of newest apparatus and hundreds of
Exceptional Radio Values on our

WHOLESALE RADIO SERVICE CO.
6-R CHURCH ST NEW YORK CITY

Best Specifies

JEFFERSON

Intermediate Frequency TRANSFORMERS

for his new superheterodyne

Gerald M. Best is recognized as the outstanding authority on the superheterodyne circuit. In planning his new heterodyne circuit—entirely different from anything known before—he was highly critical of every part that went into the finished hook-up. Naturally, only parts that were already proved reliable and scientifically accurate were considered. For transformers, Mr. Best chose Jeffersons.

The Jefferson Intermediate Frequency Transformer—a special type of Jefferson transformer exactly fitted for this work, with the uniform reliability of all Jefferson radio and electric products.

There is a Jefferson Transformer for YOUR Radio

You may not think that you require the same scientific perfection as Mr. Best demanded—but you desire the utmost possible enjoyment out of your radio—which is the same thing. There is a Jefferson Transformer which will bring an amazing improvement in your own set. From the lowest note of the bass drum to the highest pitch of the violin is the range of sound which Jefferson Transformers reproduce in your own home with greatest amplification and complete absence of distortion. Jefferson Transformers are made by the largest makers of small transformers in the world. That's because most radio fans insist on Jeffersons. If you would know what radio can do today—let Jefferson Transformers in your own set show you. At all the best dealers.

Jefferson Electric Mfg. Co.
501 So. Green St., Chicago, Ill.

Makers of Jefferson Radio Tube Rejuvenators; Radio, Bell Ringing and Toy Transformers; Jefferson Spark Coils for Automobile, Stationary and Marine Engines; Jefferson Oil Burner Ignition Coils and Transformers.

THE PRAYING JONAH

(*Continued from page 23.*)

gap with the rip of a sail letting go in a high wind.

"She'd do a thousand at night," said Jerry to himself. "But here's hoping she doesn't have to."

He shook his fist at the aged receiver screwed on the table, dragged a dusty magazine out of table drawer and cocked his feet on the table. From which one is expected to infer that Jerry O'Malley knew his stuff, and was a philosopher to boot.

Jerry's job the first night was reduced to a wisp. He checked Standard Time, logged the weather for the bridge, and listened to a shore concert and a chunk of press, to get the ball scores. The life of a radio "op" on a freighter is usually a matter of sleep, poker, meals and ennui which is French for sitting on the spine and cursing Fate. He reports his tub going out and coming in, and unless something breaks, has little else to do. Of course he gets next to nothing in pay, but then a radio operator doesn't mind this. He goes to sea for the experience anyhow. No? Oh, our mistake, then.

October 3 fell on a Monday, which is of not the slightest importance to anybody except a French laundry. The clearance papers of the *Cassie S.*, on that day, indicated that she was going to Pago-Pago somewhere down in the South Seas. The general impression of Pago-Pago is an island where everyone wears a table cloth and grows copra. Ships that go to Pago-Pago return with bankrupt college men and copra. There is money in copra.

Jerry O'Malley was not looking forward to Pago-Pago. He had been to Pago-Pago before. He knew the girls were fat and greasy, the liquor terrible, and fleas carniverous. Besides Jerry had a girl in San Francisco and he was hoping the *Cassie S.* would drop in for engine repairs or something of the kind. He wanted to go ashore and see Mary. Mary was distinctly the cat's whiskers, and if Jerry could just see those amazing eyes open with surprise when he walked in—well, you know how it is when you are twenty-five and Irish and filled with romance and a love of life!

In these few, but simple, words we have endeavored to outline Jerry's program for a couple of days ahead, the Cassie S., being due off "Frisco" about Wednesday morning, just to bring out the fact that he appeared to be a likeable, pleasant-spoken youth, with a gift of gab and an incentive to save money. In other words, a typical radio operator. After he had confided these things to the chief engineer, who in turn confided them to the skipper of the *Cassie S.*, the latter figured that he had Jerry sized up about right.

Captain Aaron Starbuck, alias the "Praying Jonah," however missed a couple of little details—matters that Jerry neglected to mention to the chief engineer. For instance there was code message "A" which Jerry sent by wireless as the ship was clearing from the dock. It went something like this:

"Gangy raddo gango gangg delco delci dormo."

There was no signature.

Another little detail was a wicked looking automatic pistol which Jerry carried under his shirt, tucked into a special holster. Rather neat, that holster. A captain of detectives had once searched Jerry from head to foot without finding a weapon on him—that's how neat it was. Without any great mental effort it is possible to figure out that Jerry is not what he seems to be. Nobody is, for that matter.

Take Captain Starbuck for instance. He appeared to be a sun-burned, free-swearing sailor man, with a kindly eye. He wasn't. He was a bilious old bilk with a disposition like a horned-toad suffering from sun stroke. Not a soul would have suspected him of being the "Praying Jonah." Even Jerry doubted his identity in this respect until the following morning when, at six bells, he came on deck to see the entire crew kneeling in an attitude of enforced reverence, in a scraggly half-circle.

Above them stood Captain Aaron Starbuck with a Bible in his hand. He wore a black Prince Albert of by-gone days, over his greasy corduroys and on his grim visage was an expression of rapt anticipation such as the Roman lions probably wore when viewing an early batch of edible Christians. Beside him, in a clean shirt, was Clancy Billings, mate, officiating as assistant, with a marlin spike in his hand.

"We thank Thee for our many blessings!" bellowed the skipper, running a careful eye over his flock.

"We thank Thee for our many blessings!" chanted the kneeling crew in broken Swedish, Norwegian, Greek, Russian, Coster English, and in the case of the cook, pigeon Chinese.

"Mr. Billings!" The captain's voice was frigid. "There doesn't seem to be much enthusiasm this morning!"

The mate fumbled with his marlin spike and stepped forward.

"We thank Thee for our many blessings!" roared the kneeling group with great enthusiasm.

The skipper nodded and closed his eyes.

" . . . and for Thy many kindnesses and benedictions. . ."

A hoarse bellow arose from the crew —one that might be interpreted as a polyglot rendition of "kindnesses and benedictions."

"Amen!"

"AMEN!"

At the one word they thoroughly understood to mean dismissal, the crew arose with alacrity. The skipper closed the Bible, opened his eyes, removed his Prince Albert and handed it to the mate.

"Now, you scum," he remarked aimiably, "is there any complaint about the grub?"

"No, sir!" This from half a dozen sources.

"Are you being well treated?"

"Yes, sir."

"All right. Get aft, where you belong, before I whale the sin and shame from your mortal flesh, you rotten carrion!"

