

DECEMBER, 1924

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RADIO

Reg. U. S. Patent Off.



BERNARD JAY MORSE





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If you only will — Old Santa himself from way up North will talk to the kiddies, and stories tell.

No Other Gift
Can Bring Such Cheer
A Gift to Last
Throughout the Year.



*A Merry Christmas
and a Happy New Year*

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Every set tested and approved by Government Licensed Radio Operators.

Tower's Scientific Headsets are guaranteed to be made of the best materials money can buy — highest test enamel, insulated magnet wire, best grade five-foot tinsel cord, unbreakable caps, polished aluminum cases — using the famous scientific head-band constructed for maximum comfort.

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The Tower Mfg. Corp.
98 Brookline Ave, Dept. E, Boston, Mass.

Scientific

Tell them that you saw it in RADIO

RADIO

Established 1917

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Due to the splendid success of thousands of constructors in building the 45,000-cycle super-heterodyne as described by G. M. Best in May RADIO, and due to the demand for more complete instructions for building the improved set, Mr. Best has completely revised his description, incorporating in it not only the best of the improvements submitted during the past six months, but also some new modifications of his own. The article will be accompanied by full-size panel and baseboard layouts that can be used directly as drilling templates. The Best super has been the radio sensation of 1924, providing great range and selectivity at moderate cost. This final constructional article should prove invaluable to all readers.

L. R. Felder proves simply yet thoroughly the superiority of the reactance coupled amplifier, developing many worth while facts in the course of his argument.

In "Round's Round Ground," Ferd Humphries describes the construction of a common-sense ground with low resistance so as to improve reception.

To improve the selectivity of a single circuit receiver Harry A. Nickerson shows some very simple changes that can be put in by anyone.

Mickey Doran continues his letters of a deep sea op. by illustrating a system whereby one aerial will give simultaneous reception on different wave lengths.

H. Diamond details a complete series of tests for a regenerative receiver.

In "Some Novel Ideas in Receiver Construction," E. E. Griffin presents complete data for a four-tube non-radiating receiver, combining portability, stability and selectivity at a cost of less than eighty dollars, including all accessories.

A new energy coupling system that fully meets the requirements of the recommendations of the Radio Conference is described by D. B. McGown, who shows its application to the Hartley, Meissner and reversed feedback circuits. It covers the range from 50 to 150 meters.

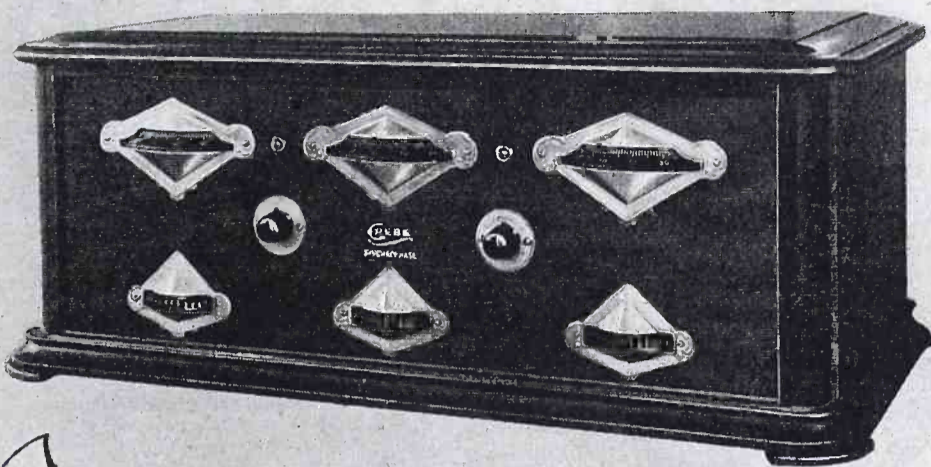
F. Dawson Bliley, 8XC, gives some improvements in the harmonic transmitter, getting down to the 10 to 80-meter wave bands.

F. L. Ulrich, in answer to many letters, tells of improvements and details in the construction of his interference eliminator, first described in May, 1924, RADIO.

L. W. Hatry finds that a C battery increases the output of his Hartley circuit and passes the details on for the benefit of his fellow amateurs.

The fiction feature is a humorous radio story entitled "The Jonah of Jasmine Bjones," by George Sumner Albee.

Robt. H. Reid
West Point, Ga.



The GREBE

SYNCHROPHASE

TRADE MARK

"By many words wit is exhausted."

— Lao Tzu

The Synchrophase needs no extravagant claims.

Doctor *Wu*

A BROADCAST Receiver that marks a step forward in radio design which will stand as a challenge to the industry for a long time to come. Its surpassing craftsmanship is equalled only by its easy, dependable operation.

Greater sensitivity has been gained through two stages of *Balanced* tuned radio frequency—the result of many months of intensive research by the Grebe engineering staff. Extreme selectivity has been obtained by the use of Binocular coils.

The settings for the various broadcast stations are equally spaced over the dials. This is accomplished by S-L-F (straight line frequency) condensers.

A new type of volume control gives an unbroken range of six variations of audio amplification.

Write for literature

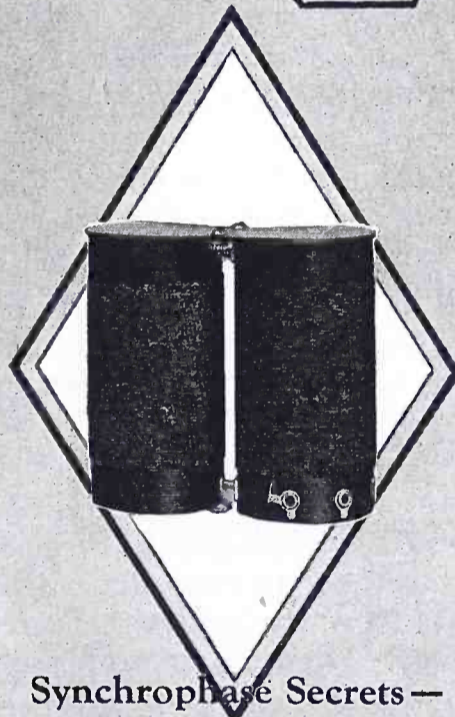
A. H. GREBE & COMPANY, INC.

Van Wyck Blvd., Richmond Hill, N.Y.

Western Branch: 443 So. San Pedro St., Los Angeles, Cal.

This Company owns and operates Station WAHG.

All Grebe apparatus is covered by patents granted and pending.



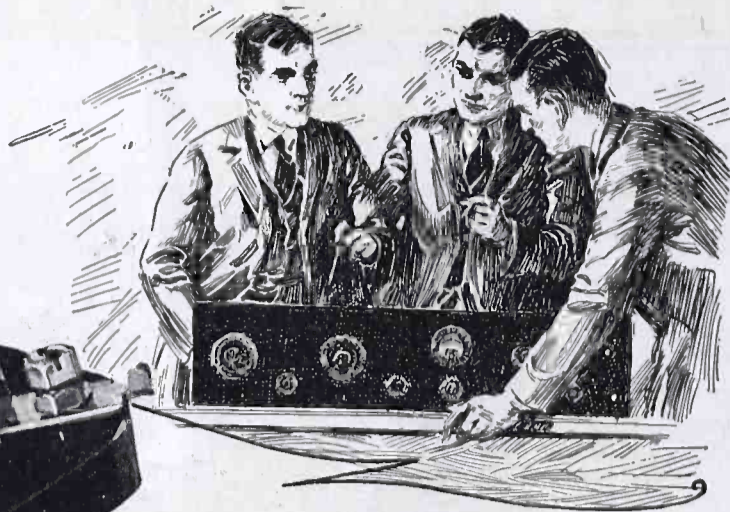
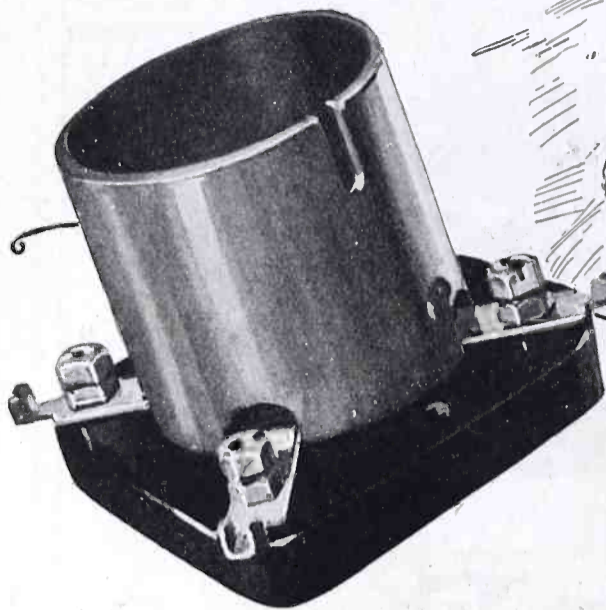
Synchrophase Secrets—
No. 1 The "Binocular" Coil

A truly fieldless coil with which the detector and radio stages are tuned. Unaffected by impulses from undesired local stations, its use is a tremendous factor in the success of the Synchrophase.



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

Tell them that you saw it in RADIO



The shell is **ORANGE Bakelite**—the base genuine **Thermoplax**

The More You Know About Radio the Better You Will Like This Socket

If ever a device were designed to increase the efficiency of all receiving sets, it was this new socket by the Master Builder. Radio engineers praise it—new set builders marvel at its ease of installation and the clear, loud reception obtained that bespeaks the absence of losses—many old-timers have even rewired their sets to establish new distance records and enjoy clearer reception with this better socket.

You'll like its construction, embodying a minimum of both insulation and metal—capacity absolutely minimized *without sacrifice of mechanical strength*. And its base of ebony Thermoplax in beautiful color contrast with the thin shell of orange Bakelite adds as greatly to the appearance of any set as the construction does to its efficiency.

You'll like its contacts (the source of losses and noise in most sockets); they are radically new in design, formed of phosphor bronze and *silver* plated—because the contact resistance of silver does not increase as it stands exposed to air. Then, too, electrical losses are minimized by providing maximum spacing between terminals, both in the insulation and in the air.

You will like the way the tube is inserted and removed without turning—which prevents twisting the bulb from its base. You will like its appearance—its small size—its neatness. You will like its silvered posts with slotted nuts that are fastened *well* with either screw driver or wrench. You will like the way the terminals are arranged for soldering—extra long so that they may be bent down where under-wiring is desired—and provided with ears to hold the wire in place for soldering. And best of all you will like the price, 90c. *This socket that meets the specifications of the most exacting radio engineer costs no more than most of those on the market today!* If your dealer has not yet been stocked, you can be supplied direct from factory at regular price plus 10c for packing and postage.

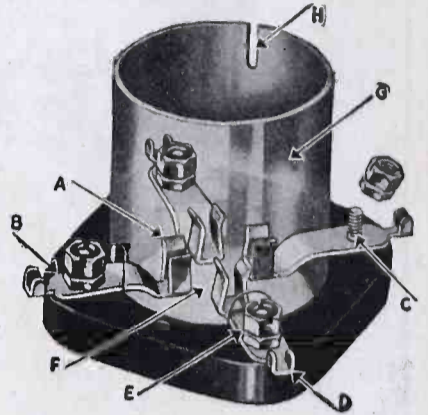
THE CUTLER-HAMMER MFG. CO.

Member Radio Section, Associated Manufacturers of Electrical Supplies

Works: MILWAUKEE and NEW YORK

“Built By The Master Builder”

*These Exclusive
Features Assure Better
Reception*



A
Perfect contact. Both sides of tube prong cleaned when inserted—no contact or wear on soldered end.

B
All metal parts *silver* plated—perfect contact for the life of the set. Silver may tarnish but its contact resistance does not change.

C
One piece contact construction. The binding post is **NOT** a part of the circuit—the wire to the socket always touches the contact strip which carries the current direct to the tube prong—no joints to cause losses.

D
Convenient terminals for soldering—full length to allow bending down for under-wiring. Ears hold wire in place for soldering.

E
Extra handy binding posts—tight connections with either wrench or screw-driver. Lock washers hold terminals rigid.

F
Wide spacing of current carrying parts both in air and insulation—true low-loss construction.

G
A minimum of both metal and insulation for low capacity. Shell of thin Bakelite—the base of genuine Thermoplax.

H
The tube is held in place by merely a vertical motion—no twisting to separate bulb from base.

The attractive orange shell helps identify this better socket, but the famous C-H trade mark both on the socket and on the orange and blue box is your genuine protection.



RADIO SOCKET

MAGNAVOX Radio

*The Utmost
in Quality and Value*



Always look for the Magnavox
Trade Mark when buying radio.



AS the rapid progress of the radio art leads every experienced user to expect supremely high standards of efficiency in his equipment, it becomes of vital importance to know what apparatus deserves your investment in hard earned cash.

Regarding the quality of Magnavox Radio Reproducers, their distinctive characteristics are too well known throughout the radio world for special explanation or comment.

Those for whom radio has become an actual daily need, however, will welcome a brief word about the new Magnavox Radio Receivers and Vacuum Tubes.

The unique feature of the Magnavox Set is the gearing together of

its several resonant circuits so as to permit **positive control by a single dial.**

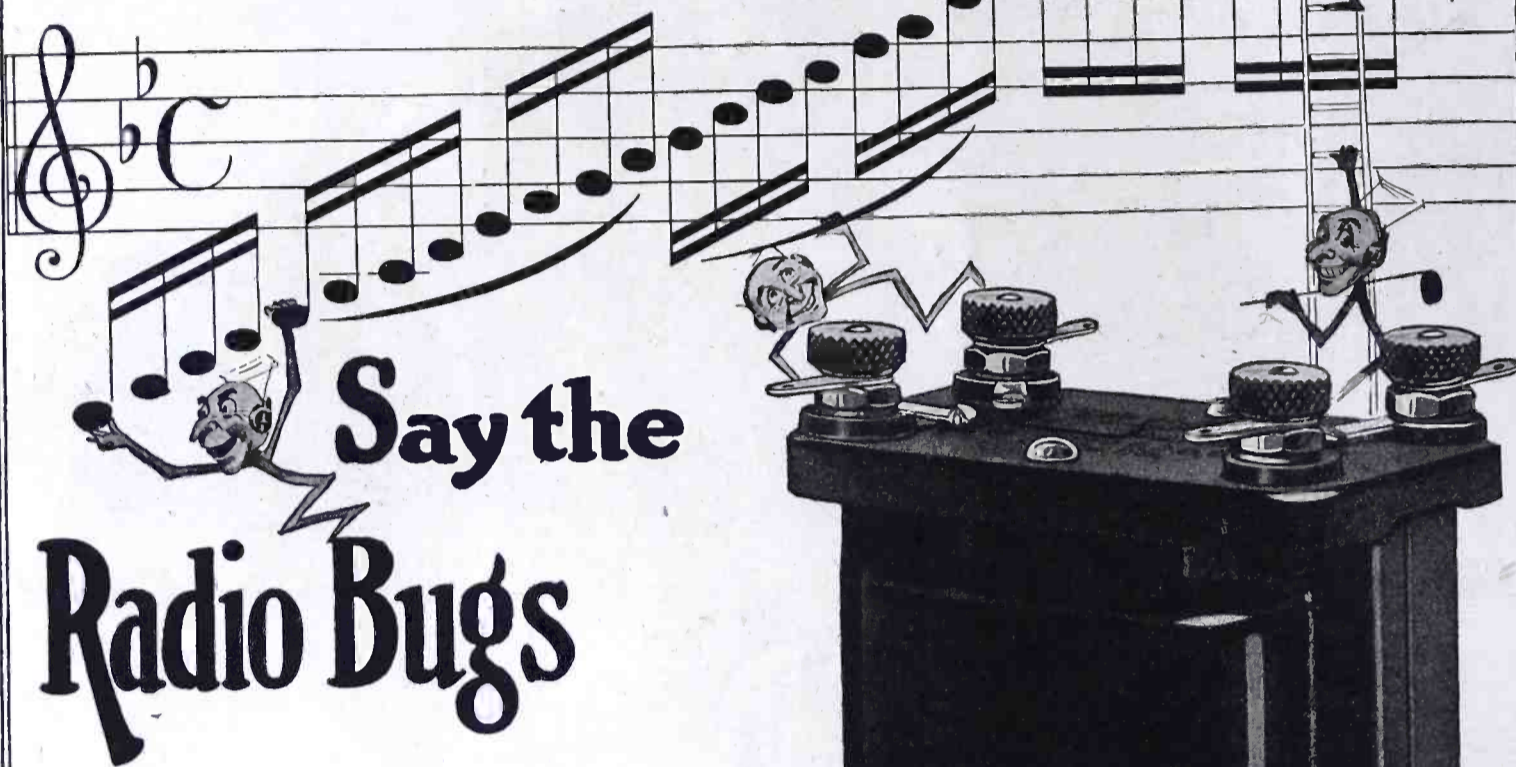
The Magnavox Tubes have extremely high amplification factors, and as detectors, give sharper tuning and eliminate microphonic noises.

It is well worth your time to examine these products at the nearest Magnavox store. Literature on request.

THE MAGNAVOX COMPANY
OAKLAND, CALIFORNIA

New York: 350 West 31st Street Chicago: 162 N. State Street San Francisco: 274 Brannan Street
Canadian Distributors: Perkins Electric Limited
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Clarity and Tone Range with Kellogg Transformer.



THE reproduction of the highest tones as well as those at the lower extreme of the scale, with faithful, pure quality is essentially the spirit of Kellogg transformer design.

The lover of better music searches for a rendition simulating the original orchestra. The ringing tones of brass, the mellowness of wood, the shrill of wind and the fan fare of reed, all in their individual expression.

The Kellogg transformer accomplishes this to a wonderful degree because of its perfect magnetic properties accomplished with the silicon steel laminations without punched holes.

This feature, distinctly Kellogg, eliminates losses to a greater degree than could be otherwise obtained. A transformer is as good as its absence of losses.

Plainly marked terminals, brass shielding, moulded Bakelite top, perfect finish, are further quality and design expressions.

Amplify your pleasure with perfect amplifiers.

USE — Is the Test

No. 501 — 4½ to 1 } Equally efficient. Price \$4.50
 No. 502 — 3 to 1 }

KELLOGG SWITCHBOARD & SUPPLY COMPANY

1066 WEST ADAMS STREET, CHICAGO, ILL.

*The
Musical
Instrument
of
Radio*

With mellow, resonant, amplifying horn of natural wood.

Model VI

(14 in. Horn) for the Home

\$30

Model VII

(21 in. Horn) for Concerts and Dancing

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MODEL VIII



The New Music Master Cabinet model, with "full floating" horn of natural wood, possessing all the wonderful reproducing qualities of the famous horn type Music Master. Powerful, sensitive unit; heavy cast aluminum tone chamber; handsome mahogany cabinet. Size 17 $\frac{7}{8}$ in. by 10 in. by 10 $\frac{1}{4}$ in.

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Connect any Music Master in place of Headphones. No batteries required. No adjustments.

Tops the Gift List

A MUSIC MASTER for Christmas! Have you thought of that? It is a thousand gifts in one. A gift that re-creates in pure, audible tones all that's best in thought and entertainment, broadcast from five hundred stations daily.

Music Master is the musical instrument of radio. It embodies all of the proved principles of sound reproduction.

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Have you heard Music Master? Your dealer will be glad to demonstrate it for you, or to place one in your home for trial.

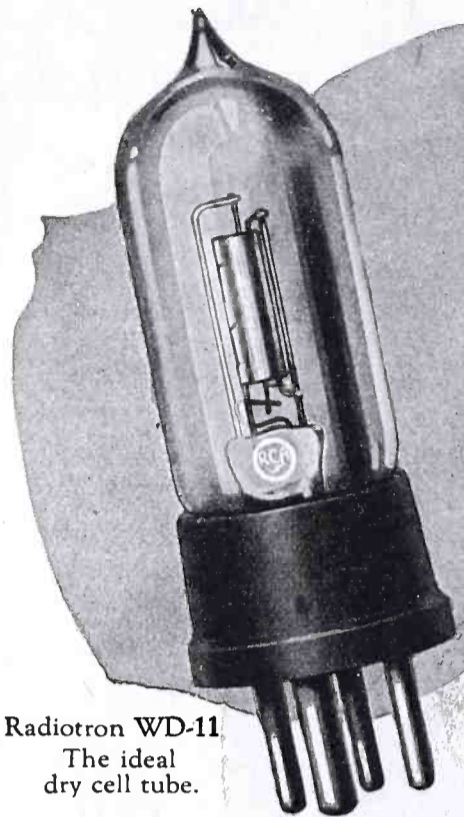
Broadcast reception is at its best only with Music Master---the musical instrument of radio.

Dealers Everywhere

MUSIC MASTER CORPORATION
Makers and Distributors of High-Grade
Radio Apparatus

TENTH AND CHERRY STREETS
Chicago PHILADELPHIA Pittsburg

**Music
Master**
RADIO REPRODUCER



Radiotron WD-11
The ideal
dry cell tube.



Give Radiotrons *for Christmas*



This symbol of
quality is your
protection

It isn't a genuine WD-11
unless it's a Radiotron.
It isn't a genuine WD-12
unless it's a Radiotron.
It isn't a genuine UV-199
unless it's a Radiotron.
It isn't a genuine UV-200
unless it's a Radiotron.
It isn't a genuine UV-201-a
unless it's a Radiotron.

Take a peek into any radio fan's set—and you know what to give him for Christmas. Note the type of Radiotron he uses. Go to any radio store—and when you buy, look for the name RADIOTRON and the RCA mark. Then you are sure to be giving him *genuine* Radiotrons. And mighty sure to be giving him the gift for a merry Christmas.

Radio Corporation of America

Sales Offices

233 Broadway, New York

10 So. La Salle Street, Chicago, Ill.

28 Geary Street, San Francisco, Cal.

Radiotron

REG. U. S. PAT. OFF.

RADIO

Established 1917

Volume 6

DECEMBER, 1924

Number 12

Radiatorial Comment

THE Third Radio Conference has passed into history after accomplishing a constructive piece of work in untangling most of the knots in the complex maze of questions presented for its consideration. Many conflicting interests were there represented, each wanting something, and, strange to say, each got what it wanted. This was not done by any feat of legerdemain but by a generous spirit of compromise and by the patient application of common sense in solving the problems.

The radiocast stations were given exclusive use of the 950 kilocycle wave band between 200 and 545 meters. Stations were given a more logical classification in accordance with their power and the character of their programs. A new zoning plan was put in effect so that each of the class 1 stations has an exclusive wave length, except those along the Atlantic and Pacific Coasts where the allocations will be duplicated. This gives 63 channels of communication, and by a possible division of time will care for 126 stations of this class.

Every precaution was taken to mitigate interference with radiocast reception. U. S. ships are to entirely discontinue the use of the 300 and 450 meter wave length and 600 meters is to be used only for calling and for the S O S. Thorough co-operation was assured by representatives of electric power, railway and telephone companies in correcting faults in their systems which may annoy radio listeners. Stress was laid upon the necessity for careful manipulation of radiating receivers and the more general use of non-radiating types was urged. A gradual reduction in the broadness of undamped waves from ship and point-to point spark stations was recommended, as was also a strenuous effort to eliminate harmonics from arc and tube sets.

The "most contentious" subject discussed was the granting of permission to use greater power in radiocasting. One self-styled "friend of the peepul" exposed to ridicule and unfriendly criticism the research and development work of "the four horsemen," as he dubbed the corporations who have done much to make radio possible today. The organized newspaper interests bitterly opposed any further extension of radio service to the public that might ensue from increased power. But as the facts regarding the advantages of 5 kw. radiophone transmitters were gradually developed a more amicable spirit prevailed and the question was settled by compromise.

Discussion as to preferable types of programs elicited the fact that no standard should be set for individual stations and that the main requirement is for variety. There was a decided difference of opinion regarding the public's attitude toward toll radiocasting or "radiotising," with a general sentiment that definite announcement should be made when a program is paid for by an advertiser. This is apparently the most practical method yet devised for compensating artists, as several attempts to secure voluntary contributions from listeners have failed. It was agreed that there should be no governmental censorship of programs.

After a brief consideration of the relative advantages of line and of space radio for the interconnection of stations it became evident that both wire telephony and the re-broadcasting of short wave radio transmission offer a practical solution of the problem. The main deterrents to immediate adoption is the high cost and the question of whether the stations are sufficiently desirous of the service to pay for it. Secretary Hoover suggested that an association might be formed to function for the radiocasters much as the Associated Press functions for the newspapers. A continuing committee was appointed to work out ways and means.

The amateur spark gave up the ghost without a struggle, its passing being noted only by the fact that no provision was made for it in the allocation of wave lengths. Thus officially ends the existence of the boy's delight and the BCL's anathema. Five wide bands of the lower wave lengths are available for C. W. transmitters using circuits loosely coupled to the radiating system or using coil antenna or loops. I. C. W. and 'phone are confined to the 170 to 180 meter band. The amateur sub-committee also recommended that the use of radiating receivers be discouraged on the short wave relay broadcast bands because of the likelihood of relayed interference from this source.

Four additional channels were provided for ship communication and a request made for voluntary reduction in the number of position reports of ships.

The strongest recommendation made by the conference, and the one most conducive to the efficient carrying out of all other recommendations, was that a more liberal appropriation of funds be made for the offices of the radio supervisors, all of whom have been greatly handicapped by insufficient personnel and equipment.

On the Trail of the Tube Sharks

An Exposé of Unscrupulous Methods Employed in the Manufacture and Repair of Bootleg Tubes

By Volney G. Mathison

HELLO! Yes, this is the Gyp & Gyp Radio Tube Company of Newark. You say the tubes we repaired don't seem to work right. Why—ahum, how strange! Perhaps your set—a three-hundred-dollar super-heterodyne. Ah, that explains it! You see, those big radio-trust sets are designed and built to work only with the common inferior grade of four-dollar tubes sold in all the stores. Our tubes are so incomparably—ah—superior that your set would have to be entirely rebuilt, to match up to them.

You, ahum, you ought to have one of our Sorrydyne sets—I beg your pardon? Refund your money! Why, really, we are mighty sorry, but— Our advertisements? Why, ah—yes, we advertise that our tube-repairs are guaranteed. We test every tube on our Slamdyne Automatic Testing Machine. That is the best we can do. No, I'm sorry, but you—ah, you know, we do not advertise or agree to refund any money. You see, at two dollars and fifty cents, we are selling so close to cost that we couldn't possibly afford—I beg your pardon? Ah, ahum, yes, that is really the best we can do. We are awfully—How is that? We a pack of crooks! What do you mean, sir! That is the most infamous thing I ever had said to me in my life! You are not a gentleman, sir! If you should dare to say that to my face—hello, hello, hello—party hung up. Ah, thank you, central.” (Aside: “Twelve-fifty out of that bird. Those things are costing us only sixty cents apiece. Ah, ahum, I think we'd better cut our prices another half-a-dollar and get in a new lot of eggs.”)

AN “egg,” reader, is a fairly stale underworld term meaning you or me, or any person that can by any hook or crook be trimmed of a couple of dollars. The foregoing is an effort to interpet briefly an experience that many thousands of people have actually suffered, either directly or by mail, during the past three years, at the hands of the innumerable repair-tube concerns infesting the eastern section of the United States from Boston to Philadelphia.

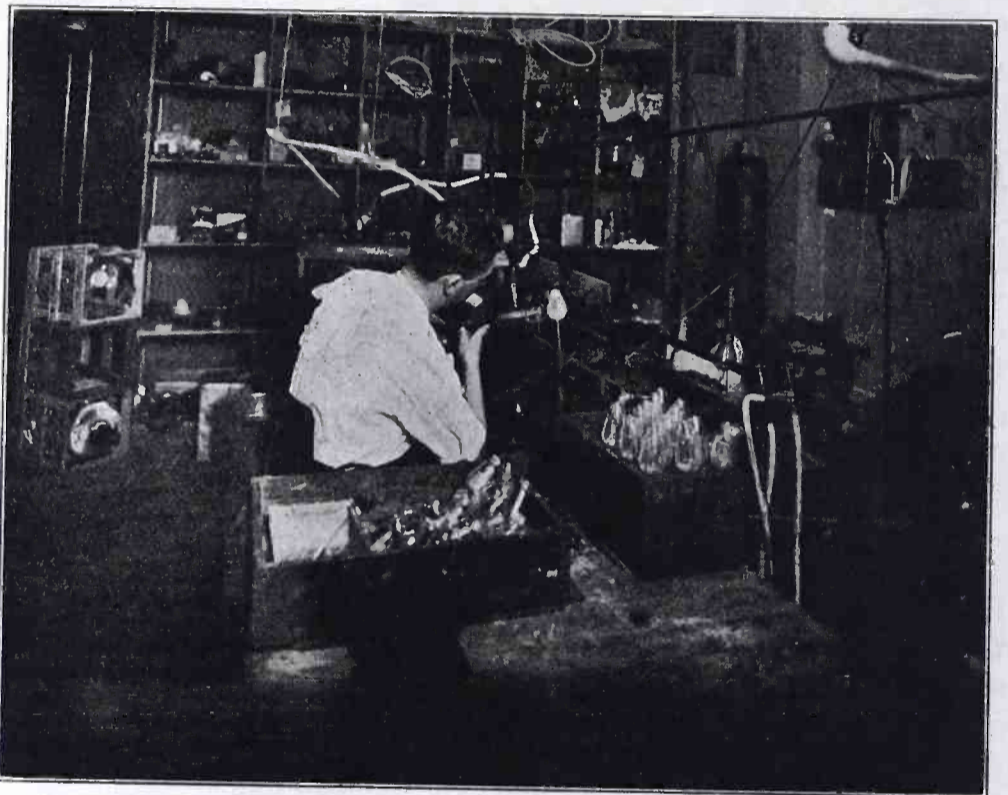
For a long time, I have been hearing and have been asked the questions, “Are repaired radio vacuum tubes any good? Are independently-manufactured new tubes any good?” These insistent queries have appeared time and again in the question and answer columns of the vari-

ous radio periodicals, and the answers given have generally been contradictory, incomplete, and only half correct. This was inevitable, owing to the necessity for compressing the replies and to the lack of any large amount of real, first-hand experience with such tubes on the part of the person called upon to answer.

The vacuum-tube has always been, and probably will be for some time, the central object in the radio spot light.

absolutely perfect tubes every day. I have seen the secret processes of coating filaments and I have studied chemical analysis reports from laboratories as far away as Berlin. Also, I have bought three-hundred and fifty tubes from twenty-five different concerns—but this is getting ahead of the story.

Armed with an imposing brief case, a hundred-dollar ice cream suit, and an engraved card announcing myself as a



In the lair of the vacuum-tube bootlegger! This shows a plant in actual operation. See ye poor tube, filled with fire! The tube is on a vacuum-pump and is being bombarded or heated by high-frequency current from a 2-KW radio spark-transmitter, in order to drive out occluded gases. The idea is right but the equipment is crude and imperfect.

So strong is the desire on every hand for information about tubes—especially for inside dope on repaired tubes and unlicensed new tubes—that about six months ago I packed my old kit bag and embarked for the East via the Panama Canal determined to find out at first-hand just what all these queer bulb noises in the gab circuit are about.

And folks, I have found out. I have seen the “makings” of vacuum tubes, from slugs of raw tungsten and nickel to the acid lettering applied to the bases of the finished product after the final fifteen-hour endurance test on the socket rack. I have been in tube-repair dives containing nothing but a gasoline blow torch, a broken down vacuum pump, and filament wires apparently removed from electric lamps—and I have camped in fifty-thousand-dollar factories operating behind locked doors producing 2,000

prosperous radio-tube jobber looking for “lots of tubes,” I was received by the mail-sales gang in New York with an enthusiastic, but cautious welcome. Cautious, I might explain, because Uncle Sam's New York postoffice has a large force of “eagles” who are wont to prowl; and I had to demonstrate myself to be a good fresh “egg,” fit to be fried—not a rotten one, liable to chloroform all hands.

My preliminary visits were to all the new tube and exchange-repair mail order concerns that advertise in the radio publications. These establishments I found all very much alike: a small, dark room buried away in some cheap sixth-rate office building, a battered desk, undoubtedly rented, and a small soap box full of burnt-out and repaired tubes. Now, this was not exactly prepossessing; but still it didn't mean very

much. Lots of successful businesses have had equally humble beginnings. But one look at the physiognomy of the bandit behind the battered desk, in almost every case made me sort of instinctively feel for the heavy old six-gun I used to lug around years ago up in Alaska. About the second day, I began to consider going down to the water front and borrowing an iron belying pin to slip into my brief case.

After two weeks of preliminary visiting among the New York "foims," and acquiring—terms cold cash—a generous quantity of sample tubes, I next embarked for Newark by way of the roaring tubes deep under the turgid waters of the Hudson. Upon arriving at Newark, the grimy mecca of the vacuum-tube egg-hunters, I proceeded through

He even went so far as to show me some of the company's correspondence, and it is a fact that this concern has done an astonishing business. They have advertised in nearly every important radio publication in the United States, and about everybody in America has had a tube repaired by them—once, I guess.

The Gyp & Gyp gentleman was so kindly and genial and showed me so many attractive tubes that I went back to visit him several times. He was so engaging I almost would have given him my watch, if he had asked me for it—and I am not chewing on a teething ring, either. Gyp & Gyp were pretty hard to size up—until I bought quite a big boxful of tubes from them. Then it was easy.

At the end of three weeks, I had seen at least two dozen mail-order offices—but not one factory or tube repair plant. After making several return visits, I began suggesting that I be shown around the plant—and here, for a long time, I ran against a stone wall. Every outfit explained to me, with much regret, that the big manufacturers of licensed vacuum-tubes do not recognize the right of any one to repair tubes or make new ones; and that these manufacturers have a formidable force of "legal investigators" or "dusty shoes," who go about endeavoring to discover the whereabouts of the small factories. Once the "dusty shoes" locate a factory or a repair plant, their employers, so I was solemnly assured, would come down upon the place like an upsetting mountain of bricks—and no rubber ones.

The small repair concerns have little fear of being molested at their places of business; because, as I have already related, their office equipment is a rented desk, and their stock, a few dozen repaired tubes. If one of the big corporations slam an injunction and a padlock on the door, nothing can be lost but a handful of tubes and a few days rent; and about two days later the "foim" appears in another little back room just around the corner, with a replica of the battered desk and a fresh soap box full of tubes, ready to exchange for burnt-outs. It reminded me of the ubiquitous flea; put your finger on him here and he hops up over there.

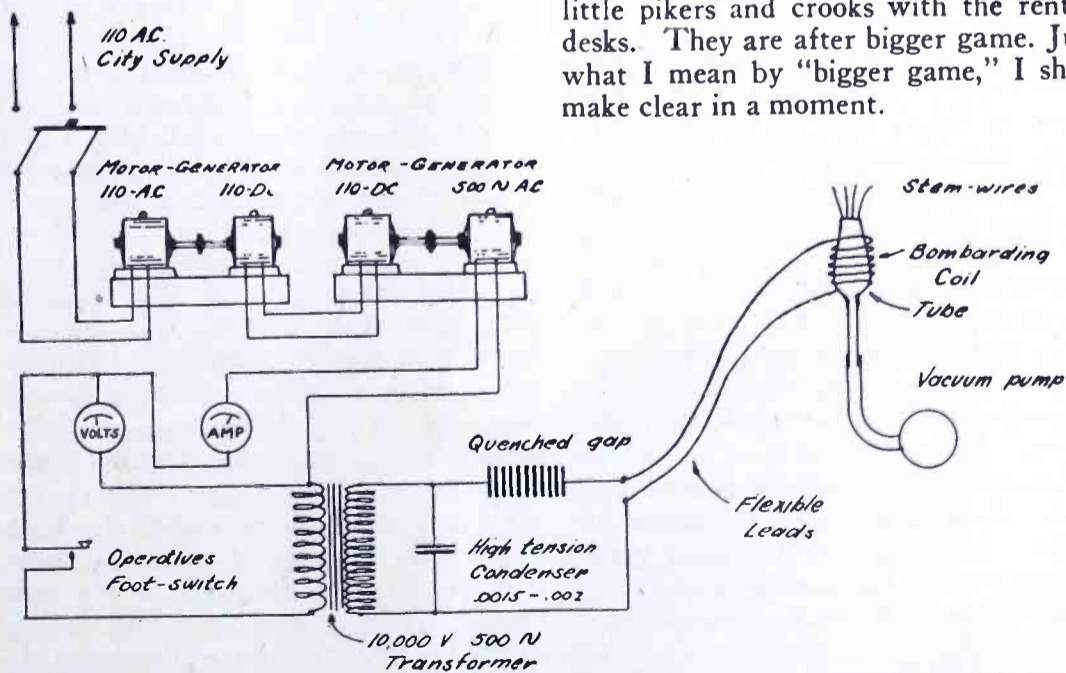
It is a fact that at least one of the big tube-making corporations maintains a staff of investigators who go around looking for information, and who sometimes work as clerks in retail stores. One of the mail order men I met in my travels was an ex-investigator who had learned so much that he had quit investigating and gone to repairing tubes! These "dusty shoes," I have learned, however, are not much interested in the little pikers and crooks with the rented desks. They are after bigger game. Just what I mean by "bigger game," I shall make clear in a moment.



Electric spot-welding plates and grids onto their supporting wires. The weld is made by a low-voltage, high-amperage arc. Note the rack full of completed stems in the foreground. These are ready for sealing into bulbs.

a haze of factory smoke to the headquarters of our friends, the Gyp & Gyp Radio Company.

I found Gyp & Gyp remarkably different from the Manhattan tube buzzards. Gyp & Gyp have a large office, several desks, and much filing equipment containing names of eggs of various grades. Here a rather large, heavily-built young gentleman, nearly bald and with dirty-looking teeth, fell upon me like a long-lost brother and figuratively speaking folded me in his arms. Instead of the cold, hostile, "can-I-get-you-before-you-get-me" glare of some of the wary hermits lurking in the caves of Gotham, this tube doctor was softly aglow with warmth and friendship. He took me within the fold; showed me a somewhat imposing stock of tubes, both new and exchange repairs, and told me at great length about all the crooks and pikers in the business of repairing vacuum-tubes.



Working diagram of the bombardier shown in the photograph. A simple quenched-spark shipboard type radio transmitter minus oscillation transformer secondary. These sets are built for D. C., hence double motor-generator. If you hear shrill quenched-spark whistles on your receiver, there may be a tube plant next door.

The operations of the tube sharks are actually the strongest possible factor in thoroughly discrediting before the public the few honest repairers and independent makers of vacuum-tubes. I have found that the only reason the gyp crowd hide their repair plants is because they do not want anybody to see their wretched equipment and underworld-type operatives. The better they know you, the less chance you have, therefore, of ever seeing their "factory." The big independent makers of genuinely good tubes, on the other hand, as soon as they are absolutely sure that you are O. K., are glad to let you in.

In the course of the second month of my investigating, I had a rather amazing experience. I had been handing out my local hotel address pretty freely among the tube exchanges. One evening my telephone rang, and the clerk in the lobby informed me that one Mr. Trask wished to see me. I asked the clerk to send the man up; but I was informed in a moment that Mr. Trask positively would not come up; I must see him in the lobby.

Somewhat mystified, I went down. I found waiting for me a small, dark, rat-eyed man, rather shabbily dressed, carrying a small black satchel. He had the furtive, wary, evil look of a burglar or a counterfeiter.

As soon as we had retired to the most secluded part of the lobby, he came to the point, without hedging.

"I understand you are a big dealer in exchange tube repairs?"

"Yes," I replied, and I waited.

Mr. Trask gave me a long, penetrating look. His grimy fingers played nervously about the catch on his black satchel.

"Do you want to see something good?" he demanded, rather huskily.

"Why, certainly," I replied, trying to keep a cool front.

The man snapped open his satchel, extracted a tube, and handed it to me. Except for a slightly old look, it appeared to be in perfect Radiotron. The proper markings were on the glass and on the base. Except for its somewhat dull appearance, it was not distinguishable from a new tube.

"Do you mean to say this is a repair!" I exclaimed, staring first at the tube and then at the man.

He smirked, nodded, and opened his satchel wider, revealing about two dozen Cunningham and Radiotron tubes of various types.

Now, this was something new to me. By this time, I had seen thousands of repaired tubes, incidentally some good ones, but they all had new bulbs and new bases, which were plainly marked "repaired."

I eventually learned the method of making these trick repairs. The solder on the tube prongs is first melted off with a gas torch. This releases the four

connecting wires from the inside of the tube. The tube base is then inserted in a resistance coil, which heats it without damaging the lettering. When the tube gets hot, the bakelite cement that holds the bulb down into the brass shell gives way; then the bulb is pulled out. With a gas-jet, the stem supporting the plate and grid is melted out of the bulb, at the place where it is joined around the bottom. The bulb is then swaged in a flame, enough to enable the withdrawal of the complete stem, plate and all. A new filament is mounted, the stem replaced and sealed back into the same bulb. The bulb is then pumped out, bombarded, and, by means of a basing machine, reset in its original base. There is an erroneous idea that this cannot be done to the new tubes with bakelite bases. It is, in fact, necessary to destroy the bases; but bakelite moulding plants are producing exact copies of them, lettering and all.

"You do a clever job," I said to Mr. Trask, trying to look sold. "What is your price?"

"One hard boy apiece," replied Mr. Trask, warming up a little—then suddenly he bored me suspiciously with his ferret-like eyes, and said, "But, mister, it's cash! No checks, no drafts! We deliver 'em personal, you hand over th' bulge. We don't care whatcha do with 'em. You can sell 'em as repaired, if ya want—or, you know."

"I see," I replied, quietly. "Give me a dozen samples, and your address."

Mr. Trask produced a card. It had nothing on it but a telephone number.

"Ring that number," he told me. "Leave word how many you want, an' where you want 'em—an' have th' jack ready."

The next day, I traced the telephone number, and found a small dirty restaurant in one of the tenement districts. The greasy-shirted proprietor denied any knowledge as to the whereabouts of Mr. Trask, but admitted that that gentleman occasionally dropped into the restaurant to eat a sandwich and receive telephone messages left him. Upon being questioned further, the restaurant keeper became surly and non-committal. It was the stone wall again.

This is one kind of crook the "dusty shoes" really are after. Thousands of these virtually counterfeit tubes are being sold in foreign countries, particularly in Argentina and Australia—and there are plenty of them around here, masquerading in both old and new boxes.

It is claimed by some of the tube folks that the production of counterfeits in the way described in the preceding paragraphs is not practicable or successful on any large scale, but that new bulbs and bases are sometimes used which have been deliberately etched and stamped in a fraudulent manner.