The crew shuffled rapidly out of sight. Jerry watched them with a broad grin. The food was rotten and the complaints below decks would fill a public library.

"If there was a single Irishman among 'em they'd throw old dilberry overboard," he mused.

Captain Starbuck walked toward him.

"Just one thing you might as well understand right now," he said sharply. "What I say goes!"

Jerry squinted at him.

"And what I say, goes in every government log on the Pacific Coast," he replied evenly. "And that's the difference between us!"

The skipper's face clouded.

"The Lord has the habit of chastening the proud and haughty!" he said sternly.

"And for all that, it's a nice day!" remarked Jerry and turned his back on the skipper. He was conscious of the bale ful glance aimed at his back and it bothered him not a whit. He knew as well as the skipper that there was a line that the latter dared not cross—a line laid down by federal regulation. And besides, it WAS a nice day and his heart was young, and he was Irish and full of romance, and what would you?

This was on Tuesday. Tuesday night, when the *Cassie S.*, was grovelling off Eureka, Captain Starbuck brought him a message addressed to a ship chandler's firm in San Francisco and marked "rush." It had to do with certain supplies. The captain stood by while Jerry gave the Radio Corporation station at Bolinas the message.

"Any answer?"

"No," said the skipper shortly, and went out.

Jerry took from his pocket what appeared to be a blank sheet of paper. He held it against the rheostat that controlled his generator, where the coils still glowed red in the gloom of the little radio cabin. After a bit, a cipher code that had been written on the paper with lemon juice began to come out in brown letters.

With utmost care Jerry compared the code with the message to the chandler's firm in San Francisco. Then he wrote out a message in a wholly different cipher—a five-letter code—the one he had used the day before. This he memorized. Then he rolled it into a little ball with the lemon-juice key, and carefully hurled the two through the porthole into the sea.

This done, he turned to the operating table, called KPH, the Bolinas station, and gave the code symbol which indicated that he had a message to transmit. The night operator at Bolinas answered him immediately. To him, Jerry sent the message he had memorized. It was unsigned, but the address caused the night operator to raise his eyebrows and route it through ahead of all other business on his spindle.

As Jerry signed off the final "AR" which indicated that he had finished transmitting, the door of the wireless cabin burst open and Captain Starbuck was framed in the entrance. His eyes glittered and his face was red with wrath.

"What was the wireless being worked for at this time?" he demanded, his fists working, and a deadly menace in his voice.

Jerry smiled at him with bland innocence.

"Yes sir, you did that. 'Twas that shore station asking for a correction in your message. Seems they had 'bolts' down as 'butts' though how they did it is a mystery to me. But that's the way with those stations. They are always balling things up." Jerry could be exceptionally talkative when he so desired.

Captain Starbuck came close and leaned down so that his face was close to that of his operator.

"God bless me, you'll not send anything unless I order you to," he gritted.

Jerry O'Malley tilted back in his chair and regarded the skipper with level eyes, as cold as ice in a polar sea.

"Captain Starbuck, I'll send anything I'm required to by federal regulations. And a board of inquiry will stand behind me."

The captain's face reddened.

"This is defiance, sir!" he thundered.

Jerry O'Malley shrugged.

"The way of the transgressor is hard!" he said quietly.

The use of the Biblical quotation flabbergasted the skipper completely, straightening him in his tracks with a puzzled expression. He glared at the young operator for a moment.

"I have nothing to do with federal regulation," he said after a moment. "I am talking about ship's business. Nothing goes without my say-so."

"You're boss," Jerry agreed. "What you say—goes—even if it's into a report. I think we understand each other."

"For your own good—I hope so," snapped the captain and whirling on his heel, banged the door behind him. Jerry chuckled.

"Nice old bilious bloater," he commented. "Right friendly old cuttle-fish."

We have said that this was Tuesday. But we have not mentioned the time. As a matter of fact this was about 9 p. m., Pacific Standard Time, which is as good a time as any other when one has a code message to send, as we see it. Had Jerry been one of those persons who keep a diary and write down their thoughts to be read in court, he would, at this point, have made the following entry:

"There being nothing doing, I went to bed!"

It is probable that Jerry dreamed of his girl in San Francisco whom he fully expected to see the following day. If so—that is Jerry's secret. When the dawn crept up he was lying on his face, sound asleep. But at six bells, he was up and dressed. He came on deck late—to avoid the usual prayer-meeting and found the *Cassie S.* rolling heavily somewhere off the Golden Gate.

At first he thought there was headway in the heavy sea. Then he missed the familiar clank of the engines and peering overside saw they were not moving. Hull down to the east, he made out the sugar-loaf crest of the Farallone Islands, seen dimly through the morning mists. The crew were forward squatted on the deck, playing cards. There was no one on the bridge and the lookout was leaning against the wheel house, half asleep.

Clancy Billings, the mate came paddling along the deck his bare feet making toad-splats on the wet deck.

"When are we going in?" asked Jerry casually.

The mate leaned on the rail and regarded him carefully out of the corners of his eyes. Finally he spat into the sea.

"We ain't!" he said briefly.

Jerry's eyebrows went up. This was news.

"How come?"

The mate jerked a thumb over his shoulder.

"Old Man's orders," he said shortly. "Did you think we was goin' in?"

"That's what he told me when I came aboard!" said Jerry.

The mate chuckled.

"He's li'ble to say anything. He's a great humorist, the old man is. No buddy—we're goin' to Pago Pago. Ain't that what you signed on for?"

"Oh, sure," said Jerry easily. "But I got a girl in Frisco and—well, you know how it is . . ."

The mate turned toward him with interest.

"Say now—that's hell, ain't it?" he said sympathetically. "I got one there too, but a lot of good it does me!"

Instantly Jerry sensed the resentment of the remark. He decided to make a play.

"Guess the Old Man's a pretty hard proposition, eh? Gave me the devil last night for workin' the wireless without him standin' by my elbow. Fairly raised rim. Is he cranky like that all the time?"

"He's a prayin' wampus with no morals, growled the mate spitting violently into the water. "Some day I'm gonna . . ."

He left the sentence unfinished and a long silence hung after the words. Presently he continued, but with a slightly lowered voice.

"It's this way with me," he said. I've banged 'round a lot—Singapore, Barrow, Yucatan, Port Said—There ain't nobody ever called me a gentle soul. I generally gets along first rate with folks because I lets 'em alone. Lick or get licked—that's me. But this here doin' dirty work for a prayin' squid gets my goat. I needed the money or I wouldn't have signed on."

"We all do," laughed Jerry.