Such manufacture of counterfeits

should not be confused, however, with "top-end" repairs. In making a top-end repair, the bulb and base are not touched; instead, the upper end of the tube is burnt open, so as to make a hole in the glass about one-fourth in. in diameter. Through this hole chemicals are introduced to clean out the old vacuum-getter and pieces of burnt-out filament. The new filament, supported at each end by tiny bars of nickel, is then lowered into place and rigidly secured to the proper lead-in wires on the stem by electric spot-welding with a specially-built long, slim-fingered welding machine. This machine also attaches pieces of properly prepared magnesium to the plate. The new filament and vacuum-getter in position, a heavy piece of glass exhaust tubing is melted or welded into the hole in the top end of the bulb, and the tube then exhausted on a mercury-vapor pump and bombarded. This is one of the latest methods of repairing and is very effective, as no part of the old tube is disturbed in any way, except the burnt-out filament. If the tubes are properly pumped and bombarded and if a high-grade filament wire is used, the results are remarkably good. Top-end repairs are readily distinguished by the unusually large heavy tips on them.

Another time, I went out to Newark to look up another tube repairer who advertises considerably. The address in the advertisements proved to be a small candy store, run by an Italian. I thought I had made a mistake, and for a few minutes I was puzzled. Upon inquiring in the candy store, however, I was informed that the tube concern was in the rear. Going back through a narrow alley, and stumbling around in a rear yard where some garage men were washing automobiles, I finally arrived at the signless door of the "Bill-Barnes" tube shop.

Here, I found a refreshing variation from the common run of repair dive. Instead of a battered desk and a soap box full of tubes, I found a crowded little office, occupied by two or three busy people. From over a plaster-board partition came the sound of whirring motors and clicking machinery—and every few seconds a burst of radio music. The intermittent music meant attempts at tube-testing.

The owner of this concern I found to be a plump, hearty, cheerful, rather temperamental Italian. He made no secret whatever of his factory. On my second visit, I was allowed into it. He had about ten operatives, mostly Italian girls, all very busy repairing tubes on rather obsolete machines.

At that time, four months ago, I did not know what to make of the "Bill-Barnes" outfit; but now, after half a year of contact with all sorts of vacuum-tube makers and repairers, and after watching the various processes day after day, from the purification of the metals

entering into the tube, to the checking up of the finished article on scientific curve sheets, I can realize that the proprietor of this concern is just an energetic glass blower stumbling along in the dark, possessing only a fragmentary knowledge of electrochemistry, electronic phenomena, and vacuum-tube manufacturing methods — and using makeshift machinery that results in a distressingly haphazard quality of his output. There are dozens of outfits like Bill Barnes, except that most of them are absolutely merciless in their dealings with victims, whereas poor Bill is conscientious. He is learning, and doing the best he can; but his missteps are sometimes hard on the consumer.

This Bill Barnes, the Italian, was offered the exclusive manufacture of the lately-advertised double-gridded mump-simus but he threw it down as beneath even him.

About four months after I began roaming this great New Jersey wilderness of vacuum-tube gyms, I ran across a small, neat advertisement in some of the radio magazines announcing several types of new tubes.

I spent half a day looking for the street address of this concern. After I had stumped three or four traffic cops, inquiring for the location of the street advertised, I finally went to the city hall of Newark and caused a search to be made on the town map. At length we spotted the place; and half an hour later I was far out in the shack town of the city. On an old narrow side street, I found the cut-price tube outfit housed in what looked like a fifteen-cent Barbary Coast rooming house.

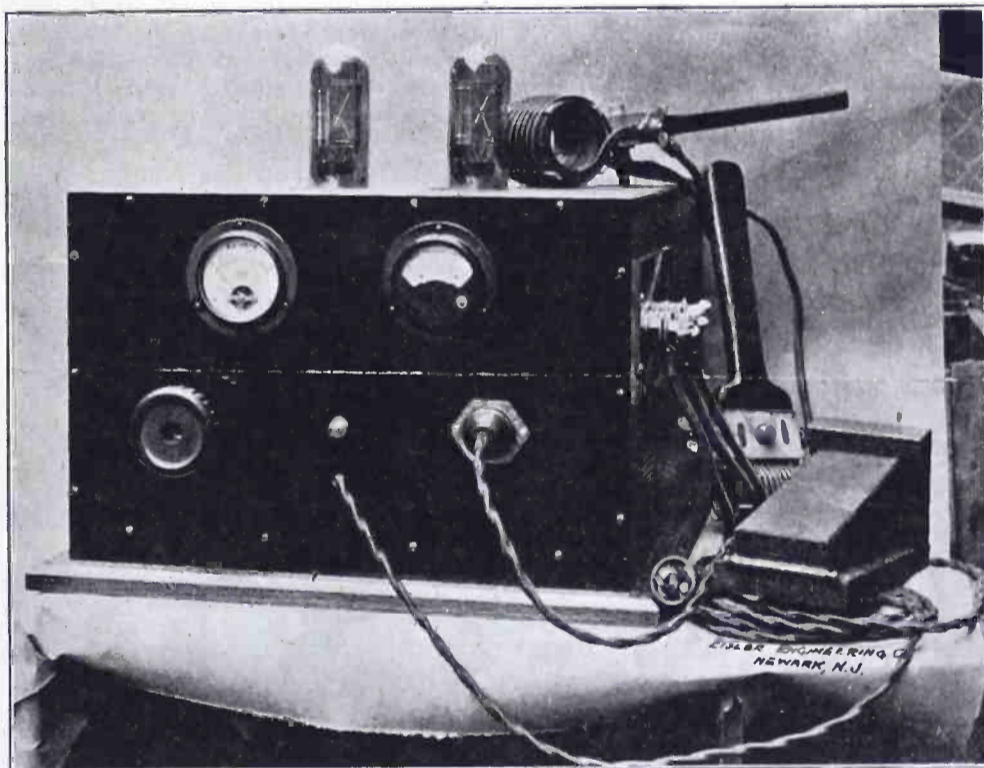
There was no sign out, no radio aerial, no distinguishing mark of any kind whatever. Just as I arrived, I fortunately found a little dark, lynx-eyed man rifling the rusty mail box near the door. There were several letters in it.

When I came up and spoke to the fellow, he reciprocated with a glare that was at once frightened and hawk-like, and he looked as if he might pull a gun. At this moment, a slovenly black-haired woman with a dirty kitchen apron on, came rushing to the rescue of her husband—I suppose he was, anyway,—and began screeching in a Greekish, Rumanian, Rumelian, or some other foreign accent,—“Thees ees a mail-order beez-ness!”—no tubes sold direct, no wholesale, no information, no anything.

When I persisted in questioning them, the pair, who looked like they might have dodged last year's immigration quota, finally declared that they had nothing whatever to do with the con-

cern. Over in New York, just the other day, I visited my thirty-fifth concern, which, at this writing, is running an attractive advertisement of new tubes. This was the usual battered-desk layout but there was an unexpected variation in the concern's selling talk. The disconsolate, hang-jawed individual holding the slack reins of the lonely-looking business informed me sourly that he wanted to get clear of eastern trade, because everybody in the east who buy vacuum-tubes are liars and fools they say his wonderful tubes are no good and ceaselessly demand replacements; he knows his tubes are the best in the world; he has his stomach full of replacements, now, and is not going to replace another tube—unless he considers the buyer “entitled” to it. He is looking for “westoin business;” but he did not appear to be doing much outside of looking glum.

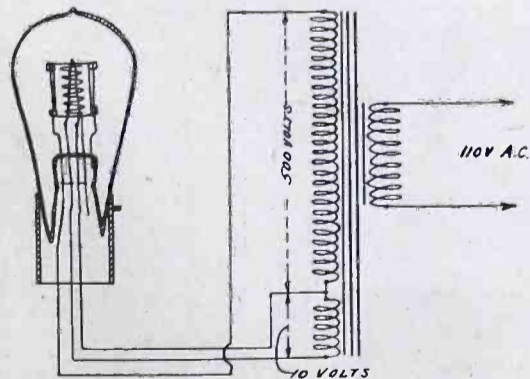
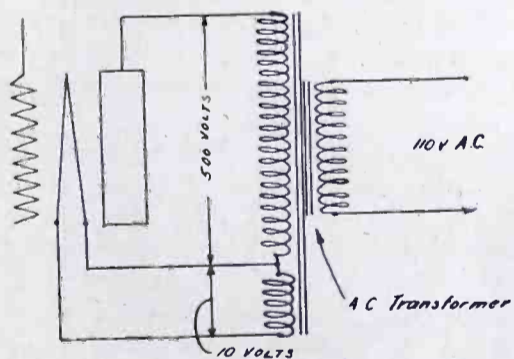
In a former article, I described in



Here is a real vacuum-tube bombarder. It is really a powerful little 100-watt CW transmitter, using two 50-watt power tubes. The long-handled heating coil besides the right-hand power tube is for bombarding 201-A tubes; the other one resting against the cabinet is for 199 tubes. To the right of the bombarded is a foot-switch for controlling the machine. This is the latest and most efficient bombarding apparatus so far produced.

cern, but that their “brother-in-law” owned the business. I politely asked for this worthy brother-in-law's name. The fellow, still clutching his letters, seemed stuck; then, glancing swiftly at me, as I held my note book up against the flimsy, crooked wall of the house, preparing to write the name down, he replied coolly,—“Mr. Wall!” I next asked where I could see Mr. “Wall,” and was informed that he worked somewhere or other and would be home at six-thirty in the evening. I came back at 6:40 p. m. and found the house dark, deserted, locked and abandoned! I never could find anybody around that joint again—but the mail box was not neglected. Most of the letters that enter that box are in small boys' handwriting.

detail some of the correct processes of manufacturing and repairing tubes. In order, however, that the reader may appreciate the picture accompanying this article showing a method of bombardment, I shall explain here that when a radio tube has been evacuated, it is necessary to heat the plates and larger supporting wires on the stem to a bright cherry red, in order to drive out gases occluded or absorbed by the metal. The tube is on the air pump while this heating is carried on; so that all gases driven out will be withdrawn from the bulb. If this process is not perfect and thorough, the occluded gases will later be thrown out of the metallic elements while the bulb is in use, and in a few hours it will be “soft,”—that is, full of gas.



Theoretical diagram of “bombarding off the filament.” The enormous plate current heats the plate red hot and liberates the magnesium vacuum-getter; but the extraordinary discharge of electrons from the incandescent filament literally tears the metal to pieces, destroys the thorium content, and leaves the wire brittle and lifeless.

One way of heating the tube elements is to place a high-frequency coil around the bulb; the high-frequency coil around by this coil causes a molecular or electronic vibration of the metal in the plate and wires; and this rapid motion of the molecules or electrons causes friction and consequently heat. In this way, the tube elements are brought to a bright red heat, gases are driven out or cracked loose from the metal, and are sucked out of the bulb by the vacuum pump.

In the accompanying picture, an operative is applying the high-frequency coil to a bulb on the pump. The vacuum-tube can be seen, filled with a brilliant glow; it is really purple in color, like the glow of a mercury lamp. This illumination is caused partly by ionized gas, and its dazzling intensity indicates a somewhat defective process, as will be explained later. The high-frequency current for the copper coil around the bulb is produced by an ordinary two-kilowatt quenched-spark radio transmitter, which is on the other side of the operative. The machine in the picture is a piece of discarded U. S. Navy equipment. The entire process shown here is obsolete and uncertain in its effect. It produces non-uniform tubes. It is not so bad as the method of the worst of the crook repairers, who bombard by heating the filament to twice the normal operating temperature and applying 500 volts to the plate; but it is inferior to the meth-

ods of expert repairers and tube-makers, who use a high-power CW bombarding circuit.

Now, about my sample tubes. Finding one Newark company to be the biggest mail order tube concern, I eventually bought one hundred tubes from them, of various types. Here are my results:

Tubes that pulled from 200 to 800% excess of normal registered filament current	41
Tubes that were half dead, produced microphonic noises, rattled, howled, refused to work on radio frequency, markedly poor volume, fuzzy tones	46
Tubes OK	13
Total	100

This shipment cost \$200.57, delivered, or \$15.42 each for the thirteen good tubes. Commenting upon the failure of their tubes to operate on radio frequency and super-heterodyne, this concern writes:—

“Relative to radio frequency, be advised that tubes manufactured in this country, disregardless of whether they are made by R. C. A. or any other independent, it is at this particular time a physical impossibility to manufacture tubes or repair them to be used exclusively for radio frequency work.

“We might say, as a matter of suggestion, when receiving tubes, to test them out thoroughly and you will find that some come up to the standard and others of course will not. Those that are not up to the standard desired for radio frequency should be disposed of to those who use them as audio frequency amplifiers.”

“Disregardless” of the classical rhetoric in this letter, its meaning is clear. If the radio dealer can’t sting the wise ham with a radio frequency DX receiver, then let him hook the poor B. C. L. with an audio frequency amplifier! Some mail order concerns must be operated by mind readers or telepathists; they know what kind of set you have, the instant they see your order! Observe that in the above letter there is not a word said about replacing or making good on tubes that do not come up to “the standard.”

Just three days ago, I listened to a terrific row between the slightly-built, innocent-eyed, almost angelic-looking “president” of this concern and a hard-fisted, honest-faced man from California. The man from California runs a high-grade repair factory out west; he had got swamped with orders and had bought a big shipment of exchange tubes from the Newark people to carry him over. But they had nearly carried him under.

“Say, do you know that I’ve refunded as much as thirty-five dollars in a single day to people sending your rotten tubes back!” he thundered, in a rage, after failing to get any satisfactory adjustment.

“Why refund—” began the angelic-eyed president.

“Why, hell!” bellowed the sun-burnt

Continued on page 52



What Kin a Feller Do?

A One Control Super-Heterodyne

Complete Constructional Details with Improvements Developed Since This Arrangement Was Described in November "QST."

By James Leo McLaughlin

Research Engineer of Precise Manufacturing Corporation

RADIO is no exception to the general tendency towards simplicity in all engineering design. In the case of a receiving set this crystallizes in the layman's demand for simplicity of control, for the substitution of a single control tuner for the two and three-dial types. This can be readily done in the case of the two most popular types of receivers, the neutrodyne and the super-heterodyne, though such sets are not yet commercially available.

As the super-heterodyne, when built with reliable parts, is one of the most selective and sensitive circuits yet devised, and as it can be simplified so as to require but one tuning control, many readers will be interested in the construction of such a satisfactory receiver, especially as it can be built at a cost no greater than that of a good neutrodyne. It uses seven tubes and a 21½-inch panel. The set here described has been duplicated many times and has given uniformly good results.

Several experimental amateurs in Rochester, New York, using similar sets had no difficulty in picking Pacific Coast stations regularly through the late summer. Another set using the longwave

amplifier unit in this super-heterodyne in San Francisco has brought in Pittsburgh on a loudspeaker, using but one stage of audio. Those on the Pacific Coast will appreciate what getting over the Rockies means. So, we are describing something that has been thoroughly tried out months ahead of the publication of this article.

Some may wonder how the super-heterodyne can be made to operate with but one control, when we have two circuits that are not tuned to the same frequency and when it is necessary that these circuits be so tuned that a differ-

ence in frequency of the two circuits equals the frequency of the longwave amplifier. This may be 40,000 or 30,000 cycles or for whatever frequency the outfit is designed. No matter what wave length the tuner is set to, the oscillator must be tuned to produce a difference in frequency equal to this. It is necessary therefore, if we restrict ourselves to one control, to connect these two circuits in such a manner that the frequency difference between the two is kept constant over the whole tuning range.