The mate nodded.

"Yeah—that's what makes me sore. Here's this religious o' crab gettin' sixty dollars a case for salmon and no cut for the rest of us. All goes into the old Shylock's pocket. I ain't hankerin' for dirty work but when I has to do it I like to get paid for it. I'd like to chuck the old skinflint overboard."

"Sixty dollars is a lot of money for a case—of salmon," said Jerry significantly.

"Yeah!" The mate winked. "For salmon! Ain't it rich! I ask you, now!"

"What kind of salmon, for the love of Mike?"

The mate shot a cautious glance all around.

"Personal I think it's bonded salmon from B. C.," he replied. "Of course, I don't know. Nobody knows but the skipper. It's all in cases marked regular and all that. But I ain't dumb like an oyster—not me. I'm just guessin' that's all. I don't want to know nothin'. Sooner or later one of these cutters runs us down and the less I knows when that happens, the better chance I got of stayin' out of jail. Get me?"

Jerry nodded and jerked his head toward the distant islands.

"What are we lying here for?" he asked.

"F. O. B. airline express," grinned the mate. "You've got to hand it to the old wampus—he's right modern. He's what I calls a live limey. Just the same I'd like to bust his face."

Before Jerry could question him further, Captain Starbuck's voice was heard coming on deck. Billings with a wink and a hitch of his belt moved along the rail and began to berate one of the crew about some detail. Jerry rolled a cigarette and digested his information. Once a slow smile hovered at the corners of his mouth.

At noon, Captain Starbuck called the operator to the bridge and handed him a message.

"Shoot that through Radio corporation and get me answer," he commanded.

Jerry sent along a message of his own to accompany it. But as before, his message was in code. Where it went is nobody's business. A few minutes later Captain Starbuck's answer came back from the ship chandlers. The answer was "o. k." Merely that and nothing more, to quote the well-known and justly celebrated raven that expressed itself from the top of a door. But the answer seemed to please the skipper so that he was almost polite to Jerry O'Malley.

Two hours later a plane appeared off the land side. The drone of the engine, three thousand feet up, brought the Captain on deck. The pilot hung out of the cock-pit and circled the *Cassie S.* several times, finally coming close enough for Jerry to make out that it was a seaplane, but carrying no designating marks. One of the crew signalled with a flag.

The plane promptly turned, banked sharply, dipped down, passed the *Cassie S.* almost at water level, and went splashing and careening in between the rolling swells. With perilous skill it finally came to rest a short distance away, its wings dipping and rocking with the roll of the water.

Under Captain Starbuck's orders, a number of cases marked "Canned Salmon" were brought up from the hold, transfered to small boats and taken over to the plane. There, with great difficulty, they were gotten aboard and stowed in the cockpit. The pilot passed the skipper something—money Jerry figured—and the pilot clambered back into the driver's seat. One of the men in the ship's boat climbed out on the forward structure and gave the propeller a twist.

The powerful engine sprang into life with a roar. As the propeller blurred with the terrific speed, the man dived backward off the plane which passed over him with gathering headway. Even as he struck out for the small boat, the plane skipped along between combers, smacked the crest of one and burst it into spray, crashed half through another, spun half around, clipped another wave that drenched the pilot, and then spurning the water, rose lightly into the air and was away—a mechanical gull, winging down the sky.

"By golly, that's a man's job at that!" Jerry said admiringly as he watched the plane out of sight. And then, his eyes suddenly dilated and he stared long and intently at a tiny wisp of smoke that hung off there beyond the Farallone Islands— hung and spread out and seemed to grow blacker minute by minute. Almost at the same instant the lookout, more alert then Jerry had supposed, saw the same thing.

His sharp call brought the mate Billings on the run. The latter watched the smudge for a second and then sped toward the bridge where Captain Starbuck had gone. Down below the engine room controls jangled and the *Cassie S.* began to lumber through the water. Jerry strolled over to the wireless cabin, dropped down in his chair and donned his receivers.

There was a lot of static, but this bothered Jerry not a whit. He rolled a cigarette and waited patiently. Presently something else crept in—something that was not static. It was a clear insistent call—"JO"—that broke through sharply. By a singular coincidence these happened to be Jerry O'Malley's initials which may have accounted for his interest in them. As a matter of fact the message that followed was intended for him. The message was "Oglot."

Jerry seemed to derive a vast lot of satisfaction from "Oglot." There are many people like that. A single word will throw them into ecstacies. Jerry being a true Irishman, patted the gun under his belt to see that it was in place, smiled happily and hummed a little tune as one about to go into conflict. With the cheery joy of a bull dog walking down the middle of an alley on Sunday morning, he went back on deck.

The *Cassie S.* with its praying skipper, its unwilling mate and its non-descript crew, not to mention its canned salmon, was hog-wallowing southward and traveling as fast as its ramshackle engines would permit. Directly aheel and gaining on them every minute was a neat, little grey craft with a sassy look, a Union Jack and an air of knowing what it wanted. Its stack was laid back and the ripple over its bow indicated that it was in a hurry to get it.

Jerry found Clancy Billings hanging over the rail and watching it with disconsolate eyes.

"We seem to have company," he remarked genially.

The mate grunted.

"That there, buddy, is Leavenworth prison chasin' us. The old wampus is up on the bridge prayin' to hisself and kiddin' himself into thinkin' he can get away. Ain't it sad? Makes it nice for me, it does."

"How's that?" asked Jerry with a chuckle, at the other's disgust.

"My girl says she won't hook up with me if I gets in jail any more. Every time we sets a date I'm in the hoosegow. She's gettin' tired of it. I promises to save my money this trip and not go drinkin' or fightin'. Now it's all off. When she hears I got pinched for running hooch with the Prayin' Jonah—well, my goose is cooked." He shook a fist at the bridge. "I'll kill that wampus yet, I will."

Jerry laughed outright, and then his

face changed as he came to a sudden quick decision. He spoke suddenly and his words had a whip crack of authority that jerked the mate up like a taut hawser.

"Billings, do you want to stay out of jail and marry that girl?"

The mate looked at him with his mouth open.

"Hey—fellah—ask me!" he said.

"All right—line up that helpless crew and crack the first man that makes a move. Understand? I'm in charge now and you take orders from me!"

"Hey" gasped the mate. "Th'that's mutiny!"

"Not with this behind you!"

The operator held out his hand with something cupped in it. Billings looked.

"Criminently—Gee Moses A'-mighty!" he exclaimed and his color faded to a dirty tan.

"You've got a chance to be on the right side, Billings. It's up to you. What's the answer?"

The mate hitched his feet in sudden excitement and his face lighted suddenly.

"Lead on, buddy," he said. "I been overseas. I can take orders!'

"All right. Line up that crew."

Jerry snapped out the command and raced for the bridge. The next instant he kicked upon the door of the wheel house and stepped inside.

Captain Starbuck was at the wheel. He whirled as the operator entered.

"God bless me, what do you mean by bursting in . . ."

But Jerry cut him short.

"Captain Starbuck, you are under arrest. The United States Government is in charge. You will set your ship's telegraph to' stop' and await orders from the revenue cutter." He held out his badge, the insignia of the Internal Revenue Service.

The skipper's face purpled.

"By Saint Andrew," he said. "You're the dirty skunk that brought that hell hound down on us, are you? I'll show you how we treat your kind on this ship." He dropped the wheel, and jerked a revolver from a chart drawer. Even as he levelled the weapon up, Jerry sprang for him, wrenched it from his hand and planted a blow in the captain's face. The gun clattered on the floor as the two men clinched.

There isn't much room in a wheel house for a battle between two full-sized men, not when one has murder in his heart and no conscience. But of the two, the skipper's style was the most cramped. He was used to fighting on the open deck with plenty of room to bite and strangle. Jerry, who had grown up in a boxing club and had "stepped" semi-professionally in a ring, needed only an exposed chin and four inches for his right fist.

Billings, down on the deck, heard the scrap and ran lightly up the ladder.

Jerry became aware of him first, standing in the door, watching the battle with gleaming eyes. Instead of rushing to aid of his commander as a loyal mate should, he calmly bit off a chew of tobacco from a herculean plug, and rolled it under his tongue with a thoughtful bovine expression.

"Grab his feet, Mr. Billings!" the skipper panted.

"Go to hell," said the mate placidly. "I hope he breaks your neck!"

The captain "God-blessed" him under his breath and tried for a strangle hold. Jerry planted a stiff left in the old man's midsection.

"Kick him in the face," Billings advised judicially. "He's kinda weak there!"

Jerry grinned and blacked the skipper's eye with a neat hook, and had his own head rocked with a cork-screw that carried a terrific impact. Jerry shook his head, got the opening he wanted and stepped back. With a twisting motion he brought up his fist, striking upward from the rib-line. The skipper saw it coming, recognized its deadly quality, tried to duck out of it and failed.

The blow took him directly on the point of the chin, and the commander of *Cassie S.* turned up the soles of his feet and struck on his back—out, pulling over a table and a stack of books as he fell.

"Very sweet," commented the mate. "Very VERY sweet and pretty!"

Without a glance at the fallen skipper, Jerry jumped for the ship's telegraph and signalled the engine-room crew for a full stop. This done he swung on the mate.

"Captain," he said, "you are in charge. I want the papers and the old boy's log."

"Yes, sir." The mate jerked open a drawer and slid them across the chart rack. Then with something in his face that reflected the joyful cameraderie of the Great War, he drew himself up and saluted with the beautiful precision possible only to an ex-sergeant of marines.

"Yes sir—right away sir!" he said snappily.

And Jerry O'Malley, with an answering gleam in his own eyes, came to attention and returned the salute with the faultless accuracy of one who has served under a chief-of-staff at a not too remote period of time.

Fifteen minutes later a boarding party came aboard from the revenue cutter, heavily armed and prepared for trouble. The officer in charge seemed a bit surprised at the stunned, polyglot crew. But the thing that caught his eye and held it was Captain Aaron Starbuck, the "praying Jonah" with two black eyes and a cut lip violating all the canons of his own reputation, by cursing with a fluency of diction that fairly scorched the deck, at the handcuffs on his wrists. The officer turned to Jerry.

"We thought we had missed you until we got your code message. It was relayed back to us from shore."

Jerry grinned.

"And I got yours," he said. "Did you see the plane?"

"Yes. It will walk right into our hands. There's a scout from Crissey field on its tail and we've got the clerk in the chandler's that was a go-between. A cleanup, sir."

He turned to the shackled commander, now the target for the grins of his own crew.

"Captain, my compliments, and will you kindly go aboard the cutter?"

"Ar-r-rh!" snarled the captain and spat out a loose tooth.

"And you too," snapped the officer to Billings. Jerry interposed.

"Billings is going to bring the *Cassie S.* in for us," he said. "He's been working with me on this. He's a government witness."

"Oh, all right," said the officer. "You'll follow us then, will you?"

"Yes, sir."

"Then Captain—I'll trouble you to come aboard alone."

Something flickered in the mate's face. It lighted suddenly and he slapped his leg. Then he whirled on the abject crew of the *Cassie S.*

"PRAYERS!" he roared in stentorian imitation of Captain Starbuck's best Sabbath-morning manner. "And God bless me if I don't skin you alive if you're slow about it!"

There was a moment of paralyzed consternation and then as one man the dazed crew sank to its knees, at the familiar quotation from the verbal ritual of the "praying Jonah."

"We thank Thee for Thy many blessings!" roared the mate.

"WE THANK THEE FOR THY MANY BLESSINGS!" bellowed the crew with real form.

" . . . and for Thy kindness in sending this cock-eyed old wampus Captain Starbuck to jail where he belongs—amen!"

"AMEN!" roared the crew, this time with such volume and enthusiasm, that a sea gull, perched in the halyards and watching events with astonishment, shut his eyes and fell backwards into the water.

"Well I'm damned!" ejaculated the dapper young officer and clutched his side-arms nervously.

But Jerry O'Malley only leaned against the rail and laughed and laughed until the tears ran down his cheeks.

If any of you who read, would like to know just what Captain Aaron Starbuck thinks about the whole matter you might drop into Leavenworth prison some time and ask him.

MODIFIED BEST SUPER-HETERODYNE

(*Continued from page 16.*)

necessary. When wires had to be run through the metal shelf or partitions they were passed through ¼ in. holes drilled in the sheet metal and fitted with small bakelite or hard rubber bushings turned out on a lathe. If this procedure is too much trouble, spaghetti may be used instead of the bushings without appreciable difference.

Upon completing the wiring, a careful check of all leads should be made, and one of the tubes inserted in each socket in turn, with the A battery connected. It is also a good plan to connect the plus *A* battery lead to the 22, 45 and 90 volt leads in turn, examining the filament of the tube to see that it does not light. If the filament lights while the *A* battery is connected to the *B* terminals there is a short circuit somewhere in the wiring which should be located before the *B* battery is actually connected to the set.