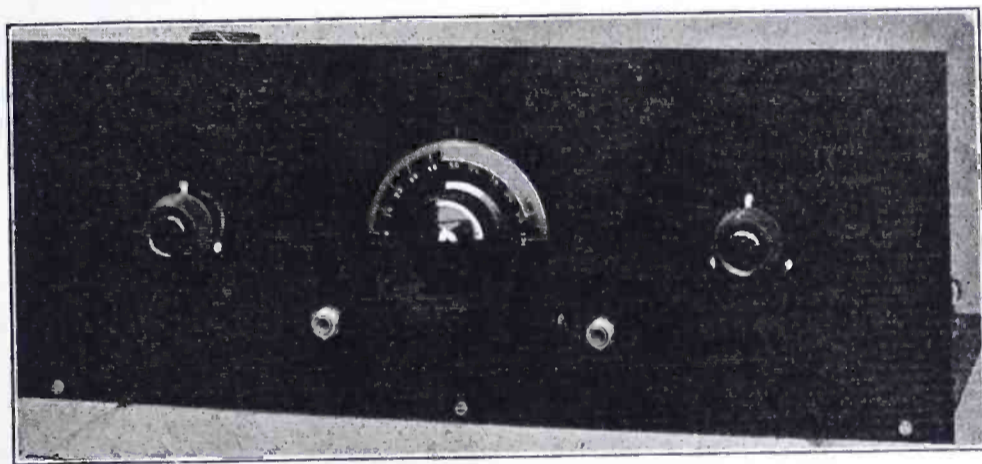


Fig. 1. Panel View of 7-tube Super-Heterodyne

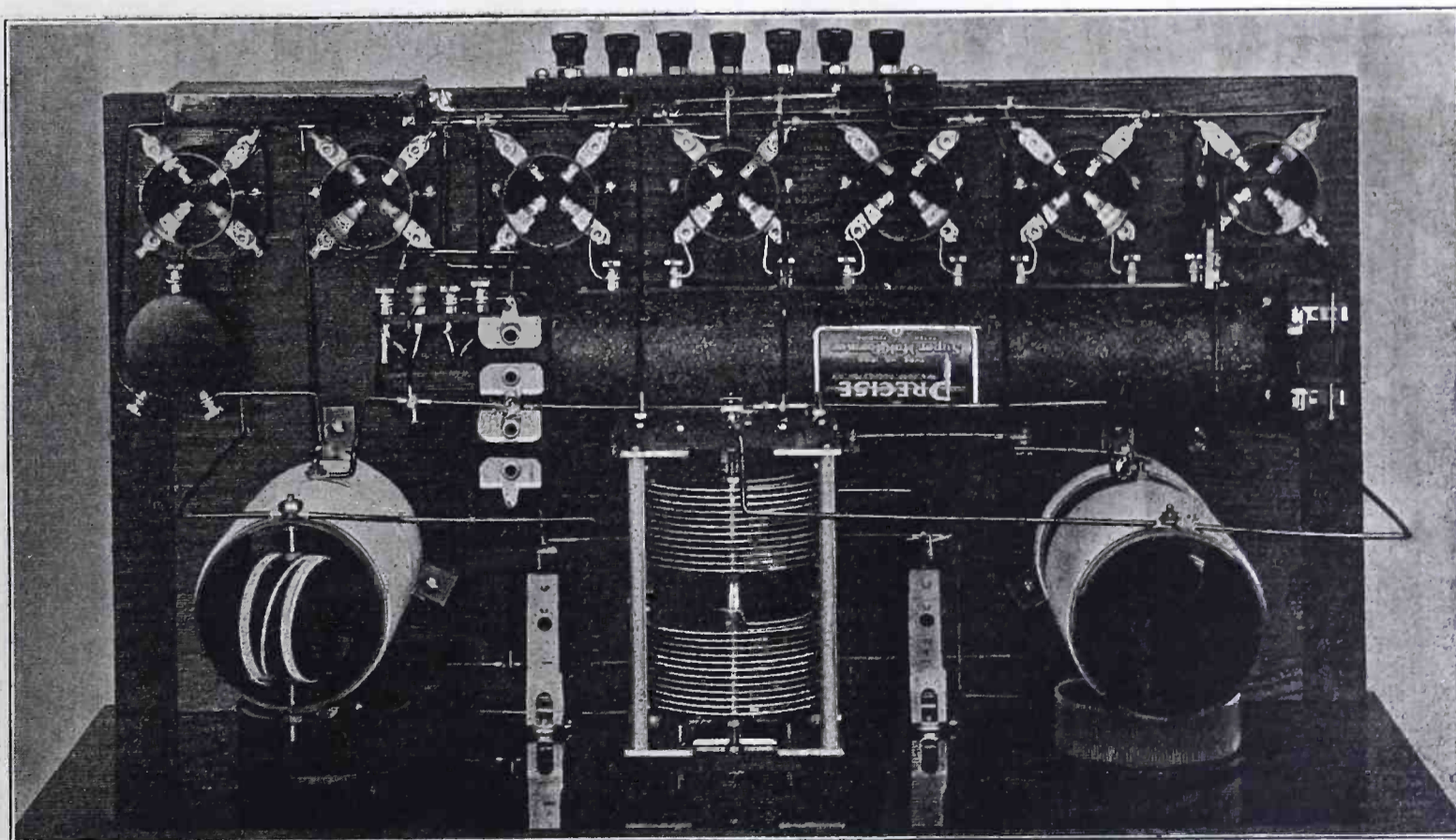


Fig. 2. Panel and Baseboard Mounting of Parts

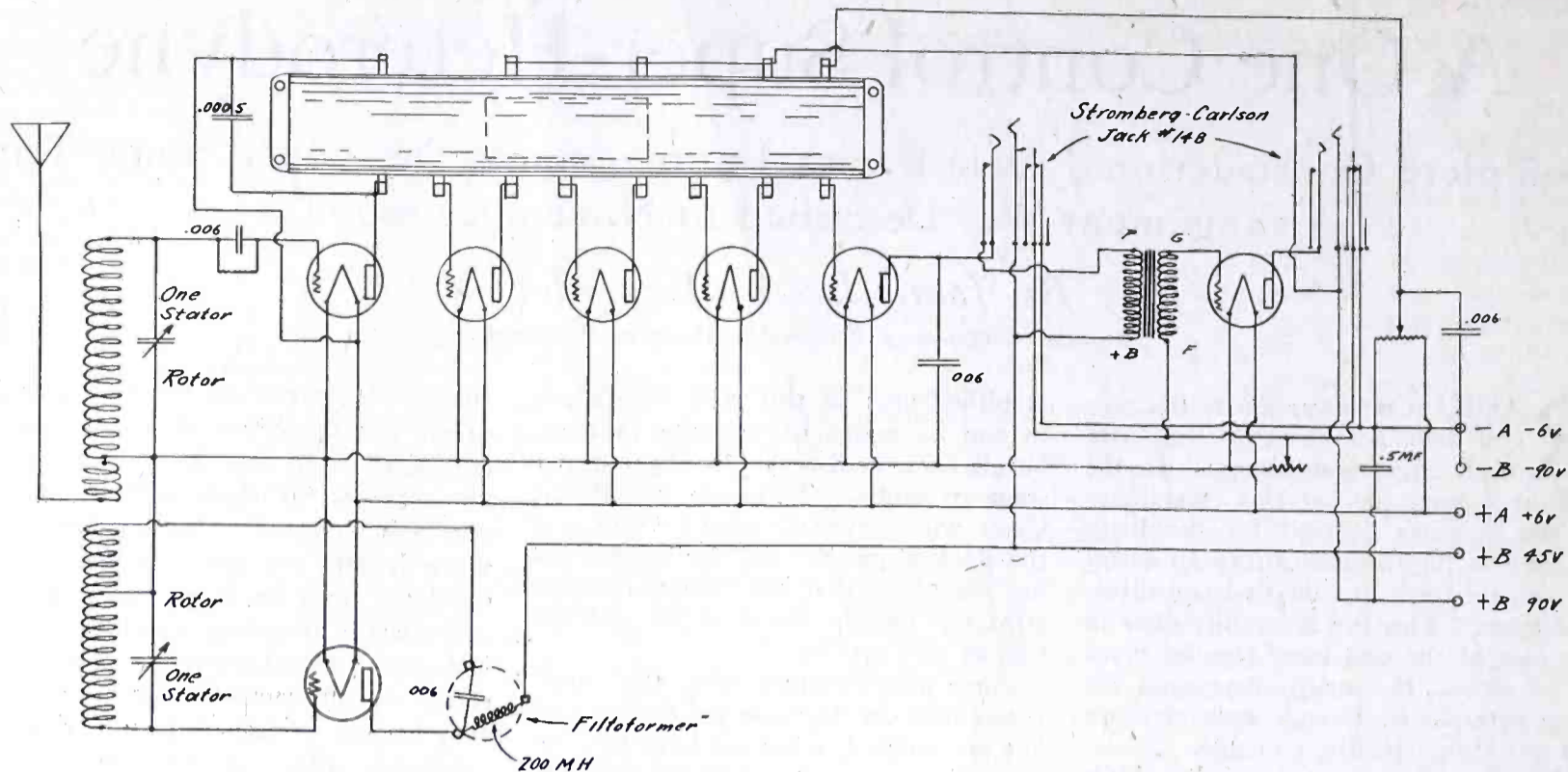


Fig. 3. Wiring Diagram for 7-tube Single Control Super-Heterodyne

This may be accomplished in various manners. It may be done by the use of a cam cut so that the rotation of one condenser varies relatively to the other in such a manner that the frequency result is obtained. It may be accomplished by making the inductance in the tuning circuit and the heterodyning circuit identical. Then by the use of straight line frequency condensers with one set ahead of the other, a difference of frequency may be produced and kept that way over the whole range of the condenser. I presume there are many other modifications that could be devised.

A method that is simple, sure and efficient, and so far as we know, original, employs two condensers geared together. The capacity of both should vary directly as the angle of rotation. One of these condensers is placed across the tuning circuit of the first detector, the other across the tuning inductance of the oscillator. The inductance of these two circuits is designed so that a difference in frequency equal to that of the long-wave amplifier, is produced at any setting of the coupled condensers. The complete theory of operation of this arrangement was described in November

QST by the writer and will not be discussed here. In the original article, the set used two condensers geared together. In this article, a special double condenser that may be readily purchased is used.

There are many modifications of the fundamental super-heterodyne circuit and it would be well at this point to state that the original circuit or arrangement of apparatus will produce results equal to any of the modifications when properly adjusted. The reason for one super-heterodyne being superior to another is generally due to the choice

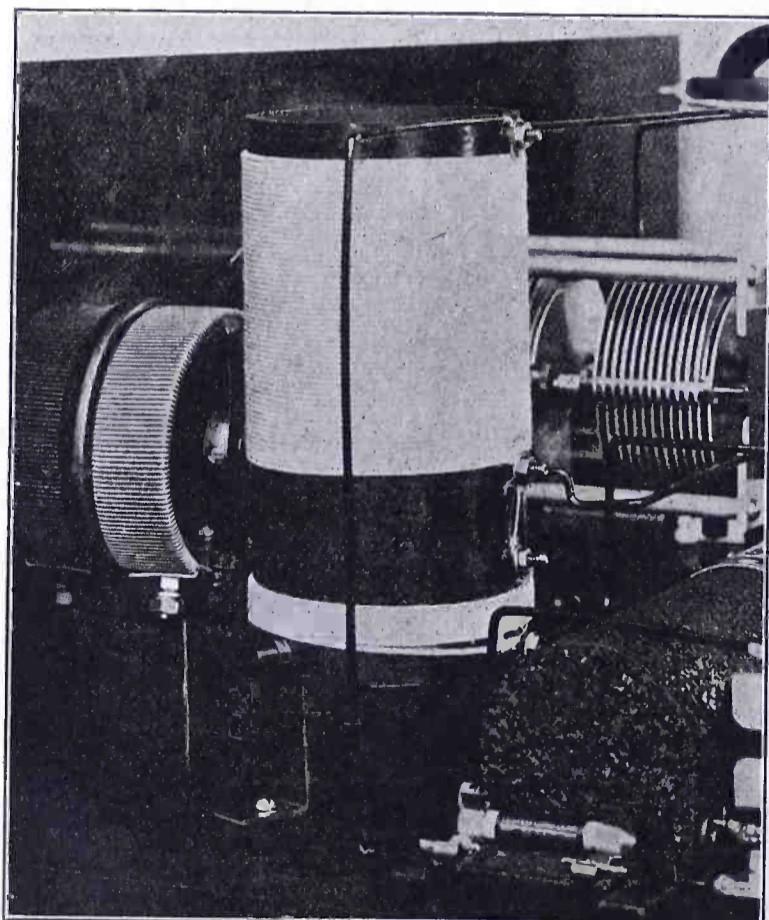


Fig. 4. Tuning Coil

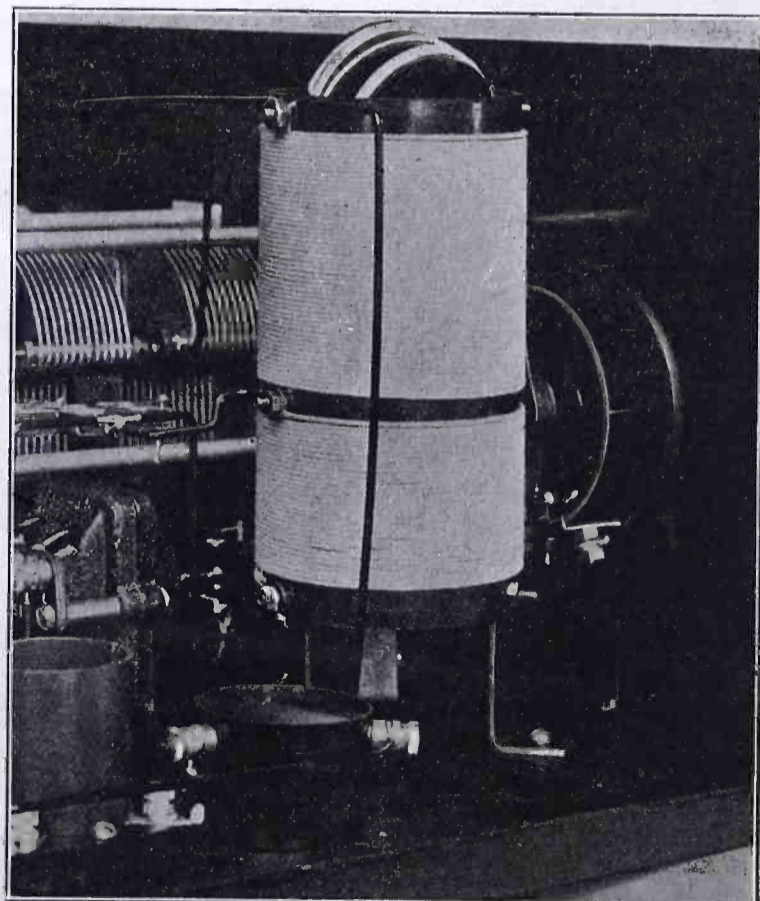


Fig. 5. Oscillator Coil

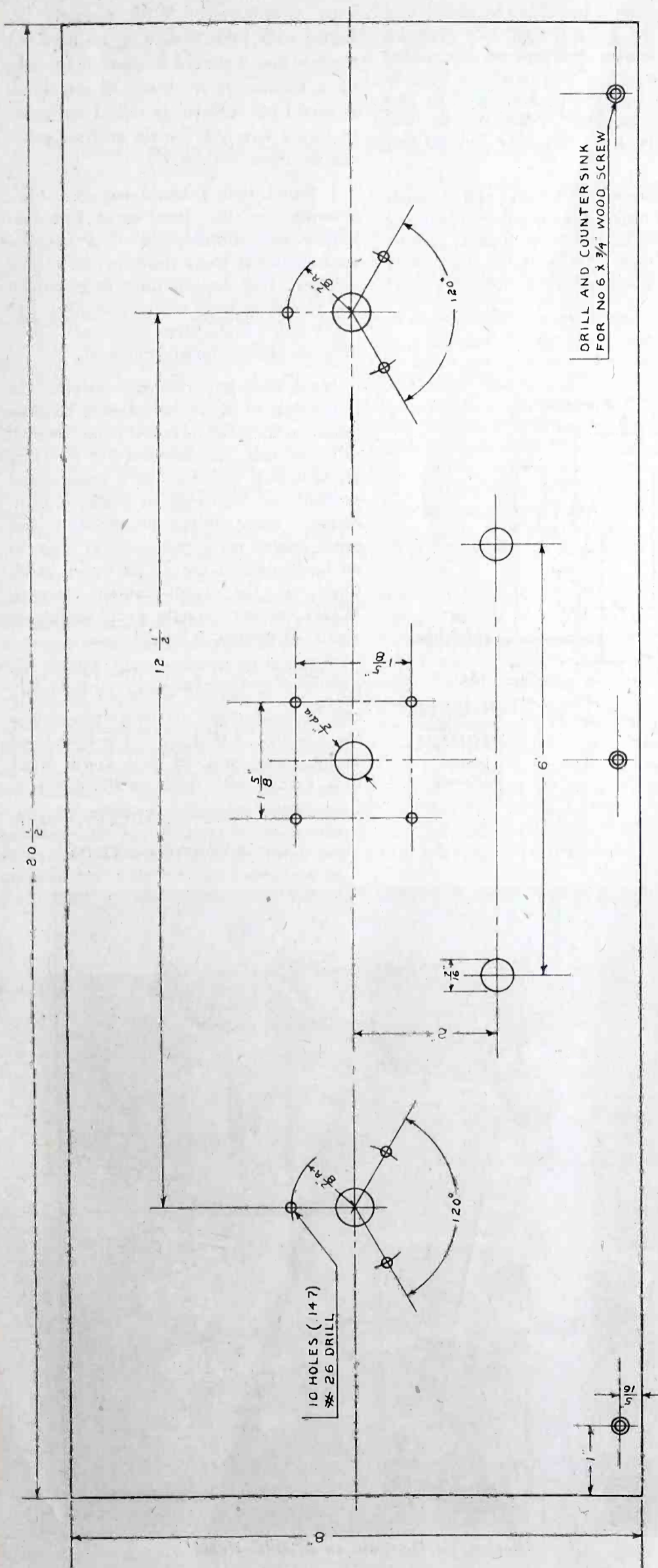


Fig. 6. Panel Layout

of apparatus, correct layout and care in connecting. Established engineering practice cannot be ignored without disastrous results.

The principal parts required are as follows:

- 1 Panel, 20½x8 inches.
- 1 Baseboard, 20x10x5⁄8 inches.
- 7 Tube Sockets.
- 1 7-ohm. Rheostat to carry 1½ amps.
- 1 400 ohm Potentiometer.
- 2 Condensers mounted on same shaft (National Co. of Cambridge, Mass.) with vernier dial.
- 1 Precise Super-Multiformer.
- 1 Precise Filtoformer (or 200 m. h. choke and .006 mfd. condenser).
- 2 Pieces Formica Tubing 3 in. diam., 5½ in. long.
- 1 Piece Formica Tubing 1¾ in. diam., 1¼ in. long.
- 1 A. F. Transformer (Precise 285).
Jacks, Wire, etc.

The tuning coil is wound on a piece of formica tubing 5½ in. long and 3 in. in diameter. Fig. 4 shows it in detail. The antenna coil, which is the lower coil in the picture, consists of 8 turns of No. 18 double cotton covered magnet wire. Without cutting the wire leave a space 1¼ in. on the tube, and start the secondary winding which consists of 59 turns of the same wire.

Fig. 5 shows the oscillator coil which is wound on the same size and length of tubing. The plate coil, which is the smaller of the two, is started first, and is wound on the lower end of the tubing. It consists of 33 turns of No. 18 DCC wire. Without cutting the wire, start ¼ in. from the end of this coil with the grid coil. The separation between these coils is necessary for the small bolt that comes through the formica tubing to make necessary connections. The grid coil consists of 54 turns of the same size wire.

In the pictures a smaller coil is shown at the top of the grid coil. This coil is in series with the grid coil, and is used to change the inductance in the circuit. It consists of 5 turns of No. 18 wire wound in the same direction as the other coils on formica tubing 1¾ in. in diameter and 1¼ in. long. All coils should be wound in the same direction.

The sockets, the super-multiformer, the audio frequency transformer, etc. are screwed down to the baseboard in the position shown in the pictures. The panel may next be attached (after it has been drilled) and the double condenser, the rheostat, potentiometer and jacks mounted.

Do not mount the coils until the wiring of the potentiometer and the rheostat have been done. When wiring up the set it is best to begin with the filament connections of the sockets. Start with the positive lead and run one wire from the first socket to the last, then make connections along this wire, where necessary to the other sockets. Next connect

Continued on page 62

LETTERS OF A DEEP SEA OP.

A 75-80 Meter Receiver Without a Variable Condenser

Dear Jack:—

I suppose you've seen the dope on the low wave bands the Department of Commerce slipped the amateurs. Been wishing I had that short wave super-het we used last winter on KDKA but funds are too low for anything like that now. In fact, funds are so blamed low that even a low loss variable con-

tickler, or both, towards the tuning coil shortens the wave length, and gives an overlap between the taps on the tuning coil. The set is very selective but the tuning is not sharp—that is it is not necessary to hold your breath and squeeze the dials for hair line adjustments.

As for losses I believe this receiver has none, unless they occur in resistance where the battery clip makes contact with the taps. Incidentally, Jack, why wouldn't this same stunt work in a short

wave transmitter. With properly designed coils there would be no need for the taps and it should be possible to make up a set having no losses of any kind. If ever I get sufficiently rich, I am going to buy a five-watt bottle and see what can be done with it.

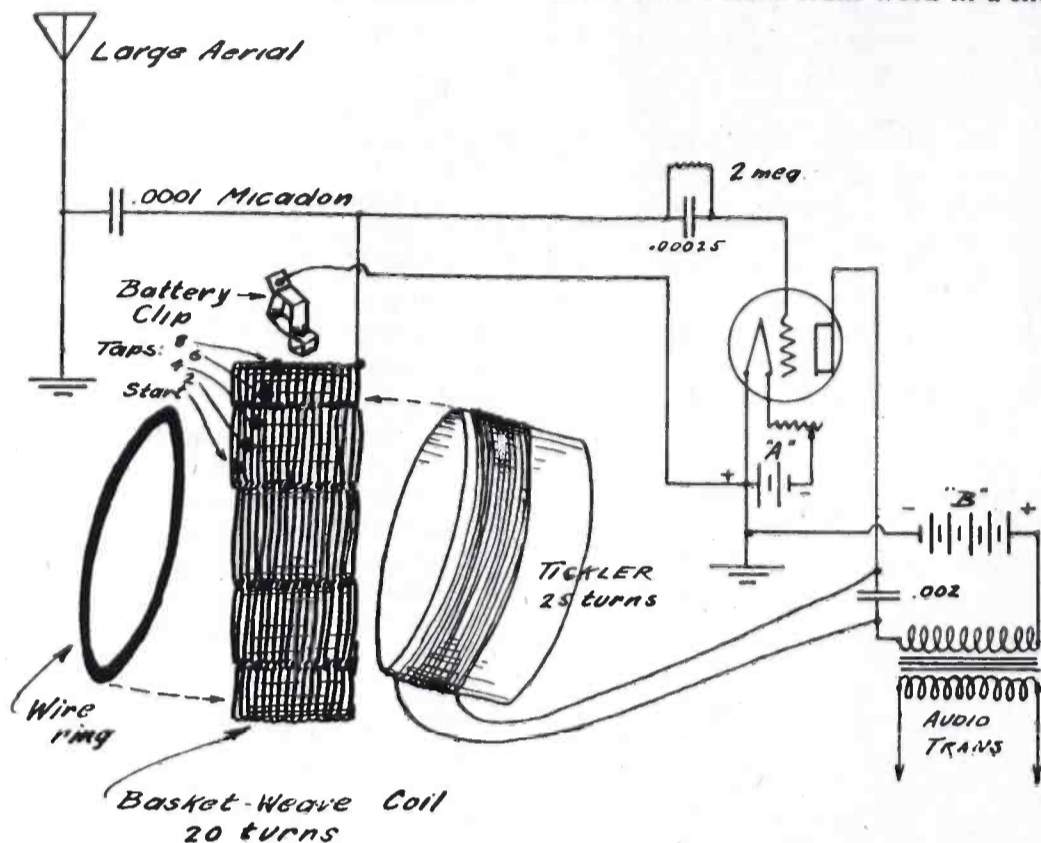
I found that I could use the ship's antenna for this low wave reception which was considerable of a surprise as the antenna has a fundamental of 370 meters. The antenna must be grounded and the short wave receiver connected to it through a small series condenser. The diagram shows the arrangement.

Have only had this rig working the last couple of nights but already have an imposing list of calls heard from the 3rd, 4th, 5th, 6th, 7th, 8th and 9th districts, all of which rolled in with good signal strength on one stage of audio amplification. Some of the broadcasters and other longer wave stations also come in on harmonics in the 75-80 meter band. One of the transatlantic stations, WGH, is very strong every night on about 70 meters.

Judging by the way the low wave boys roll in here it ought to be fairly easy to hear some of them clear across the Pacific. I'll drop you a line from Hong Kong and let you know what luck I have with them on the trip out.

73° From MICKEY DORAN

A CHEAP SHORT WAVE TUNER



denser is out of the question. Anyway, I was seized with a desire to see what was doing on the 75-80 meter stuff the other day and old John Memory came to the rescue with a solution of the variable tuning problem.

Do you remember the stunt we used last winter on neutrodynes that wouldn't "neut?" A ring of wire around one end of the neutroformer coil seemed to localize the field and made neutralization possible when all other methods failed. I remembered that stunt and also remembered that when the ring was used the condenser settings for a given wave length always had to be jumped about 10 or 15 degrees. Obviously, the wire ring shortened the wave length of the coil. What could be sweeter—here was an inexpensive method of short wave tuning.

I made up a basket weave coil, 20 turns of No. 20 DCC wound on 11 pins set in a 3½-in. circle. 25 turns of No. 24 DCC on a piece of 2½-in. cardboard tubing made the tickler and a 3½-in. ring of bus bar wire served as the tuning element. The basket weave tuning coil has five taps as shown in the diagram. Moving the wire ring or the



Dick Dingbat, the Detecatif, on a "Still" Hunt!!

Radio Frequency Amplifier With Untuned Transformers

A Frank Discussion of the Moot Questions of Potentiometer Control and Reflex Circuits

By C. M. Fansky, Jr.

ONE type of radio frequency amplifier makes use of iron or air core transformers. The principles of operation are the same as those for audio frequency amplifiers, but the transformers must of course be specially designed for the frequencies involved. In the design of an audio frequency transformer consideration should be given to the characteristics of the tube with which it will be used. This factor is of still greater importance in the design of transformers for radio frequency amplification.

While a radio frequency transformer may be labeled with figures indicating the band of frequencies over which it should be used, this does not mean that the same efficiency can be expected at any frequency within that band. Iron core radio frequency transformers will give more uniform frequency characteristics than air core transformers, but air core transformers will in general be more efficient at some particular frequency. The use of iron cores introduces losses due to eddy currents in the metal. While these losses reduce the amplification they have the effect of flattening the frequency characteristic and preventing regeneration in the circuit from reaching a point where radio frequency oscilla-

It will be remembered that in October RADIO we discussed regeneration and production of oscillation by the aid of energy fed from the plate circuit to the grid circuit due to the capacitance which exists between the grid and plate of the tube. If the primary of a radio frequency transformer is connected into the plate circuit of a tube the regenerative effect produced by coupling between the plate and grid may be sufficient to produce oscillations. Regeneration up to this point is desirable, but the production of oscillation destroys the characteristics of incoming speech and music.