Connect the antenna to the terminal provided for it and make sure that the shield is grounded and connected to the common point of the rotor and stator windings of the variocoupler. Insert a .1 megohm grid leak in the mounting at the rear of the oscillator compartment and place all the vacuum tubes in their sockets. Turn on the filament rheostat and adjust the filament circuit to 3 volts, with the voltmeter as a guide. Plug in the headset in the output jack and turn the oscillator dial until a local station is heard. Set the antenna and secondary condensers for maximum volume and adjust the volume control rheostat until the volume in the headphones is of the proper value. It may be that the grid leak connecting the oscillator and frequency changer is too small, in which case the local station may seem unduly broad in tuning, or else the signal is distorted. Try substituting a .25 megohm leak in place of the .1 megohm and see if an improvement in selectivity and quality is noted. In extreme cases, where the oscillator tube is delivering a large amount of energy, a .5 megohm leak will be required, but it has been found that for the average run of tubes a .1 megohm resistance is the correct value.

The rotor of the coupler should now be adjusted for critical coupling, which will be at a point somewhere near its right angle setting with respect to the secondary coil. At this point the signal will suddenly become weaker and the secondary adjustment more critical, so that the coupling should be set at a point before the signal drops in volume. This adjustment will give a surprising degree of selectivity and need not again be touched even for the shorter wavelengths.

In case the grid condenser C_3 in the frequency changer circuit is of too large a capacity, a different setting of the secondary condenser will be noted for each side band setting of the oscillator, these two settings being noticeable at the higher wavelengths. The only remedy is to reduce the capacity of the condenser. For convenience in the experimental layout, a variable XL grid condenser normally ranging from .00015 to .0005 mfd. was dissected and a few of the plates removed, so that the minimum capacity was approximately 30 mmf. and the maximum around 100 mmf. The small adjusting screw provided with the condenser will permit changing the capacity to suit the circuit, and it should be set at a point where the changing of the oscillator dial from one side band to the other will not affect the secondary tuning.

Having adjusted the oscillator system and the rotor of the coupler for the wavelength range from 200 to 600 meters, it becomes necessary to adjust for the shorter waves. Remove the long wave oscillator coil and insert the

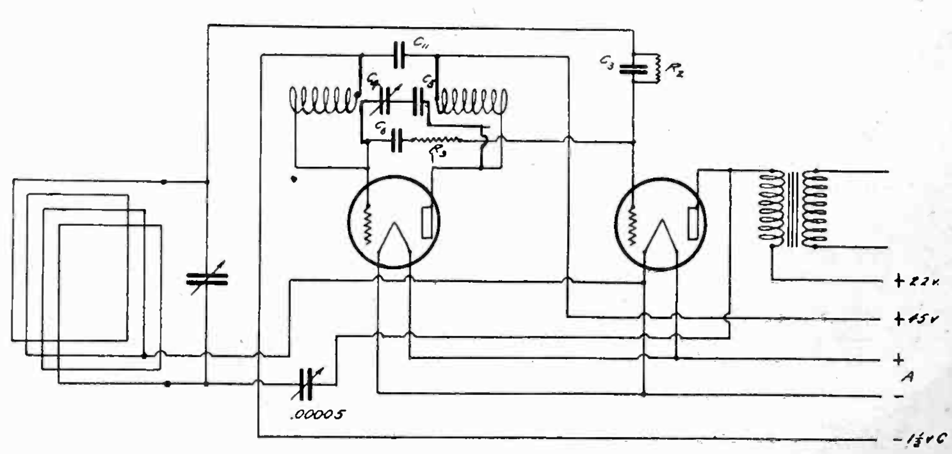


Fig. 4. Method of Connecting Loop Antenna.

coil designed to cover the range from 50 to 150 meters The tap on the loading coil may be brought out to a terminal block located on the rear of the shelf, the antenna lead being connected through the series condenser to whatever terminal corresponds to the correct tap on the coil. The antenna should be connected so that only 15 turns of the loading coil are in the circuit, and the secondary coil tap adjusted so that but 10 turns are connected across the secondary condenser. This will mean dead end losses, to be sure, but the intermediate amplifier provides so much amplification that such losses can be tolerated in order to obtain the desired simplicity of the tuned circuit.

If the antenna is about 75 feet long, measured from the far end through the receiver to ground, the antenna system should tune over a range from 50 to 200 meters, with the 15 turn load coil. With the entire loading coil and secondary in the circuit the range is from 180 to 580 meters. Where waves from 150 to 300 meters are desired, the use of the oscillator coil having the 100-300 meter range is recommended, so that the oscillator settings will be near the center of the scale, and the secondary turns should be increased to 24. If the antenna circuit does not tune satisfactorily at the waves between 50 and 200 meters, the tap taken out on the loading coil may not be at the proper point and in that case a little experimenting will soon show the proper amount of loading inductance which should be in the circuit.

The completed set should be fastened to the cabinet by means of four machine screws, with acorn nuts, as shown in the picture of the front panel layout. At each end of the cabinet, strips of wood at least ½ in. wide should be fastened so that they will furnish a support for the panel, the mounting screws passing through holes drilled in the wooden strips. The distance the strips are set back from the front edge of the cabinet depends upon the thickness of the panel, and for a 3/16 in. bakelite panel, with 1/16 in. sheet brass shield, the strips should be set back a total of ¼ in.

Should the constructor desire to use a loop instead of the outdoor antenna, the antenna series condenser, loading coil and coupler can be omitted, thus requiring only two variable condensers. The loop should be connected to the frequency changer as shown in Fig. 4, in which case the regenerative loop feature can be employed, using a small balancing condenser of not over 50 micromicrofarads.

In the next issue of RADIO the baseboard model will be described, for use especially with a loop antenna. Those who wish to employ as many of the storage battery tubes as is practicable will find the data of value, at the same time enabling the conversion of previously built sets into the new arrangement.

NAVAL SHORT-WAVE WORK

(*Continued from page* 10.)

The Naval Research Laboratory was transmitting on a 20-meter wavelength, whereas the Australian amateur station was sending on 21 meters. The Naval shortwave receiver has a frequency range from 2,000 to 17,000 kilocycles (150 to 20 meters.)

The transmitter employed by Dr. Taylor, consists of three 250-watt vacuum tubes. These are of the XL filament type. It has a frequency range from 2,000 to 17,000 kilocycles. This transmitter was used in "working" both the stations in London, England, at noon and in Sydney, Australia, during night time. Regular communication can be carried on with stations in California at any period of the day, thus giving proof that high frequencies travel over considerable distances during daylight. Low frequencies are not so fortunate in this respect.