(Note: It should be pointed out that the device called a potentiometer is really a voltage divider, a potentiometer being a much more complicated piece of electrical equipment. The name potentiometer, however, has come into common usage and but few would know the device if called by its correct name.)

The control of regeneration by the use of a potentiometer is open to the added objection that the bias voltage on the grid is never at a point where efficient amplification results. In fact, the bias voltage is so adjusted that inefficient amplification is produced in order to prevent the production of oscil-

The production of oscillation in tuned

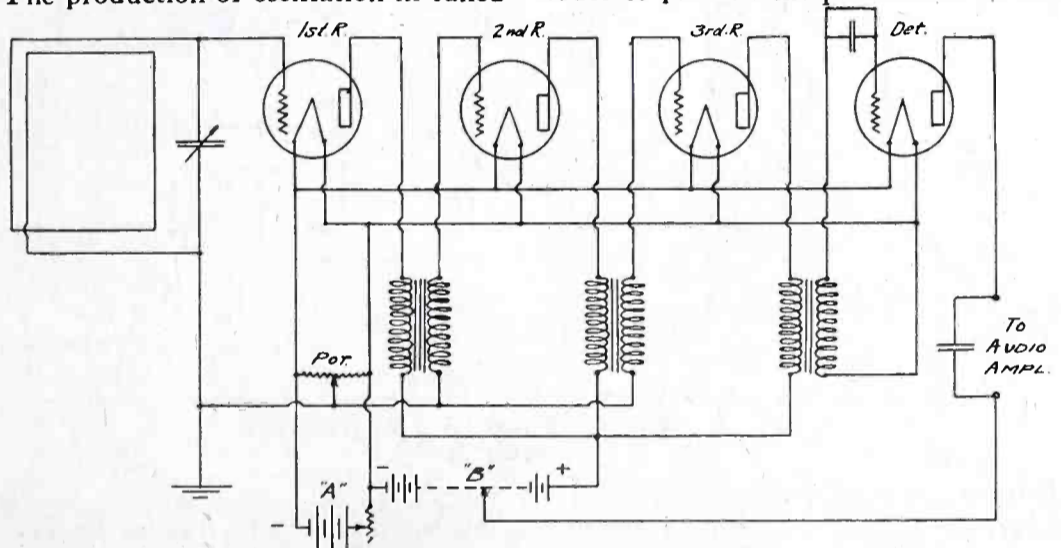


Fig. 2. Transformer Coupled R. F. Amplifier

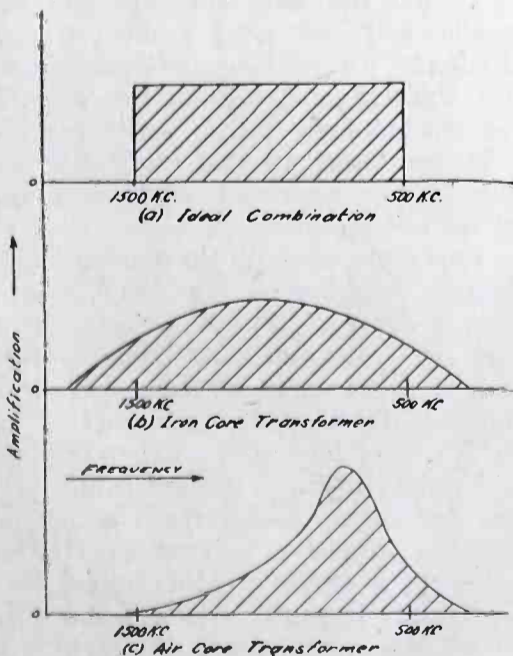


Fig. 1. Possible Characteristics of Three Hypothetical R. F. Transformers

tions will be produced. Fig. 1 shows possible theoretical frequency characteristics for three hypothetical radio frequency transformers. These curves are not intended to represent any transformer on the market and are drawn merely for the purpose of illustration.

circuit radio frequency amplifiers is usually prevented by neutralizing the effect of the plate grid coupling. This will be discussed later. In radio frequency amplifiers using iron core transformers the regeneration is partly limited by the losses in the transformers due to eddy currents, etc. Further losses are introduced by the use of a potentiometer in the grid circuit or by the introduction of non-inductive resistances directly in series with the radio frequency circuits. The potentiometer method of control is the more common.

Fig. 2 shows a receiver using four tubes: three as radio frequency amplifiers and one as a detector. Audio frequency amplification can of course be added. A circuit of this type will give very good results using a coil antenna. Some control of regeneration can be obtained by adjusting the potentiometer, but in general it will be found that a point is reached where the circuit suddenly produces violent oscillation before efficient regeneration can be secured. It is questionable as to whether or not the regenerative effect obtained by potentiometer adjustment is of much value.

This means that the grid is usually positive and heavy plate currents result which quickly run down the plate batteries. If series resistance is used it must not only be inserted in the loop circuit but also in each radio frequency circuit, as local radio frequency oscillations may be set up in one of the amplifiers circuits. Due to capacitance between windings and core losses practically no radio frequency transformer has a voltage ratio greater than one, and many actually deliver less voltage at the secondary than is delivered to the primary winding.

The main objection to radio frequency amplifiers using untuned transformers is the fact that they are comparatively inefficient and lack selectivity. In general it takes at least one and one-half stages of the best transformer coupled radio frequency amplification to make up for the fact that efficient regeneration cannot be obtained. This means that a three tube set using two tubes in a transformer coupled radio frequency amplifier and one as a detector is but little better than a one tube regenerative

set. For this reason one stage of transformer coupled radio frequency amplification is worse than none. In order to obtain a real advantage at least three stages of amplification should be used. A good receiving set of this type which would give sufficiently loud signals for a loud speaker with a coil aerial would use six tubes, three as radio frequency amplifiers, one as a detector and two as audio frequency amplifiers.

The large number of tubes required for a receiving set of the type under discussion has led to the development of reflex circuit in which the same tubes

tends to destroy any selectivity which may exist in a straight radio frequency set, as the additional circuits necessary for routing the audio frequency back through the radio frequency circuits provide additional coupling for radio frequency currents as well. These criticisms may be summarized in the statement that it is extremely difficult to build a reflex amplifier in which either radio or audio frequency amplification is as efficiently accomplished as would be the case if the amplifier were designed to handle only one or the other. The only justification for the use of reflex

stage as is the case in the straight reflex circuit. This statement is based on the assumption that the radio frequency currents and voltages cannot be of sufficient magnitude to overload the tube by themselves and are of small magnitude in comparison to the audio frequency currents and voltages. This must be the case if any audio frequency amplification is obtained at all and therefore from the standpoint of overloading the tubes it is immaterial whether straight or inverse reflexing is used.

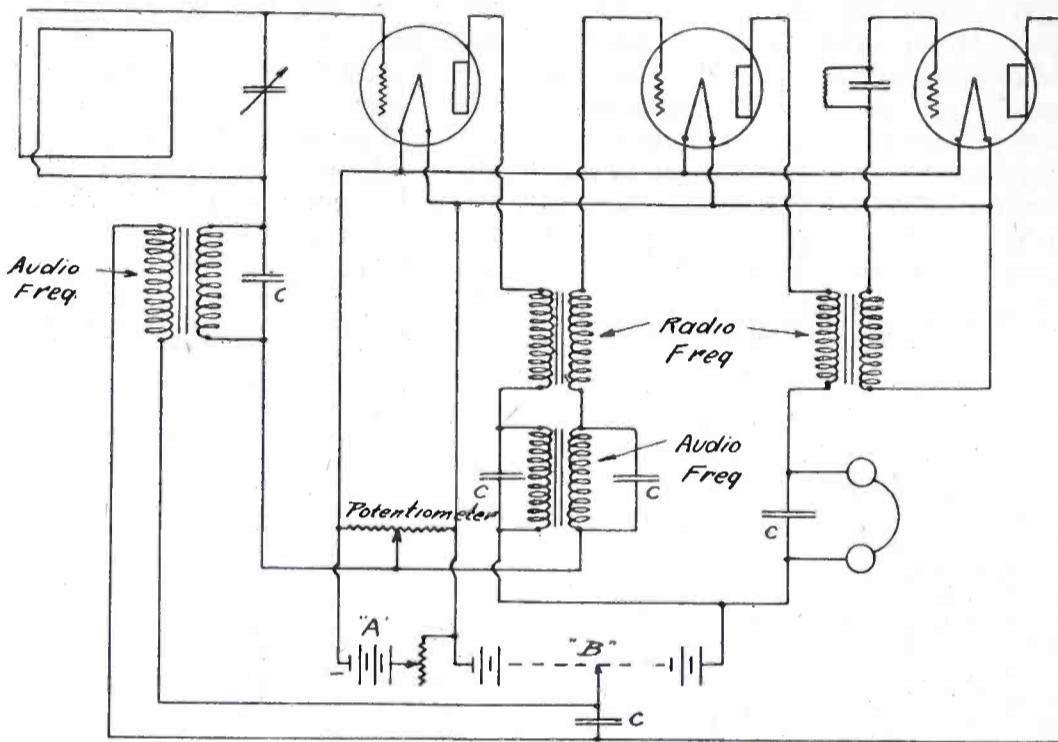


Fig. 3. Wiring Diagram for a Simple Reflex Amplifier Set

are used for both audio and radio frequency amplification. Fig. 3 shows a circuit of this type. The radio and audio frequency transformers are connected in series and condensers *C* are connected across the audio frequency transformers. The radio frequency passes through these by-pass condensers. The audio frequency easily passes through the small inductance of the radio frequency transformer but cannot pass through the condensers *C* because of their high reactance to audio frequency.

Fig. 3 shows the so-called potentiometer method of preventing local oscillations. This is open to the very serious objection that the grid bias must usually be made positive or at least only slightly negative to prevent local oscillations, in which case efficient audio frequency amplification is not possible. Reflexing also

circuits is therefore a necessity for limiting the number of tubes in the set.

It is believed by some that in a straight reflex set the tube which operates in the last stage of the radio frequency amplifier circuit is overloaded, as this tube also operates in the last stage of the audio frequency circuit. To meet such a situation the inverse reflex circuits have been developed in which the audio frequency currents are carried first to the tube in the last stage of the radio frequency amplifier and then back to the next to the last stage, etc., as shown in Fig. 4. The writer is not convinced of the necessity of this as it is very doubtful if the effect of the highest stage audio frequency currents and voltages will be any less detrimental if present in the first radio stage as is the case in the inverse reflexing than they will be if acting in the last radio

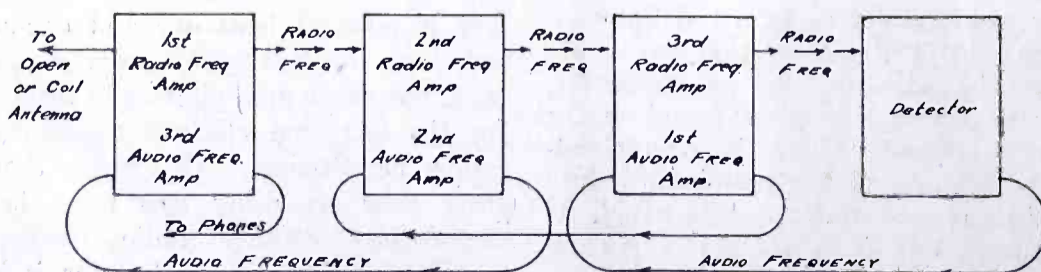


Fig. 4. Routing in an Inverse Reflex Amplifier

MY FIRST TRIP AS AN OPERATOR

By DONALD G. STEWART

MY FIRST trip as a commercial ship's operator was on the lumber schooner *Santa Rita*, which carried on a coastwise trade between Puget Sound and San Pedro. While staying at Long Beach, I received a telegram from San Francisco informing me that the operator on the *Santa Rita* wished to be relieved and that I was to take his place.

The next day I was on hand at the lumber yard on Terminal Island, where the *Santa Rita* had discharged her cargo, and reported for duty. The operator whom I was to relieve was busy getting his personal effects together and seemed glad to be rid of the job.

"Well!" I remarked, "I hear the old 'hooker' rolls a little too much to suit you." "Yes," he replied, "she does roll pretty bad going north empty."

Together we checked over the apparatus and spare parts, after which he bid me goodbye and went ashore.

It was not long until the ship was under way and after a short stop at Redondo we were again headed north for Puget Sound. About two days out we encountered rough weather which soon convinced me that the rolling and pitching of an empty vessel was anything but pleasant.

One night while off the coast of Washington, I picked up an SOS from a ship in distress. The *S. S. Nika* was on fire two miles south of Umatilla Reef and in urgent need of assistance. I informed the Captain immediately, but as I learned later that another ship was on its way to the *Nika* and could reach her before we could, the Captain decided to proceed on his course. He then asked me to obtain a radio compass bearing from Tatoosh, which I did, but which was not accurate, as we were in their uncalibrated area. I stayed on watch that night until 4 A. M. and sent in a message to the ship's agents in Seattle informing them of our expected arrival within a few hours. I then snapped off the light and went to bed, thinking that when I got up again I would see the ship tied up snug and tight to the dock.

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Things Equal to the Same Thing

An Analysis of Complex Circuits Into Their Simpler Components

By Harry A. Nickerson

SOME of the radio manufacturers and radio magazines seem to have adopted the motto, "A Dyne a day makes radio pay." One would think that there was a new circuit born with each new name, but it takes but casual inspection to recognize the old friend in a new suit of clothes. About the easiest method to make a "new circuit," is to substitute a coil with a condenser in place of a variometer, or vice versa. Then there is the method of making a double set of coils of the neutroformer type take the place of a single coil, with appropriate change of connections.

There comes a day to the radio novice when he can inspect a so-called "new circuit" and analyze it in terms of the familiar old circuit. This article is intended to assist the novice in more quickly arriving at the day of analysis.

It is first essential that one understand the difference between "single" and "double" circuit tuning devices. The standard "single circuit regenerative" hookup is shown in Fig. 1. Coil *PS* is

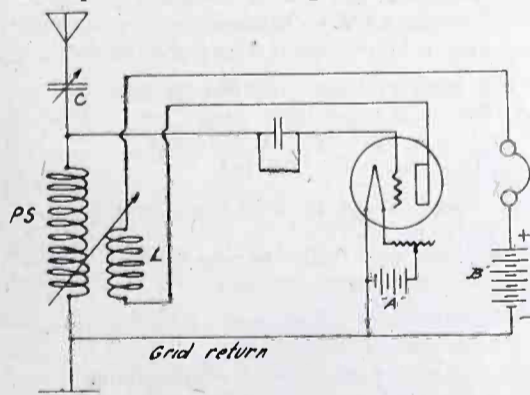


Fig. 1. Single Circuit Regenerative

an inductance tuned by a variable condenser *C* in series, and constitutes the antenna-ground circuit. This same coil being a connection from grid of vacuum tube to filament of tube is likewise a part of the "grid filament circuit," so-called.

The double-circuit is shown in Fig. 2, where *P* may be an "untuned primary" consisting of say 6 turns wound outside of *S*, a secondary of say 50 turns on a 3 in. diameter tube. *P* is the antenna-ground inductance and *S* is the secondary or "grid-filament" circuit, "tuned" by variable condenser *C*₂. Understanding so much, it is not hard to see that instead of a 6-turn primary, some other form of inductance may be substituted. For example, a honey-comb coil, a spider-

web coil or a variometer might be used at *P*. So with *S*, a honey-comb or spider-web coil or a variometer might be used.

In very crude but perhaps understandable language, it is the function of the grid circuit to let pass or "squeeze forward" into the vacuum tube plate circuit, signals of only one wavelength or frequency.

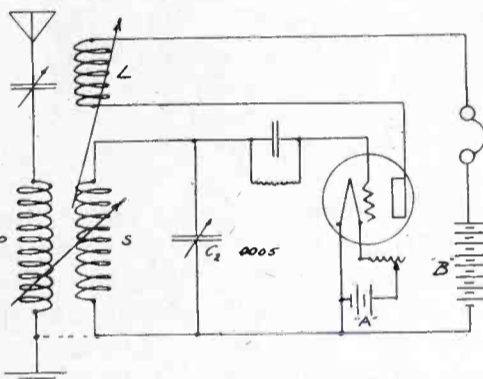


Fig. 2. Double Circuit With Regeneration

In the plate circuit, we may have some device to secure regeneration, or "feed-back" of radio-frequency from the plate circuit into which it has been "squeezed" by the grid circuit. This regeneration is most simply had by use of an inductance *L* which can be moved back and forth beside the grid inductance (*PS* in Fig. 1, or *S* in Fig. 2). Of course again, this inductance (*R*) may be honey-comb, spider-web, or a coil of wire wound on a ball-shaped or tubular shaped rotor, as seen in the usual variocoupler.

Another very common method of securing regeneration is that found where a variometer is inserted in the plate circuit in the same place as the inductance *L*. The feed-back is then said to take place through the capacity existing between the elements of the vacuum tube itself, these acting as a small condenser for the passage of radio-frequency currents. The "Greene Concert Receiver" makes use of this method of securing regeneration. Other methods of securing regeneration are the various ultra audion and Reinartz circuits.

The radio-frequency amplification "hook-up" of Fig. 3 is similar to the single circuit in Fig. 1. *PS* is the tuning device that determines whether you are going to receive a 220 or a 550 meter wave and passes on the tuned-wave to the plate circuit, where *L*₂ (which is in this case, "tuned" by a variable condenser) again "squeezes" the desired wave into the right hand tube, where the audio-frequency part of the wave sent out by the station is heard in the phones.

The tube at the right in Fig. 3, is non-regenerative, because there is no provision intentionally made for a feed-back indicated in the diagram. But a tickler coil (as *L*, Fig. 1) might be inserted at *X*. It is plain that *L* might then be made to feed back from the right hand tube either into the grid circuit of this tube or into the grid circuit of the left hand or r. f. tube, merely by

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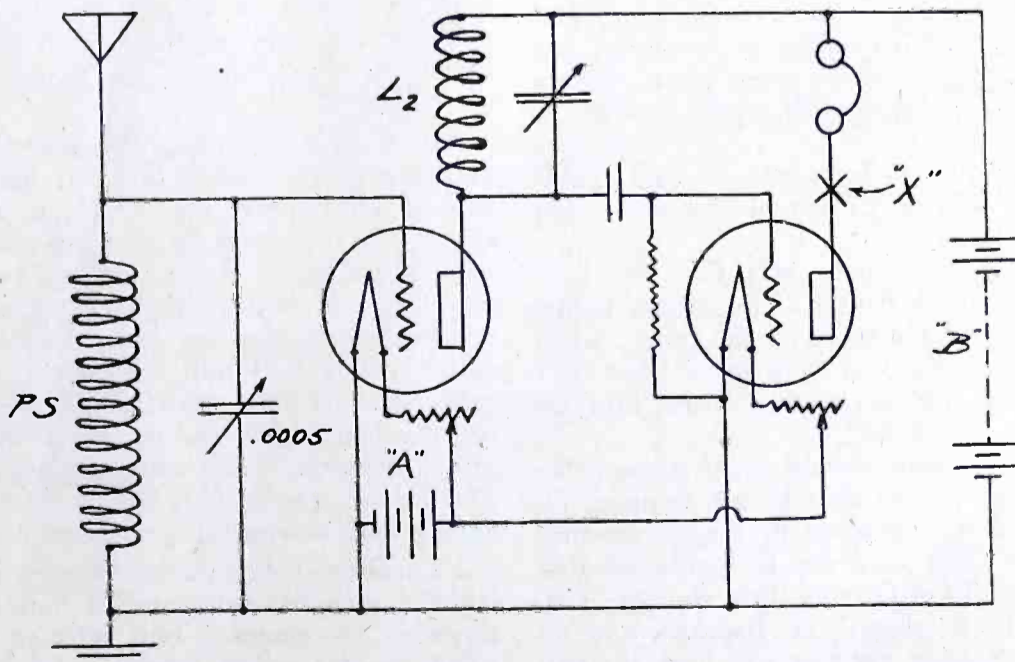


Fig. 3. "Tuned Impedance" R. F. Amplification

SCRATCHI OUTCASTS FROM YELLOW PERILS

By DAVID P. GIBBONS

To Editor of RADIO (which omit blowing up its own horn).

Ed dear:

Will you please excuse me, thank you, for my impromptness in writing at you for so extensive period. As a matter of facts, I have just returned myself back again from quite distant sea voyage over the widely-spread Pacific Ocean, which are not often so.

My Cousin Scratchi depose that I should reform you about the radio situations in the faraway climbs which I visited at, but I think, Ed, that there are quite sufficient nr. of things to reform at home without stepping on strangers toenails, dont you?

"And more over too," I yip at my Cousin. "RADIO are respectable mag and do not ever reprint such exploding langwidge like a republican vice candy-date exhale."

Scratchi then become very dumb and I grasp my rusty type machine in like manner.

Most outsticking necessity of present moment are, I think, Ed, a national correspondent school for announcers. Since it are possible in few brief lessons to become dashing radio fizishon with tax free paper income of many figures or to become expensive fingermark hunter by simple coupon method of forwarding cash payments to Mister Addison Simms of Seattle or somebody like that, why are it not also possible to do similar good scout turn for the mispaid announcers? Answer are "Why not?"

Course should be entirely complete in ten lessons and first lesson should devote himself to convints announcing student that in many instants the listener-on actuley have a few brains of his own. This will seem very radikle idea to many mike-owners, like "Are Mars infested?" and "Did monkeys ascend from men?" and other such high-dome interrogations.

Next lesson should point towards fact that at all times when announcer say "You have just had great pleasure from hearing Madame Blatalotti singing 'I would I was a birdie'", every knob-spinner grunt peevily "Izzatso!", and might-be he add on "I would you was a hot boiled owl".

Wasent it not, Mr. Ed, the Hon Lincoln which said "You cannot kiddie all the people much of the time", when he took his first ride in a lizzie-car? Answer, of course, to this one also are "Yes, it was not".

Same lesson should expel strong caution to learner that he are stepping on thin water-ice when he inform the universe "You will now be highly flavored by the Taxi Drivers Trio singing "Oh, dear! Oh, dear!" by Badman, and on next Sunday eve you will have the special gladness to hear the Fish Peddlers

Sextet render apart the first 16 verses of "The Rain have Ceased", by Golli.

This lesson should indicate to announcer that after radiator or radiatress have strutted his stuffing, the unseen audients are subposed to be jury of whether it are good or the perverse, as often happen, and they deject to have a microformer do up their minds for them beforehand. Like moving fillum fans who have absorbed high power descriptions of next stupendus output from studio and find when it come along that it are one more flat tire, the radiolists are balking away from bait which are too brightly colored, dont you think, Mr. Ed, or do you?

Fourth lesson which this fresh school would infect into its scholars are that broadcast studio are quite public platform and announcer who allow idea to ingrow that he are the entire jugful of the cat's cold cream are more silly person than theatre man who turn the spotty light on himself instead of on "The Trained Murphies" in their side-cracking novelty. This lesson should farthermore assist to attach tin cannister to studio people who project little private mags to friends on the exterior, and who step around legal rules by inserting remark like "Next we will donate to you touchy little balid called "Take me away from mossy Dixie". This one are dedicated to Mr. Sandy Haig who are having hot dog party at home of his brother who live far off at nr. 16007 Cactus Ave, Sagebrush County, Los Angeles."

Next chapter would aim itself to erase the gent who use voice with that school-girl deflection and who think his delicious remarks are "just too sweet." Most of his audients which cannot tune him away also think likewise, Mr. Ed.

Same chapter would rub off gent who protract each sillabel like he were talking to dumb and deaf little boy about 3 and half yrs. old, and last part of this chapter would deal out some helpless hints for terribly intelligent woman announcer who address mike with more super-refined impressions than two books of ettiket.

My Cousin Scratchi, who sometime hatch up rather comicle idea, say he expose to hold littery digest pole to discover who are most highly unpopular woman talking or singing on the radio wavelets, and as prize package for winner he sniggest a self-starting gas bomb which voters will jollily present. Remaining losers must accept sample of my cousin's home brew and use same in internal manner. Such contest however, Mr. Ed, seem to withold slite eliment of danger in it, as something might go bang.

Remaining lesson would express on budding empressarios that first hundred times are the easiest. This refer to so-stiled popular songs, falsetto solos and "The Road to Mental Hay."

When tenor warblers at six wide-scattering stations demand to know for the 101st insecutive time "What'll I do? What'll I do?" then the furiated ear-drummers begin biting large chunks out of hard rubber panels and toss forth eager snuggestions what he should do and also where.

New crop of graduets turned out from this school, Mr. Ed, are sure of quick position because it are mere axidental chance if any of present microformers, except about two, can survive the on-coming cold weather snaps.

My Cousin keep popping question at me to find out how do American and foreign broadcaster compare favoritely with each others, so I yap at him that only mentionable stations on far edge of Pacific are at New Zealand and Australia, and only crack I can say, Mr. Ed, are that home made variety are not a bit worse than his wool-growing brothers in bushy home of bouncing kangaroo, which make everybody smile at his humerus antix.

Wishing you are likewise, Mr. Ed.

I will fold myself up and stay,

Your depreciative reader,

HILOLI NOGO.

A RADIO WIDOW

By RUTH DEAMER

My husband has a radio set,
He's had it just a year,
But if it stays another week—
I'm going away from here.

I'm tired of taking second place,
And don't see why I should;
I'm going back to Mother's,
For I know she'll treat me good.

We used to have just lots of fun
Before he got this pest,
And now that he's an amateur
He's nutty like the rest.

A "ham" drops in most every night,
Perhaps 6XYZ,
Or some such silly person—
Who has no use for me.

They turn the knobs, and twist the dials,
Change the wires too,
And wonder why—with single tubes
They can't hear Kalamazoo.

Some one comes on with music,
But as they start to play
We skip from "Red Hot Mamma"
To "The End of a Perfect Day."

A sermon or a recipe,
It doesn't matter which,
They're cut in two completely
When the boys decide to switch.

They talk about grid-leaks,
The rheostats, and such,
And if I change the subject
I'm sure "to get in Dutch."

Thus we spend our evenings—
Or nearly every one,
So I can't see just where and how
I'm having any fun.

Since we don't go to dances
I'm getting stiff—and say!
If this keeps up I know for sure
I'll soon be turning gray.

And so this world and then the next,
But I hope where'er I go
The place won't be all cluttered up
With some old radio.

"Station GFS"—A Christmas Story

By R. W. Shirey

FROM the time he was five—hours, not years, until he was twenty—five—years, not hours, Raymond Shaw treated his grandfather, whom he always referred to as "GFS," in a manner dictated by his mood. At times he snubbed the old man, then smiled at him like a May morning, or smote him like the March wind, all to suit his convenience and all for the same purpose, to get his own way.

Grandfather Shaw said if "Sonny" had been properly spanked, instead of spoiled all his life, he would have developed a proper respect for his elders. Had any one dared to suggest that it was he who had saved the boy from the needed spankings, the president of the Shaw Radio Manufacturing Corporation would roar them down. Roaring down people was his hobby.

It was in this environment that Raymond Shaw had passed through the years of childhood. Too much love and devotion had been bestowed upon him by his grandparents, who had taken him when he was left an orphan.

Today, years later, Raymond Shaw sat with bowed head. He could hardly comprehend the edict of banishment that bright December morning. Youth's heart does not turn bitter in an hour. There he sat in the office with the white haired grandfather. Always before "GFS" had dealt out the deserved praise and reproach, or a threat of pun-

ishment, which he never expected to fulfill. To be sure, none of the occasions had ever approached the seriousness of this one. It must be a dream that his grandfather, after speaking certain unforgiving decrees, had turned his back on him like something unclean, and sat staring blankly out of the window at the lineman tapping like some woodpecker on a nearby pole.

In the corner stood the open safe from which the money had been taken.

"Grandfather I can't let Old Hubbard go to jail just because he came in the office to fix a leaky radiator after you left to answer that long distance phone call from Denver. I was alone in the office a few minutes after you left. The safe was open and I took the money. I had some debts to pay. I thought you wouldn't miss the small amount, and besides I fully intended to pay it back."

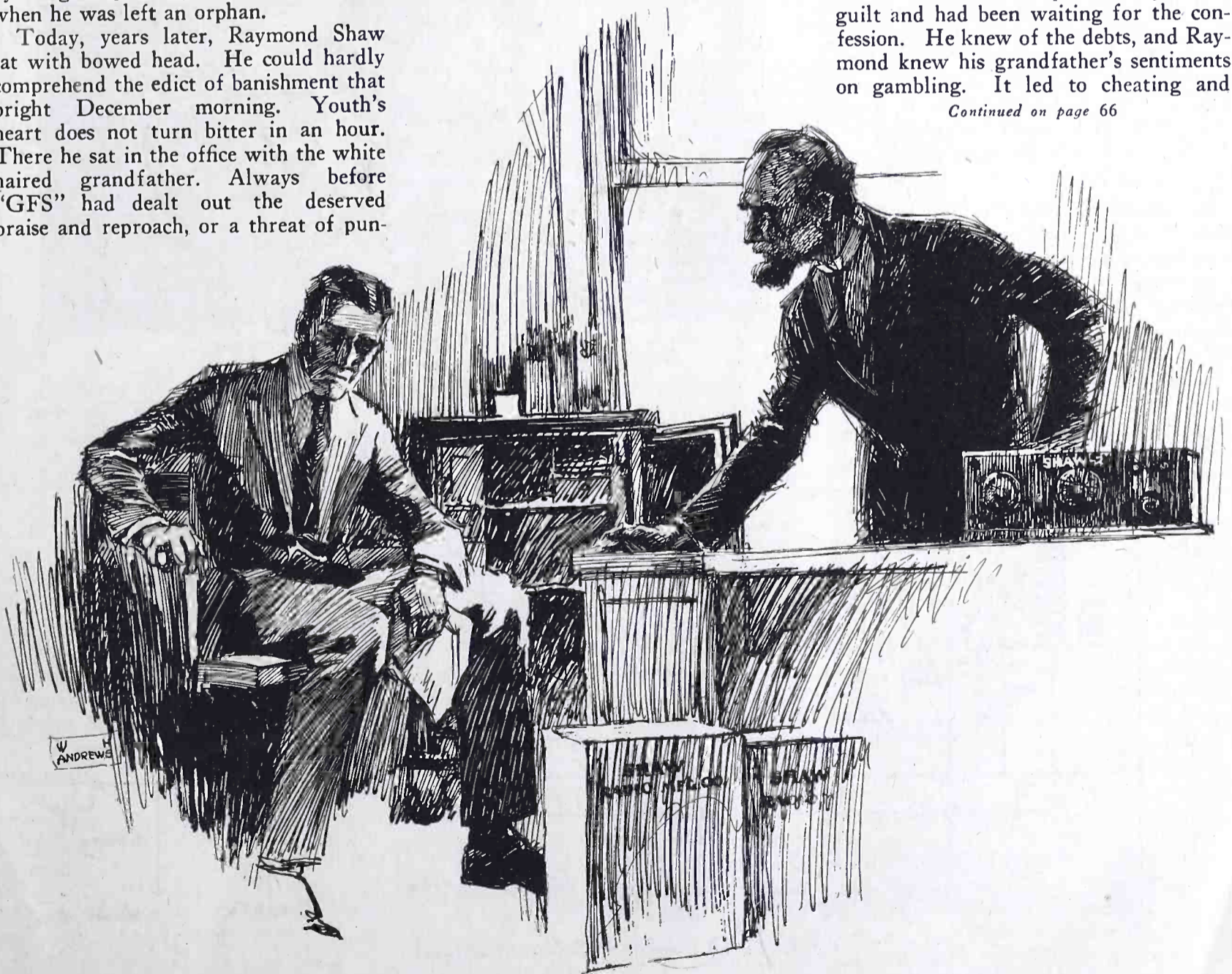
It was pity for old lady Hubbard and her daughter that caused him to confess. The old lady had been on the brink of nervous prostration at the horror of her

husband's being accused of theft and sent to jail. She knew that he was innocent, but crimes have been proven on innocent men, and they have had to pay the penalty. Young Miss Hubbard would have to give up her place in the high school if the disgrace was not removed. And, dash it all! it was Christmas time. He couldn't let it go on with the worry and sorrow that it was sure to bring them.

His grandfather would be aroused, of course, give him a lecture, fix a stiff penance, and then it would be hushed up. By and by it would all blow over, everything would be rosy for Old Hubbard, and none the worse for Raymond, especially if he walked the straight henceforth, which he fully expected to do now that he was engaged to the finest girl in Long Beach.

But this time "GFS" didn't play the expected part. For the sake of the family name he would hush the publicity, after enough had been published to clear Hubbard. But in his private judgment the old man had suspected Raymond's guilt and had been waiting for the confession. He knew of the debts, and Raymond knew his grandfather's sentiments on gambling. It led to cheating and

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A Reflexed Neutrodyne

An Interesting Record of Experiments Which May Be Of Aid To Others Working On This Problem

By Philip N. Emigh

LIKE many others, I built a five-tube neutrodyne set using 15 and 65-turn transformers tuned with 11-plate condensers. While results were good, nevertheless I was not satisfied, as the extra equipment did not give much better signals than a standard three-tube regenerative set. I used a tuned antenna circuit and the four controls made it difficult for the younger members of the family to handle. Also the signals on the upper wavelengths, 450 to 550 meters, were weak. This I believed to be due to too much capacity in the tuning circuit.

After some experimenting, I found that a radio-frequency transformer wound with 91 turns on the secondary and 28 on the primary, tuned with a 7-plate condenser, gave a wavelength range of from 300 to 550 meters. This covered the Class B radio casting stations nicely. A primary or aerial coil of five turns was wound on the first transformer, and this, when used with my regular antenna, which is 400 ft. long and 100 ft. high, tuned to resonance by the click method at any point within the range of the set.

In building these radio-frequency transformers a little care is necessary. The outer tube or secondary may be cut to a length of 3 in. and is $3\frac{1}{2}$ in. in diameter. The inner or primary is $1\frac{1}{4}$ in. in length by 3 in. in diameter.

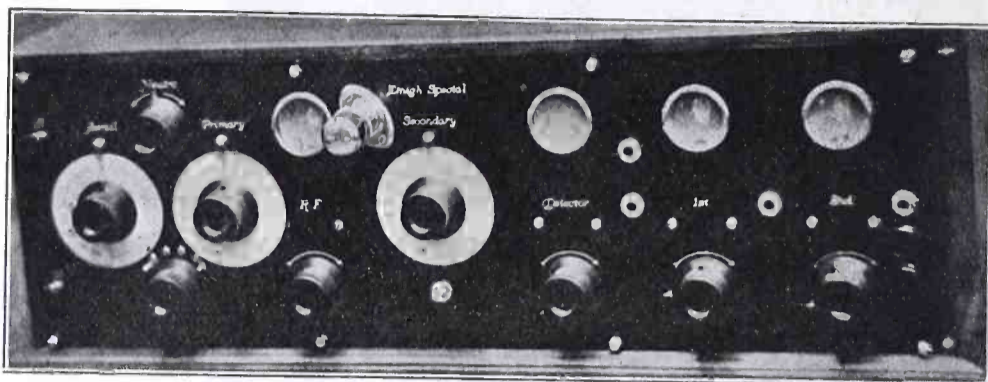


Fig. 1. Panel View of Reflexed Neutrodyne

Prestretched single silk-covered wire of 24 B. & S. gauge is used, and all coils are wound in the same direction and connected as shown in Fig. 3. The primary is inserted inside the secondary and is secured at the negative end of the latter. One stage of radio-frequency amplification now gave signals that were

satisfactory as to volume and clarity.

It was found that the neutralizing condenser C_4 would have to be variable, as there was a strong tendency for the set to spill over. This condenser may be seen in Fig. 2 and in detail in Fig. 5. As it is very sensitive to body capacity effects, it was set over to one side and

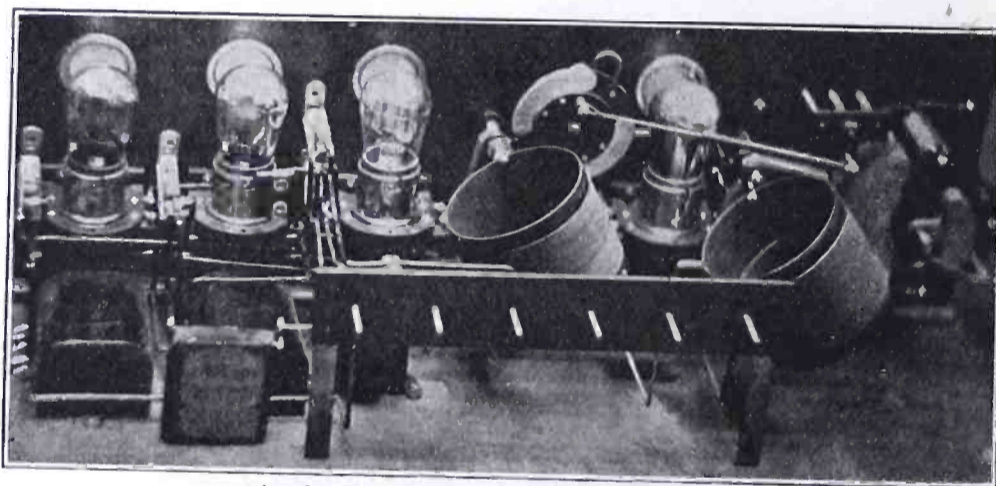


Fig. 2. Rear View of Reflexed Neutrodyne

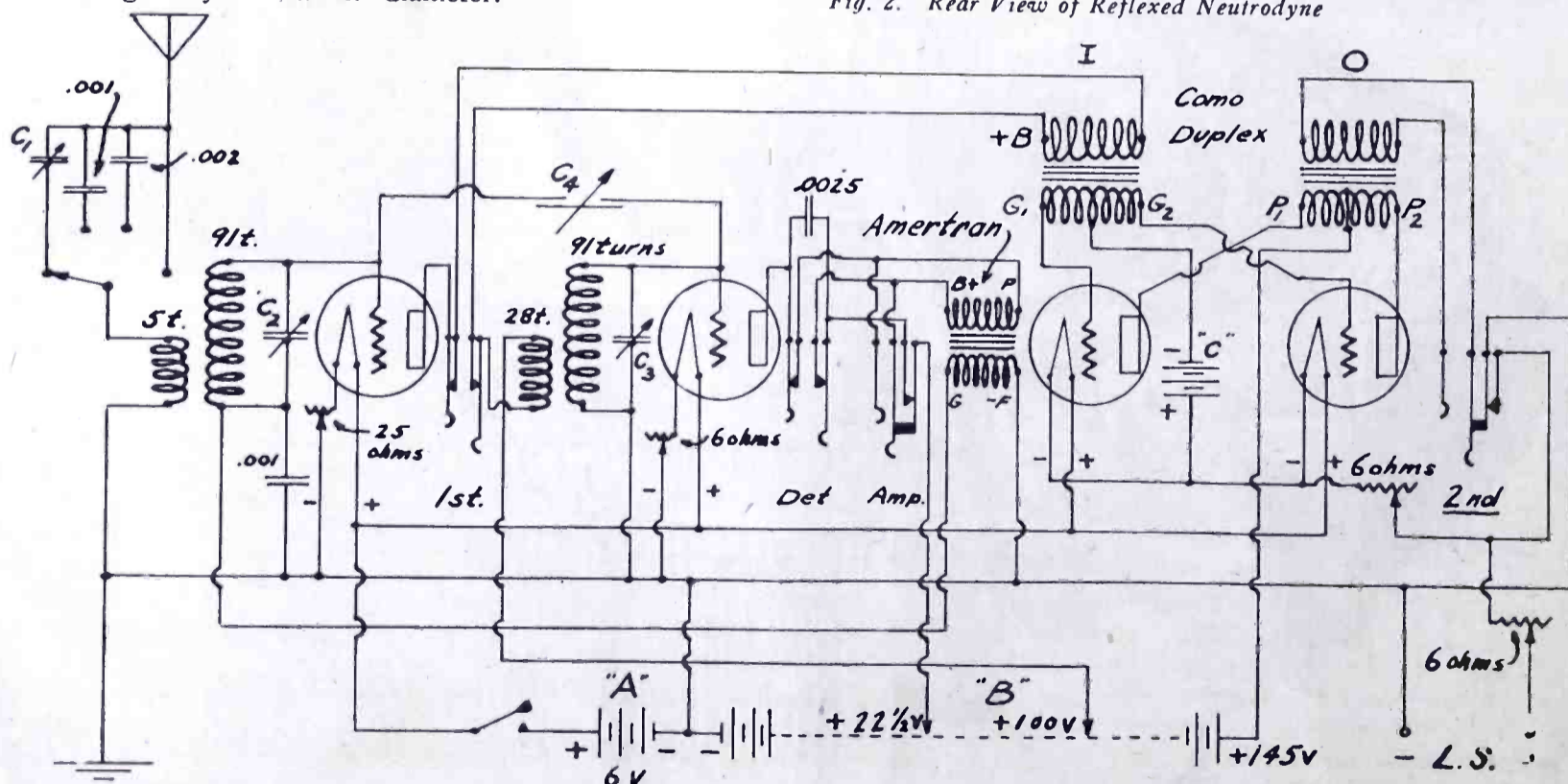


Fig. 3. Circuit Diagram of Reflexed Neutrodyne

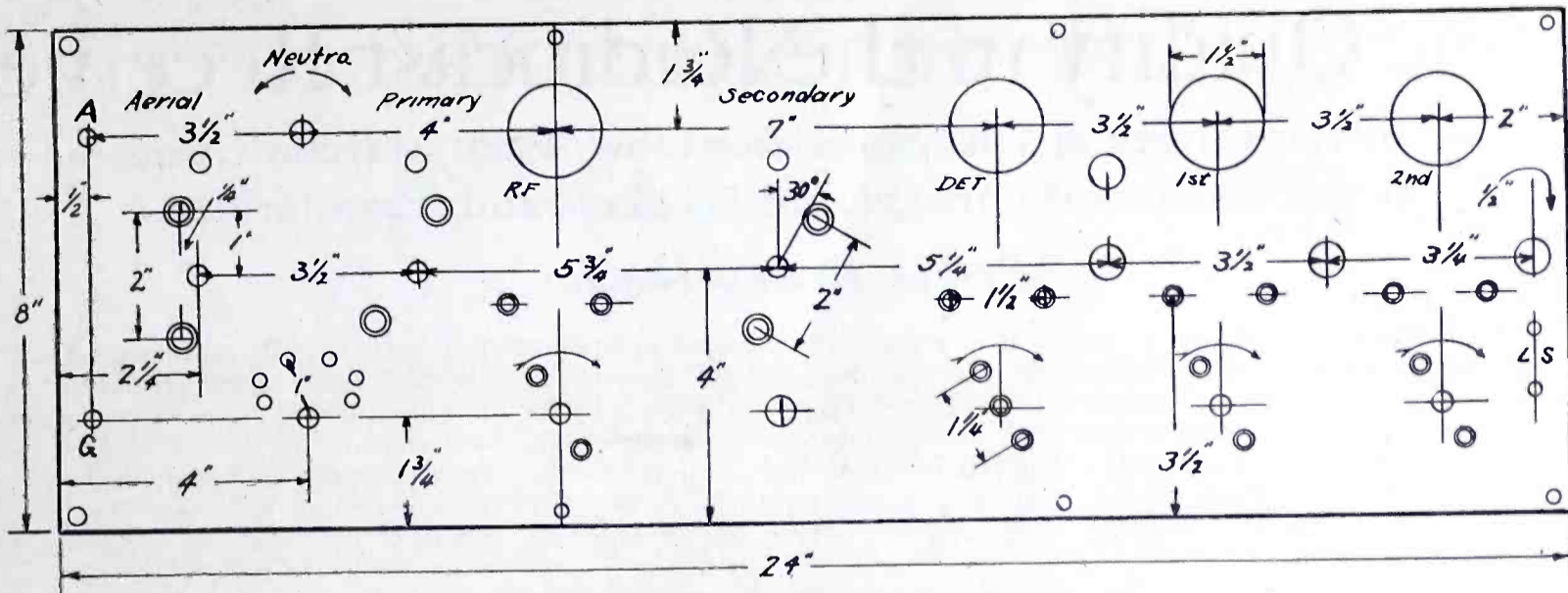


Fig. 4. Panel Layout

connected to the control knob by means of an insulated coupling rod. It was found that the operation of the set was vastly improved by removing the grid condenser from the detector circuit.