The Naval Research Laboratory is not only demonstrating the utility value of short waves on the order of 20 to 100 meters—but in the transmission of high frequencies this experimental station is operating precisely on the wavelengths indicated. The deviation—from 20 meters, for instance—is negligible, estimated to be only one-thousandth of one per cent. This work of accurate frequency adjustment is a credit to Doctor Taylor and his co-laborers. If all the radiocast stations operated upon a correspondingly precise frequency basis there would be less confusion in the air and not so much difficulty in separating the signals of two transmitting stations at the receiving points.

MORE MILES TO THE DOLLAR

(*Continued from page* 22.)

dred stations on a good loud-speaker. The list includes stations up to 2000 miles distance. By the addition of another step of audio-frequency amplification the volume may be increased to a point where it is beyond criticism.

It is my plain opinion, based on the experience outlined above, that the Browning-Drake is destined to become one of our premier circuits. It excels most neutrodynes, costs less than a good superheterodyne, and has none of the maddening idiosyncrasies of the Roberts.

Ho, for some magnet wire and a handful of twenty-penny nails—the rest of the stuff is in that old set of yours that mixes missing people with grand opera and gets out of town like the small boy who decides to run away from home, but desists from hunger before he reaches the city limits.

A short piece of common lamp-cord, with terminals on each end, will make a very handy article around the radio table.

IDEAL TUNING IN KILO-CYCLES

(*Continued from page 26*)

The case of the straight line wave-length condenser is much stronger, as its functioning in tuning is excellent and its capacity ratio great. When used with the proper inductances it admirably covers the entire band of desired frequencies, and possesses the only slight disadvantage of unequal station spacing. Its ideal use, though, is in wavemeters, etc., but in time to come, it also, must be supplanted by the straight line frequency type, whose use on very short waves or the extremely high frequencies now opening up, is imperative.

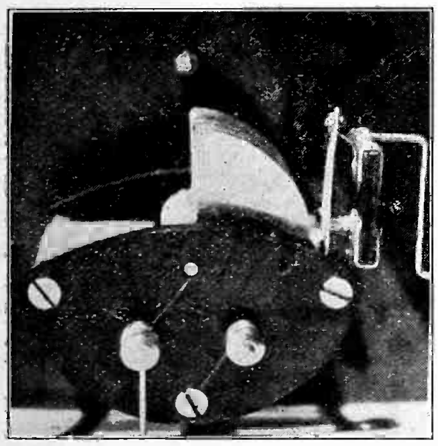


Fig. 6A. Series Condenser Closed.

There are many sets in use today that fail to tune down to the new radiocast frequencies. This trouble may be remedied by using a small fixed condenser in series with the set's variable condenser, so that the total effective capacity is thereby lowered, thus increasing the range. A .00015 or .0002 mfd. condenser may be fastened and connected to the stationary plates of the receiver's variable, as in Fig. 6. A short strip of spring brass with a contact point and backed by a thin piece of insulating material is mounted on the condenser's upper terminal, so that rotation of the

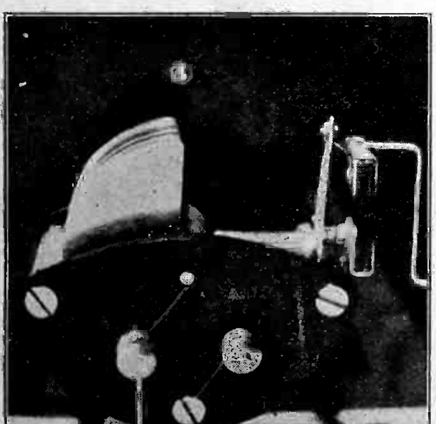


Fig. 6B. Series Condenser Open.

variable's plates causes the contact to shortcircuit the small fixed condenser. The lead to the stationary plates of the variable is taken off and connected to the fixed condenser's upper terminal.

RADIOADS

A Classified Advertising Section Read by Better Buyers

The rate per word is eight cents net. Remittance must accompany all advertisements. Include name and address when counting words.

ADS FOR THE SEPTEMBER ISSUE MUST REACH US BY AUGUST FIFTH

A RECHARGEABLE "B"
With a Strong Guarantee

The See-Jay Battery has met all tests and is endorsed and recommended by the Washington Information Service Bureau and thousands of satisfied users. Genuine Alkaline connected elements. Strictest Government tests passed. No drilling or wiring. Connectors crimped under 1000 pounds pressure. Save Time, Temper and Money. 100-Volt Unit, $7.00; 140-Volt, $10.00. Why pay more? Complete assembled batteries, solution separate, shipped dry, 100-Volt, $12.00; 140-Volt, $16.00. See-Jay Units sold on money-back guarantee. Write for literature and send 20c for improved sample cell. See-Jay Battery Co., Dept. R, 915 Brook Ave., New York. Prompt Mail Order Service. Wholesale and Retail.

ARC & SPARK SYSTEMS
Send for Descriptive Circular QRD.
Interesting and Instructive
Pacific Radio School 433 Call Bldg., San Francisco

2650 MILES DISTANCE with one tube. Any novice understands our Simplified Instructions including Panel Layout, picture diagrams, etc. Write for BIG FREE BOOKLET. VESCO RADIO CO., BOX 117-RC, OAKLAND, CAL. (TC)

AGENTS—Signs for stores and offices. Entirely new. $50 week easily made. World Signs, 116 W. Washington, Chicago. (TC)

SWAMP THE STATIC. Circuit and specifications for powerful four-tube broadcast receiver covering 40 to 600 meters mailed for $3.00. Easy when you know how. W. G. CONGER, Independence, Missouri.

LEARN CODE in one hour. Method now $1.50 postpaid. H. Anderson, Box 593, Great Falls, Mont.

THE NEW square plate Ensign Variable Condensers. JUST OUT! Brass plates. Efficient on low waves. Get one of these condensers without cost in return for your subscription to "RADIO" for only two years. Five dollars brings you the condenser and the magazine. Send your check now. There are only a few of these condensers in our stock. "RADIO," Pacific Building, San Francisco.

THE LEFAX RADIO HANDBOOK, 7th Edition. In bound form. Contains a wealth of useful radio data. Very convenient size for carrying in your pocket. This $2.50 book is given to you free of cost if you subscribe to "RADIO" for one year. $2.50 covers the entire cost of this big offer. "RADIO," Pacific Building, San Francisco.

PHONOGRAPH UNITS FREE. The new Union Fabric Unit with soft rubber attachment. One subscription to "RADIO" for one year at $2.50 brings you the unit as a premium. Get one now. Only a few on hand. "RADIO," Pacific Building, San Francisco.

KEEP station records in THE RADIO LOG BOOK, a handy pamphlet for recording stations heard, dial settings and other data. The price is only 10 cents per copy. For sale by Pacific Radio Pub. Co., Pacific Bldg., San Francisco.

FUNNY RADIO STORIES. 12 of 'em in the "RADIOBUSTER," Volney G. Mathison's humorous thriller. 112 pages in bound form. Mathison knows how to write. You will enjoy his stories. Send $1.00 today for a copy of the "RADIOBUSTER," or get it free with your subscription to "RADIO" for one year ($2.50). Pacific Radio Publishing Co., Pacific Bldg., San Francisco.

YOUR RADIO QUESTIONS ANSWERED FREE.—Gerald M. Best, technical editor of "RADIO," will answer ten radio questions for you if you subscribe to "RADIO" for only one year at $2.50. Get this wonderful technical service, together with a good, practical radio magazine. "RADIO," Pacific Bldg., San Francisco.

FOR SALE—Kennedy Type 110 Universal and Type 525, 2 stage amp. $80.00 Paragon R. A. 10 Tuner and DA2, 2 Stage Amp. $40.00. Magnavox A. C.-2, 2 stage power amp. $20.00 Magnavox R-3 $15.00. William Gray, Jr., Milford, Del.

RADIO HOSPITAL—Specialists in Neutrodyne and Superheterodyne, Dept. 3, Abilene, Kansas. (T.C.)

TRANSMITTING HAMS! ! ! 500 cycles makes great stuff for the plates. Listen for KFUH and see how it sounds, and carries. Have several generators, 500 cycle, AC, from ¼ to 2 K.W. which will make the tubes reach out in the same way for you. Priced right. Send for details. D. B. McGown, 1247 Forty-seventh Ave., San Francisco, Calif.

TESTED GALENA CRYSTALS 50c pound, bulk. Buskett, Metallurgist, Joplin, Mo. (3TO).

GENUINE EDISON ELEMENTS, 2 cents pair. Connected Elements, crimped on under heavy pressure, 3 cents pair; any quantity. SEE-JAY BATTERY CO., 915 Brook Ave., Dept. R., New York City.

BUILD YOUR OWN RECHARGEABLE "B" BATTERY. Large Edison elements wired with pure nickle wire, welded connections 7½ cents per pair postpaid. Sample and "dope" sheet 10 cents. Separators ½ cent each. Good money may be made assembling and selling these batteries to radio set owners. Chas. Snively, 7UV, Woodburn, Oregon.

1500 VOLTS FOR $45.00! ! ! RADIO GENERATORS. Brand new General Electric 24 volt, 31 amp. drive, to 1500 V 233 M.A. Naval Air-Service radio dynamotors $45.00 each. These machines also make first class high voltage generators for plate supply, and as such can be furnished with shafts extended for belt drive for $3.00 extra, F.O.B. San Francisco. Have 750 volt tap, and may also be used on lower input voltage or lower speed for lower voltage. D. B. McGown, 1247 Forty-seventh Avenue, San Francisco, Calif.

LARGE NUMBER STANDARD PYREX COPPER PLATED, large size Leyden Jars, .002 Mfd., Capacity; all brand new and in original packages; made by John Firth of New York. Priced at $2.00 each. (list at about $7.50). D. B. McGown, 1247 Forty-seventh Avenue, San Francisco, Calif.

SPECIAL TRANSFORMERS, steel, insulation, distortionless audio transformers, "B" supplies. S. M. Gardner, Emeryville, Calif.

SALESMAN, experienced assembling demonstrating and selling radio, desires connection with northwest firm, calling on dealers or selling direct. Have car, references exchanged. W. I. C., 2110 N. Sheridan Ave., Minneapolis, Minn.

FOR SALE—Make your loud speaker set be heard three blocks. Western Electric three-stage power amlithree blocks. Western Electric three-stage power ampli-Newman, Calif.

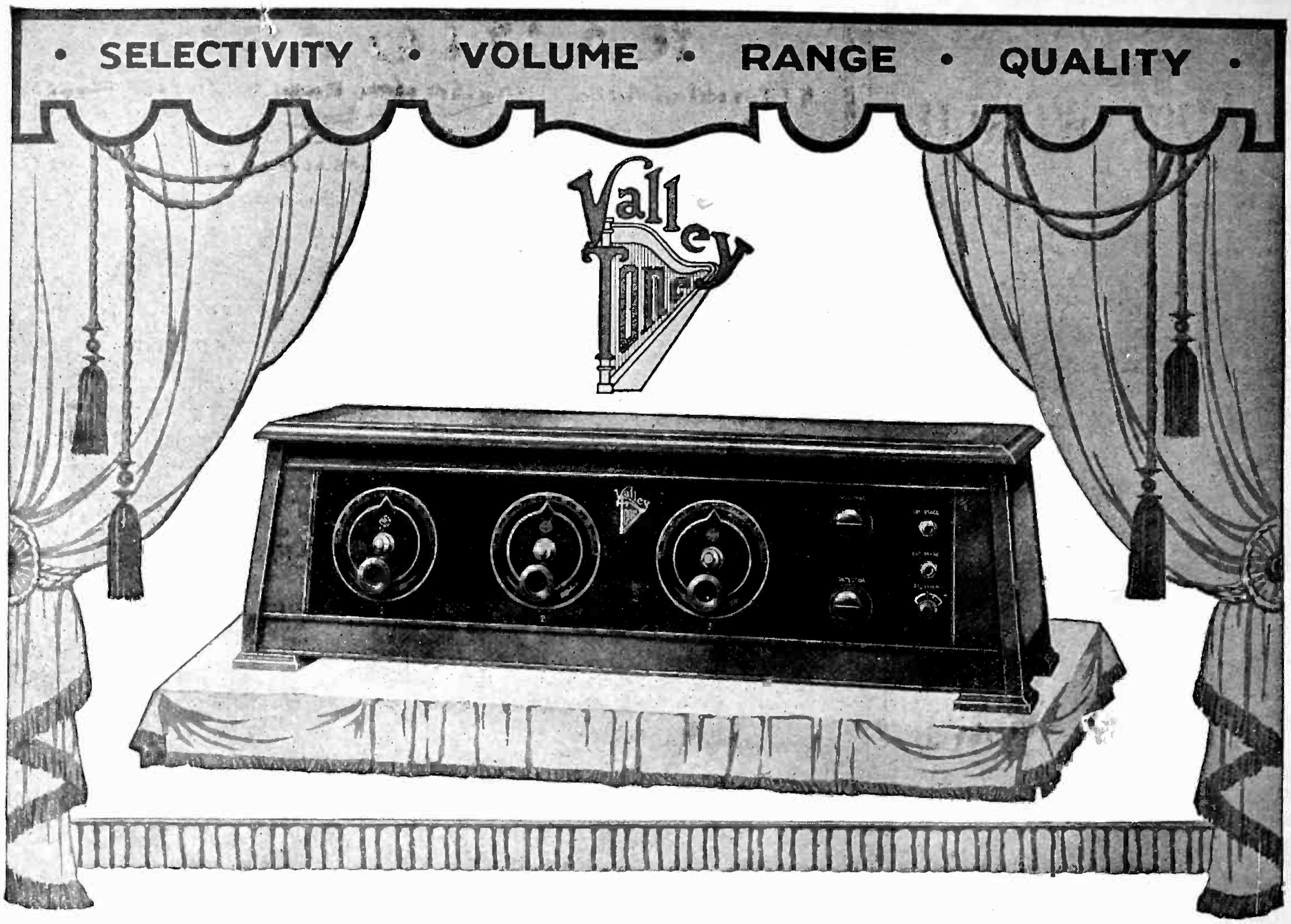
HERE'S THE PROOF!