No biasing batteries were necessary to secure perfect rectification of incoming signals. Both UV-200 and 201A tubes were used as detectors with not much difference in results.

audio-frequency amplification, using push-pull transformers with two UV-201A tubes, controlled from one 6-ohm rheostat, with 145 volts on the plates and a 9-volt C battery on the grids. This combination was hard to beat.

With this set as now constructed, I have logged all but four of the Class B radio cast stations in the U. S., a majority of those in Canada; Havana,

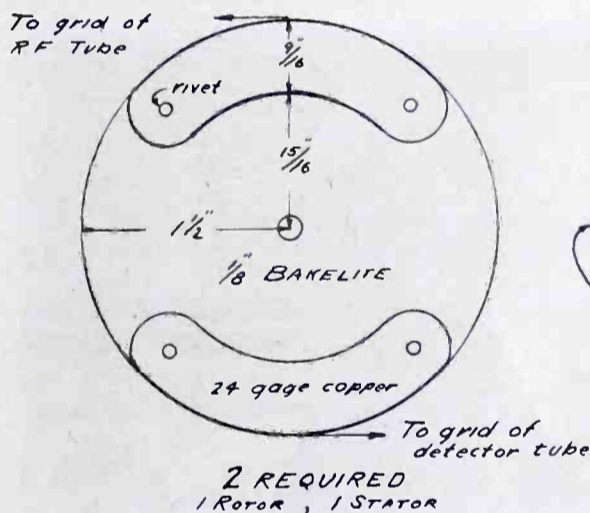


Fig. 5. Constructional Details

It was found that, while the UV-200 tube was very critical as regards plate voltage, the B battery could be eliminated, and, by attaching the former 22 1/2-volt lead to the positive of the A battery, very good signals could be obtained. This is on the Solodyne principle.

I now put in the first stage of audio-frequency amplification, reflexing the radio-frequency tube for this purpose. A .001 mfd. condenser was inserted between the former negative end of the secondary of the first radio-frequency transformer and the negative battery lead. This was the only extra condenser necessary.

I am indebted to Mr. M. B. Sleeper's hint in March, 1924 RADIO, "Connect the primary of the audio-frequency transformer between the plate and the second radio-frequency transformer." This is fine business and will sometimes cure an otherwise incurable howl.

Next, I added the second stage of

Cuba; 2LO, London, England; and 2BD, Aberdeen, Scotland. A daylight range of 500 miles is consistently covered, while I have reached 900 miles under the same conditions.

For the benefit of those who may desire to build this set, I am giving a list of material which I used. Fig. 4 gives the panel layout, which is correct for the items listed.

- 1 Bakelite panel 8 in. x 24 in. x 1/4 in.
- 1 Cabinet with removable bottom.
- 4 6-ohm rheostats. Federal.
- 2 Closed-circuit jacks. Federal.
- 1 Filament control jack. Federal.
- 1 Open-circuit jack. Federal (rebuilt).
- 10 Large size binding posts.
- 2 Sleeper high ratio condensers, 7-plate (rebuilt).
- 1 Sleeper high-ratio condenser, 43-plate.
- Micon condensers as follows: 2 .001 mfd.; 1 .002 mfd.; 1 .0025 mfd.
- 1 Neutralizing condenser, C, Fig. 3 (home made).
- 1 A.F. transformer. Amertran A.F. 6.
- 1 Pair como-duplex push-and-pull A.F. transformers.
- 4 Paragon panel mounting sockets.
- 3 3-in. Somerville metal dials.
- 9 Somerville knobs, small size.
- 1 Cutler-Hammer switch.
- 1 Cutler-Hammer 25-ohm resistance.
- 1 C battery, 9 volts.
- 4 Contact points, 2 switch stops, 1 switch arm.
- 2 Pieces Bakelite 10 3/4 in. x 1 1/2 in. x 3/16 in. (terminal mounting).
- Nos. 12 and 14-ga. bus wire, spaghetti, screws, bezels.
- 1/4 in. round brass rod, 1/4 in. round fibre, etc.
- 2 Pieces Bakelite tubing 3 in. long x 3 1/2 in. diameter.
- 2 Pieces Bakelite tubing 1 1/4 in. long x 3 in. diameter.
- 1/4 Pound No. 24 B & S gauge SSC magnet wire.

Fig. 1 shows the front view of the set. The switch arm and contacts at the lower left hand control the series antenna condensers. With this arm at the left as shown, the .001 mfd. variable is cut in series. At the next point a .001 Micon is added. At the next a .002 Micon is cut in, while the last point cuts

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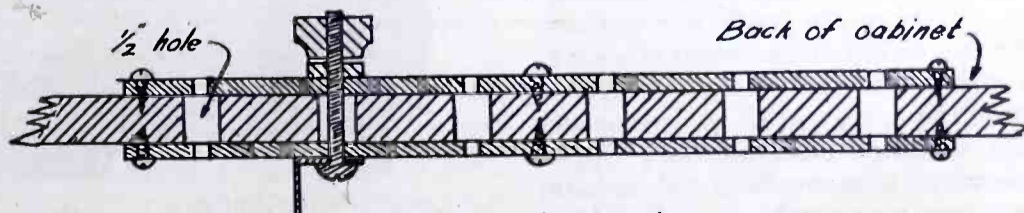
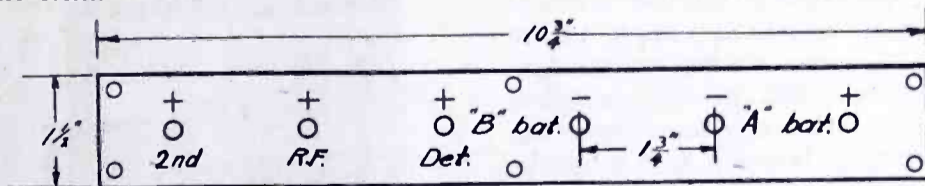


Fig. 6. Terminal Board

Tone Quality in the Radiocast Receiver

Some of the Causes of Distortion and How They May Be Corrected
in the Choice of Tubes, Loud Speakers and Transformers

By Maurice Buchbinder

THE foremost consideration in judging a radio set is undoubtedly quality—quality of sound and faithful reproduction. This is the chief consideration in any musical instrument, whether it be a piano, phonograph or neutrodyne receiver. For this reason, in purchasing or constructing a broadcast receiver, we should know just what elements go to make up musical quality, just wherein we may economize and wherein the best that the market affords is possibly not quite good enough.

There is one simple principle of sound which lies at the basis of the whole subject. An orchestra is made up of many instruments, some being very high pitched like the piccolo and first violins, some very low pitched like the bass violas, cellos and drums. The range of pitch on frequency is probably from as low as 20 to as high as 4,000 cycles vibrations per second. In the same way the note emitted by any one instrument is made up of a single frequency, what we call the pitch, plus a series of higher frequencies, twice, three times, four times, and so on as high, called the overtones or harmonics. It is the presence of these higher harmonics which gives the tone individuality, and which enables us to distinguish a violin from a piano playing the same note, or a soprano from a tenor singing the same note. Finally, speech consists of a very complicated mixture of tones of very many frequencies, some of long, some of short duration, some of great, some of minute intensity. Yet every one of these frequencies is necessary if we are to recognize the quality of the voice and if it is to sound natural instead of nasal, falsetto, throaty or even entirely blurred and meaningless.

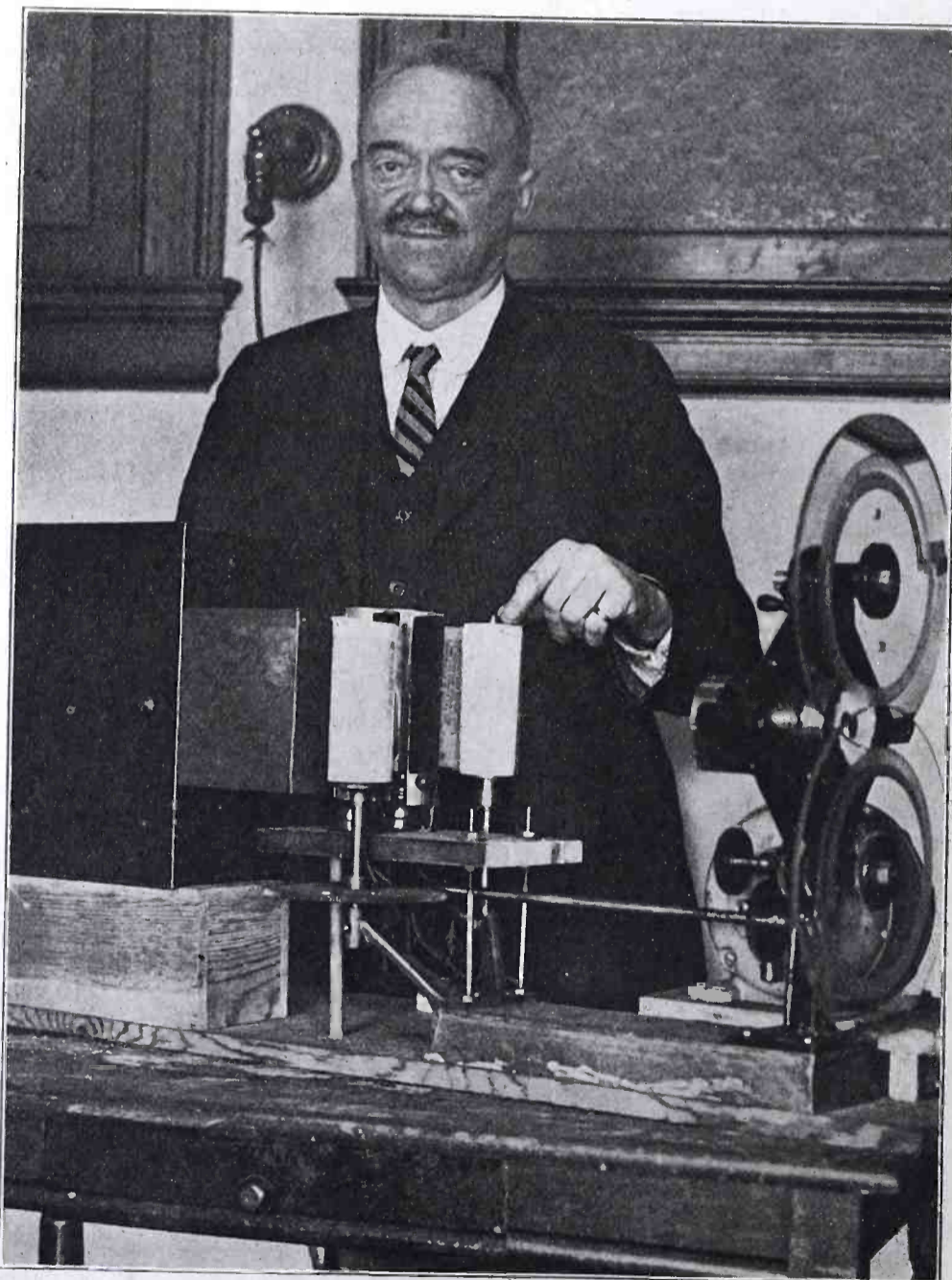
The quality of sound leaving the throat of the loud speaker depends upon the transmitter as well as receiver characteristics. The problem of transmitter design consists in preserving every one of the frequencies originally present in the studio. This means careful attention to the microphone, the speech amplifiers and the modulation system. There are great differences between station qualities, but many transmitting stations throughout the United States now deliver energy to the receiving antenna practically as it left the original source. It is then up to the receiving outfit to preserve this energy in all its frequencies despite repeated amplification. Right here is where so many thousands of radio expectations are ruined; the radio waves become adulterated in the receiver.

It is a matter of common experience that the quality of sound received in the head phones is generally much better than in the loud speaker. Many people for this reason are apt to prefer clamping their phones over the ears rather than miss words here and there owing to horn distortion. This fact is true no matter what the type of set, whether it has straight detection, regeneration or radio frequency amplification. For this reason we may conclude that mere detection or radio amplification brings in no noticeable distortion. Only when the set tends to oscillate as with unneutral neutrodynes or non-stabilized r. f. sets is there a peculiar hollowness of sound or even downright distortion.

In general we may assume that after detection the sound is clear and natural,

full of its original overtones. Yet after the two audio stages are applied, only too often do we get most unsatisfactory and discouraging results. Speech in bad cases becomes distorted, high pitched voices are thin and nasal, low pitched voices carry a fringe of roughness, and, worst of all, the full orchestra is reduced to its highest pitched instruments, the lowest pitches having become inaudible or sounding like dull thuds. Very often when a certain note is reached by the instrument or singer, the whole receiving system swells in a tremendous and ear-bursting resonant echo. These distressing distortions are conceivably caused by any or all of the vital elements of the audio frequency amplifying system, the tubes, the loud speaker and the transformers.

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Henry Miller Photo

C. Francis Jenkins and His Apparatus for Radio Projection of Photographs
Radio Station 6BBQ

Electric Filters

An Elementary Explanation of Their Purpose and Performance with Special Reference to Their Action as Wave Traps

By Jesse Marsten

A GOOD insight into the physical properties and behavior of electric filters can be obtained from a consideration of the resistance and reactance characteristics of the elements composing a filter circuit. These elements are an inductance formed by a coil of wire and a capacity formed by a condenser. Their reactance or opposition to the flow of an electric current varies with the frequency of the current and their filter action is directly due to this reactance variation.

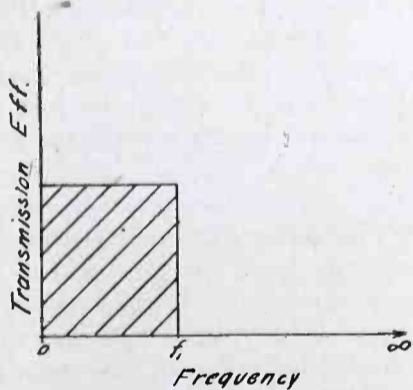


Fig. 1. Characteristics of Low Pass Filter

The best idea of the action can be secured by a comparison with an ordinary water filter which retains or excludes all solid particles so as to let clear water pass through it.

The classification of electric filters depends upon the range of frequencies admitted or excluded by the filter. If the filter admits all currents having frequencies lower than any arbitrary frequency f_1 , but excludes all currents having frequencies above f_1 it is called a "low pass" filter. Fig. 1 represents the behavior of a low pass filter, the shaded area showing that currents having frequencies lower than f_1 are passed while the unshaded area above frequency f_1 shows that these currents are not passed by the filter. Then there is the filter which admits all currents having frequencies higher than any arbitrary frequency f_1 , but which excludes all currents having frequencies lower than f_1 . This filter is called a "high pass" filter since it transmits only the higher range of frequencies. Fig. 2 shows the relative behavior of such a filter, the shaded area again designating the range of frequencies which are passed, the unshaded area the range of frequencies excluded.

These two types of filters admit or exclude currents at either one end of the frequency range or the other. Thus the low pass filter admits from zero fre-

quency up to f_1 , and the high pass filter admits from infinite frequency down to f_1 . There is also a filter which admits a band of frequencies from any arbitrary frequency f_1 to any other arbitrary frequency f_2 in the middle of the frequency range. Such a filter is called a "band pass filter." Fig. 3 shows the performance of this filter the shaded area representing the band of frequencies admitted, while on either side of it are the unshaded areas representing the frequencies not admitted. There is likewise the

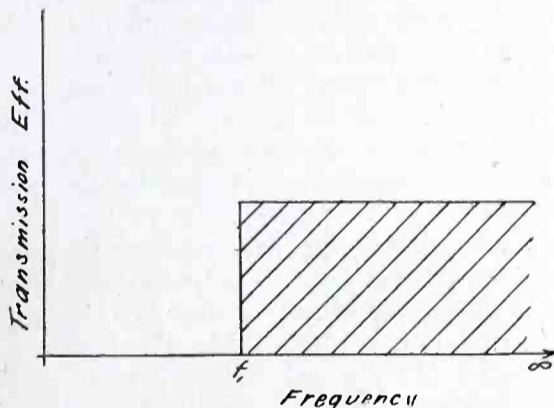


Fig. 2. Characteristics of High Pass Filter

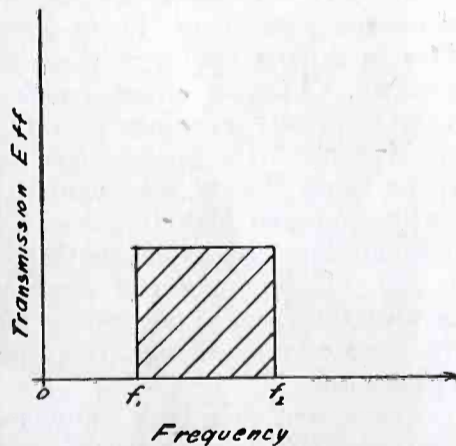


Fig. 3. Characteristics of Band Pass Filter

filter which excludes a band of frequencies from any arbitrary frequency f_1 to any other arbitrary frequency f_2 in the middle of the frequency range, while it admits all currents having frequencies outside of this band. Such a filter is called a "band exclusion filter." Fig. 4 shows the performance of this filter, the unshaded area representing the band of frequencies from f_1 to f_2 excluded by the filter, while on either side of it are the shaded areas representing the frequencies passed by the filter.

The above represent the basic types of filters. Combinations of these may be used. Thus we may have a filter which passes a band of frequencies from f_2 to f_3 , and at the same time passes all

frequencies below f_1 . Or we may have a filter which passes two bands, or admits one band of frequencies and excludes another band, and so on.

INDUCTANCE. The reactance of an inductance coil is directly proportional to the frequency. Its reactance characteristic is therefore a straight line and looks like Fig. 5, which shows that its re-

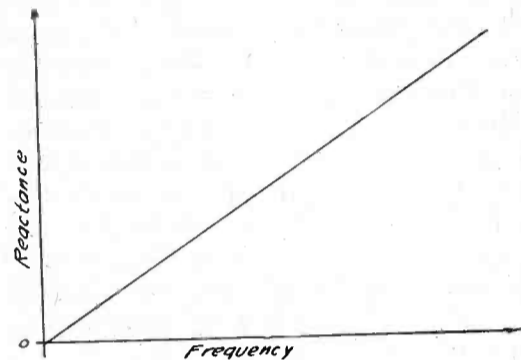


Fig. 5. Reactance Curve of an Inductance

actance is zero at zero frequency (direct current) and increases with frequency. Any circuit element may be connected either in series or in parallel with the

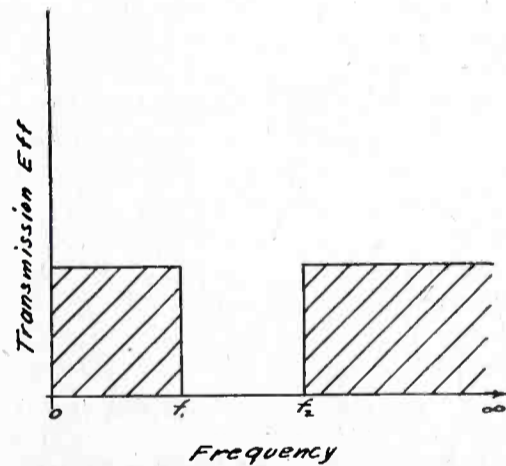


Fig. 4. Characteristics of Band Exclusion Filter

source of voltage. Suppose we have an inductance L connected in series with the source of voltage as in Fig. 6(a), and assume that the source of voltage furnishes current at all frequencies. Since the inductance has a very low reactance at the lower frequencies it is evident that low frequency currents will be passed, whereas the high frequency currents will not be passed so easily, since the reactance of L increases very rapidly with the frequency. Thus a series inductance behaves in effect as a low pass filter, though there is no sharply defined point where it completely cuts off the high frequencies. The higher the frequency of the current the more the inductance excludes it.