AN UNSOLICITED testimonial from an advertiser using the RADIOADS columns has this to say in regard to the pulling power of these little business producers:

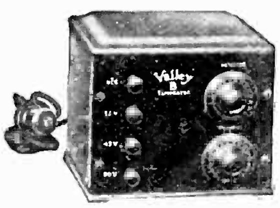
"Had no trouble in disposing of my Kennedy receiver after running an ad in your July number. Received answers from all over the country.
"(Signed) Elvyn Beall,
"Box 246, Newman, California."

There's the proof. You can also sell your used apparatus if you advertise in these columns. The rate is only 8 cents per word. Mail your copy now for the next issue.

RADIOADS PAY!

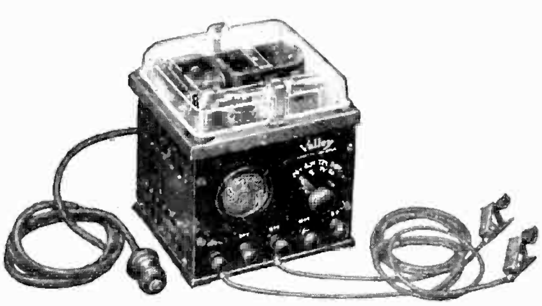


New— The Valleytone Radio Receiver



VALLEY B-ELIMINATOR

Takes the place of B batteries in providing plate voltage. Has rheostat controls for exact adjustment.



VALLEY BATTERY CHARGER

Charges A Battery at correct 6 ampere rate with minimum current consumption. Also suitable for B storage batteries. No bulbs or liquids.

Here is the Valleytone Receiving Instrument with a new principle in radio reception.

By the new "potential balance" method (Pat. Pend.), which is used for the first time and exclusively in the Valeytone Receiver, increased efficiency is obtained with the use of low loss parts throughout.

In planning the Valleytone, we realized that to make just another receiving set would not be sufficient. Accordingly we selected to head our radio engineering staff a man who for years has spent practically his entire time in radio research.

With our engineers, this expert went to work to develop a superior instrument. The result was the "potential balance" method of controlling radio frequency. The "potential balance" control suppresses all tendency of the receiver to go into oscillation and makes possible reception efficiency never before achieved in a five-tube radio frequency receiver.

In addition to the use of "potential balance" for the first time, the Valleytone is also employing for the first time the toroidal or doughnut coil radio frequency transformer. This coil is a special bank-wound toroidal giving the peak of efficiency. It will give greater distance, volume, selectivity and quality of tone.

The Valleytone Receiving Instrument has three tuning vernier dials and two rheostat dials, one governing the detector and one governing the radio frequency. It also has two jacks on the panel. Underneath the jacks is an A battery switch. All wire connections are made from the rear.

The cabinet is solid walnut in two tones, with inlaid gold stripes. The panel is Bakelite, engraved and lettered in gold. The whole instrument makes a beautiful appearance--- an ornament to any environment.

VALLEY ELECTRIC COMPANY
San Francisco Office: 144 Second Street

Valley Electric

See the Valleytone Receiver, Valley B-Eliminator, and the Valley Battery Charger at the Pacific Radio Exposition, San Francisco, August 22-28.

GENERAL RADIO

Condensers

are BALANCED

Electrically and Mechanically

for Perfect Performance in Radio Reception

For use at broadcast wavelengths General Radio Type 247 condensers represent the best balance between low conductivity, eddy current, and dielectric losses that is consistent with efficient design and popular price.

The plates of the rotor and stator groups are individually straightened before assembly and firmly soldered in a jig while they are in perfect alignment. The use of high-grade hard rubber in the end plates eliminates entirely eddy current losses from the end plates.

Specially shaped plates assure a uniform wavelength variation.

Positive contact spring bearings provide a good connection with the rotor group and eliminate the disadvantages of a pig tail connection. Mechanically as well as electrically General Radio condensers are the standards of excellence.

Rotor plates are counterbalanced to permit smooth operation and accurate dial settings.

Lower losses and lower prices make General Radio condensers the outstanding values for popular use.

Type	247-H 500 MMF Vernier	$5.00
"	247-F 500 MMF Plain	4.00
"	247-M 250 MMF Vernier	4.50
"	247-K 250 MMF Plain	3.50

Write for descriptive folder, "Quality Condensers" and our latest Catalog 921-C.

GENERAL RADIO Condensers Have Good Interplate Conductivity and Low Losses.

Total condenser losses at radio frequencies are the sum of conductivity losses, eddy current losses, and dielectric losses.

Conductivity losses most seriously affect the efficiency of a condenser under working conditions. They arise from poor contacts between plates and from poor bearing contacts. Soldered plates and positive spring bearings reduce these losses to a minimum.

Eddy Current losses occur in metal end plates and condenser plates themselves. The use of hard rubber end plates eliminates entirely eddy current losses introduced by metal end plates.

Dielectric losses are due to absorption of energy by the insulating material. When a good dielectric such as hard rubber is used in the end plates they have less effect upon the efficiency of a condenser at radio frequencies than any other set of losses.

See our product at the
PACIFIC RADIO EXPOSITION
civic auditorium
San Francisco
AUG 22-28 1925

GENERAL RADIO CO.
Cambridge, Mass.

PRINTED BY THE LEIGHTON PRESS, SAN FRANCISCO, CALIFORNIA