Suppose now that the inductance L is connected in parallel with the source of voltage, as in Fig. 6(b). Here the inductance behaves as a short circuit at the low frequencies, for its reactance at these frequencies is very low. Thus the low frequency currents are shorted or

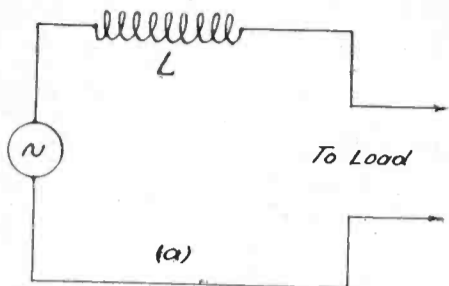


Fig. 6. (a) Series Connection of Inductance

source of voltage as in Fig. 8(a). At zero frequency or direct current its reactance is infinite, hence it stops or excludes this current completely. At the lower frequencies its reactance is very high, as shown by Fig. 7, hence it excludes currents of low frequency. At

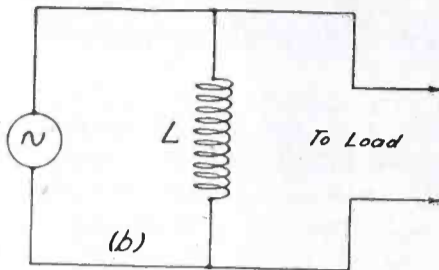


Fig. 6. (b) Parallel Connection of Inductance

by-passed, preventing them from going to the load. At the high frequencies, on the other hand, the reactance of L is so great that the high frequency currents pass to the load rather than through the high reactance of L . Thus the shunt inductance behaves in effect as a high pass filter. Here again there is no sharply defined frequency at which the low frequencies are cut off. The effect in both the series and shunt connection is a gradual one, the effect varying with the frequency.

Inductance effects, then, are these: Series inductance stops high frequencies and passes low. Shunt inductance stops low frequencies and passes high.

CAPACITY. The reactance of a con-

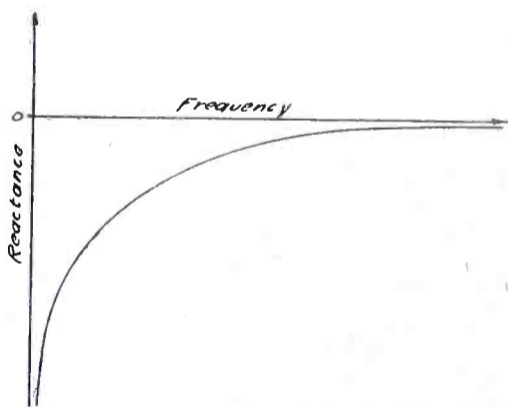


Fig. 7. Reactance Curve of Condenser

denser is inversely proportional to frequency, therefore its frequency characteristic looks like Fig. 7, which shows that its reactance is a maximum at zero frequency (direct current) and decreases with increasing frequency. Its filtering effect should therefore be the opposite to that of an inductance. Suppose that a condenser is connected in series with our

the high frequencies, however, its reactance is very low, hence it passes the high frequencies. Thus a series condenser behaves in effect as a high pass filter. As with the inductance the effect is not a sudden one, but a gradual one, there being no sharply defined frequency where it begins to cut off the lower frequencies.

Suppose now that the condenser is connected in parallel with our source of voltage as in Fig. 8(b). At the low frequencies where the reactance of the condenser is very great no current will pass through the shunt condenser, but will pass on to the load. At the high frequencies, on the other hand, where the reactance of the condenser is very low the current will be shunted through the condenser and will be prevented from passing to the load. The condenser behaves as a short circuit to the higher frequencies. Thus a shunt condenser behaves in effect as a low pass filter. Again the effect is a gradual one there being no sharp line of demarcation between the low and high frequencies.

Summarizing capacity effects then, we have the following: Series condenser stops low frequencies and passes high. Shunt condenser stops high frequencies and passes low.

It is thus seen that both inductances and capacities have properties which lend themselves to filter action. However, as noted above, there is no definite point where an inductance or a capacity, either taken alone, begins to filter. It therefore is necessary to use these units in conjunction with one another to secure sharper filtering action. When these circuit elements are used together to

form filters the filter will be found to have a series element and a shunt element, and the filter is so arranged that the action of the series element is opposite to that of the shunt element.

Thus Fig. 9 represents a typical simple low pass filter, such as is used in

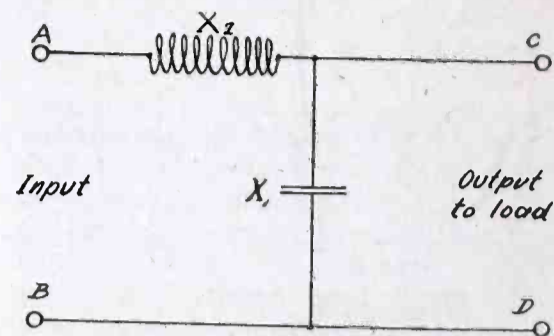


Fig. 9. Low Pass Filter

eliminating commutator hum from a d. c. generator. The series element is the inductance, and the shunt element is the capacity. The input voltage is applied to AB and the output voltage appears at CD after passing through the filter. This filter will suppress all the high frequencies and pass only the low and the values of X_1 and X_2 determine just at what frequency it begins to pass the low frequencies.

The action of this low pass filter is as follows: The series inductance L tends to suppress the high frequencies due to its high resistance, while it passes the low frequencies. The shunt capacity aids this action by behaving in an opposite manner, letting through the high frequencies, since the reactance of a condenser is low at high frequencies. But since the condenser is shunting the source of voltage, the high frequencies are in effect short circuited by the condenser and not passed on to the load. At the same time it offers a high reactance to the low frequencies, which are thus passed on to the load. The opposite actions of series and shunt elements to current of a given frequency are thus seen to aid in filtering.

The exact point at which a filter begins to function depends upon the values of the circuit elements, and by properly proportioning them any desired filtering action may be secured. Thus in the case of the low pass filter of Fig. 9, if we make L and C large enough the filter can be made so it will not pass currents of any frequency above 0, that is, it will only pass d. c. This is the case with good d. c. generator hum filters.

Fig. 10 represents one section of a high

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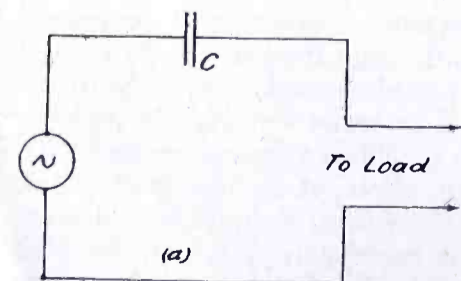


Fig. 8. (a) Series Connection of Condenser

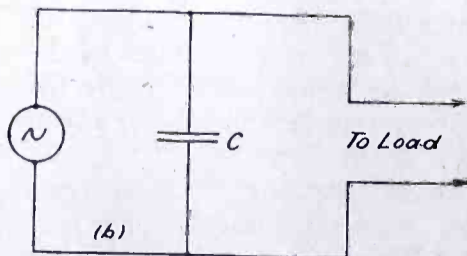


Fig. 8. (b) Parallel Connection of Condenser

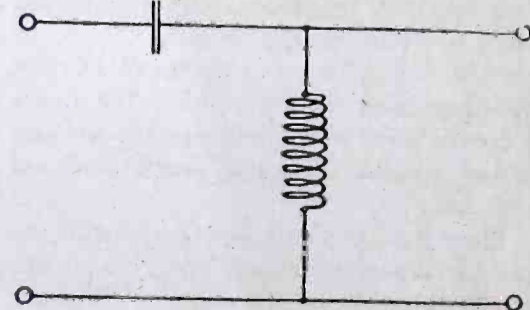


Fig. 10. High Pass Filter

Pointers on Radio Construction



A Tape Recorder from Odds and Ends

By A. Gael Simson

Doubtless every experimenter and amateur has at some time wished for a tape recorder but has been appalled at the price. As a matter of fact, a potential recorder lies in almost everyone's "junk" box. Fig. 1 shows a recorder constructed from odds and ends, and is largely self-explanatory. Apparently

of two rubber bands, as shown in Fig. 1. The tape guides are brass parts from old Ford coils.

Fig. 2 gives the pen detail. The pen from a Taylor Instrument Company Thermograph was used but any siphon pen or recorder pen would work as well. The pen arm is a piece of steel corset

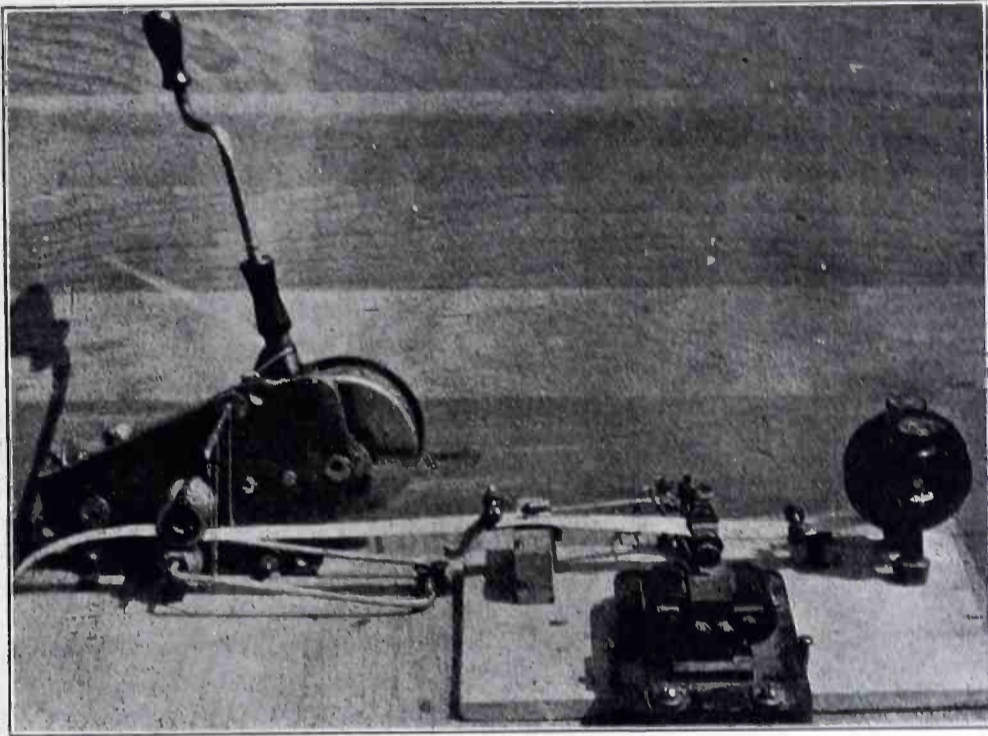


Fig. 1. Recorder

it works as well as a commercial recorder save that it lacks the automatic starting and stopping feature.

The movement is the works from an old Stewart phonograph. An Edison cylinder Graphophone would probably be better. However, with the governor set for a speed of 2 ft. per minute, the Stewart will run over an hour with one winding. On the drive shaft is a common spool wound with a couple of dozen thin rubber bands. After driving the spool on the shaft it is well to pour sufficient melted sulphur in the end of the spool to insure its remaining "put." The idler is another spool with the flanges whittled off and the ends beveled. Tension is maintained on the idler by means

stay $\frac{1}{4}$ in. wide and 3 in. long. One end is bent and soldered to a short length of brass tubing 1 in. long and just large enough to slip snugly over the quarter inch brass upright. The pen arm is connected to the armature of a small pony relay by means of a short piece of No. 28 copper wire. A sounder or even a rewired buzzer would be just as practicable.

The tape spool mounting is merely two large binding posts spaced $\frac{3}{8}$ in. apart with a nail thrust through the wire holes. A piece of heavy tin the size of a full spool of tape is placed on each side of the tape roll and allowed to turn freely with the tape. Having no regular tape available, the writer used adding machine tape hack-sawed into $\frac{1}{2}$ in. widths.

Although designed primarily to record static impulses, yet with a detector, one audio amplifier and a one-tube push-pull through a Wheatstone relay, Federal Telegraph high speed transmission was recorded without difficulty. Forty-five-volt plate battery and UV201-A tubes were used throughout.

The recorder is well worth building, if only to use it as a check-up on one's "fist." It certainly will show up unsuspected weak points in key work.

END-TURN DEAD-END SWITCH

By HARRY A. NICKERSON

The purpose of end-turn switch is to disconnect a portion of a large coil so that the balance of the coil may be used at will. The type here described is both simple and effective and costs but a few cents and a little ingenuity. It may be placed on the ordinary panel and takes but little more room than the usual switch lever and switch points.

Fig. 1 represents a top view of the switch and the manner of its connection. While only three switch points are shown a greater number may be used. The length of the switch lever may, of course, be increased in order to accommodate a considerable number of the points in a semi-circle.

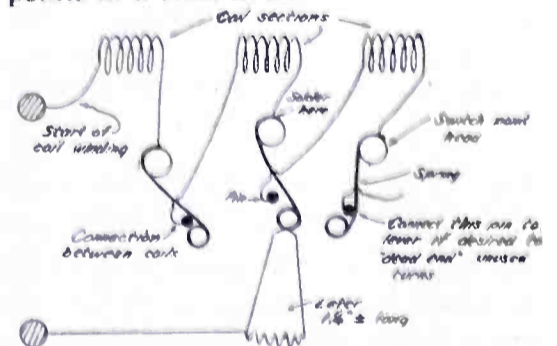


Fig. 1. Switch Connections

The heads of the switch points should be fairly thick. Below each point, say $\frac{3}{8}$ or $\frac{1}{2}$ in. down, is inserted in the panel a small pin or stop about the diameter of a piece of bus-bar wire. A 2-56 machine screw with head cut off makes an excellent stop, and if threaded into the panel will be all that could be asked for.

To the side of each switch-point head is to be soldered a piece of flat brass spring (or phosphor bronze preferred). This spring should be as wide as the switch-point head is deep and should be bent at each end as Fig. 1 shows. It should have sufficient tension so it can be readily pushed aside by the switch lever but will rest against the stop when the switch lever moves away from the spring.

Let us suppose we have a 75-turn rotor of a variocoupler, divided into three separate parts of 25 turns each, which we wish to switch in and out of a circuit. The switch connections may be made as follows:

The first pin at the left is connected to the start of the second of the three coil windings (turn 26). The first switch point is connected to the end of the first winding (turn 25). 25 and 26 are not connected together. The second pin is connected to turn 50; the second switch point to turn 50; 51 and 50 are not connected together. 75 is connected to the third or right hand switch point.

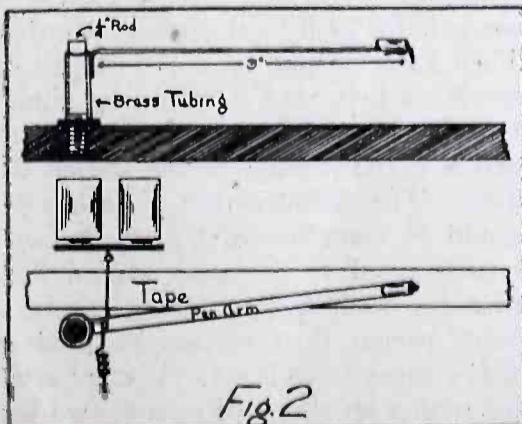


Fig. 2. Recorder Pen Details

It will be apparent that when the switch lever is turned so it will move the spring away from the first switch stop (to which it normally is in contact), that only 25 turns will be in circuit and the balance of the coil will be disconnected.

If it is desired that the unused portion of the whole coil be at all times "dead-ended," the switch lever should be connected to the last or right-hand small stop.

The final series of turns may alone be dead-ended by the method indicated in

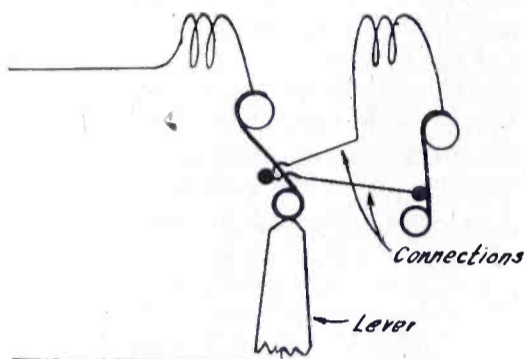


Fig. 2. Connections for Dead-Ending Final Turns

Fig. 2. The tendency to use fewer taps on coupler stators is now marked, and where two taps will suffice to cover the broadcast wave length when just the right number of turns are wound on the stator and the proper size of variable condenser used, in the usual "standard single circuit regenerative" set, the two-point switch shown in Fig. 2 works out admirably for the purpose.

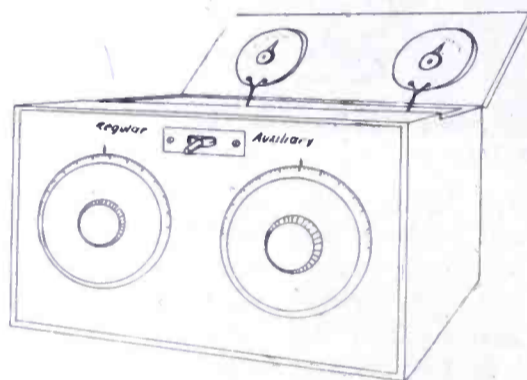
As to whether dead-ending a coil is of advantage,—it has been the writer's experience that the effect is two-fold: the inductance of the intermediate tapped portions of the coil was cut down and there was usually a slight gain in signal strength. As to the gain in signal strength, that is a matter for the set-builder to determine with the particular set at hand. The connection shown in Fig. 2 offers a ready means for comparing the two effects, providing the connecting wire between the two stops is run outside the panel of the set, allowing it to be connected or disconnected at will. Note that Fig. 2 allows the dead-ending of only the last of a series of turns on a coil, while connecting the last stop at the right (Fig. 1) to the lever allows of dead-ending all intermediate unused parts of the coil, provided a contact spring is merely in contact with the lever and not pushed away from the stop against which it normally rests.

A LABOR SAVING TUNER

By KEITH LA BAR

In many of the broadcasting stations there is someone who has the singularly interesting job of regulating the energy allowed to pass from the microphone to the modulator tubes. Sitting with his eye on a swaying needle, he tones down the noise from the Shattering Sixteen Saxes to the volume produced by their rivals, Simply Six. The almost inaudible lipings of the child prodigy are electrically reinforced, giving, as has been carefully calculated, a voice equal to the power of forty horses.

In many of our homes there is a person who holds a somewhat similar position, although not quite as willingly. The duties of the job are a bit different. All music is allowed to pass unchallenged, but upon the arrival of a dear little poem, dry speech, feeble joke, or other matter wearisome to the listeners he must instantly tune in another station. As the programs are a little of everything, this unpaid and usually unsought job is a very busy one and one calculated to call forth violent remarks.



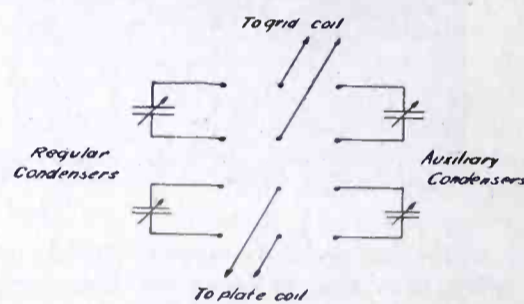
A Labor Saving Tuner

The inquiring mind naturally seeks a mechanical way out of the difficulty. A quicker method of changing from station A to station B must be found than merely twirling the dials. The most obvious plan is to use two receiving sets, but our frail and tottering pocketbook raises a weak hand in protest. An eastern manufacturer several years ago produced a set that had two separate tuners, either being available by the throw of a switch. This is a good idea, but our set is already built and the cabinet will not stand the insertion of very much more junk.

The most practicable plan seems to be to use a switch to change from one station to another by means of additional tuning controls that are always tuned to a single broadcasting station, which is

thereby available on demand by cutting out of two regular variable condensers and switching in the two additional ones. The original tuning condensers of the set may be used to tune in any other broadcasting station. When this station fails to give satisfaction one can instantly switch to the permanently tuned station and thereby quickly judge which is the lesser of the two evils. If the second station plays you false, after a few minutes the first station may be restored as the family's friend with nothing more than the throw of a switch. No re-tuning and twirling of the dials. No more heated arguments as to whether you have succeeded in getting it in as loud as it was before.

We must confess that this idea is good only on sets that have for the variable tuning controls two variable condensers. These are switched out of the circuit and two others are switched in to take their place. Putting two more condensers into the well filled cabinet presents difficulties, but they can be overcome. The most compact variable condenser for our purpose is the Dublier Variadon, or any other kind similarly constructed, which are flat and take up but little room. They are mounted on the under side of the lid of the cabinet



Circuit Diagram for Auxiliary Tuner

(see illustration), and when it is desired to tune these condensers, the lid is merely raised and they are immediately available. After being tuned to a station the lid goes down and they wait for the time that the switch calls them into action. The Federal anti-capacity four-pole double-throw switch is mounted at the top of the panel, and is connected to this set of condensers by flexible leads.

If one desired, he might build a set that would have a number of pairs of condensers, with a switch for each pair, one pair for each local station operating. Then there would be no tuning to do except at first, and it would be almost a fool proof set. Merely throw the switch corresponding to the station desired. The actual design of such a set would be complicated, but could easily be attempted if the need should ever arise for such a set. It will take a lazier person than we are to produce such a super tunable set. We are satisfied with a set that will tune to two stations at once.

A Low-Loss Transmitter

An Unusually Complete Account of Constructional Details for the Guidance of the First-Timer

By Alexander Maxwell, 9BRE-6CKG

THE trend for some time has been toward low-loss receivers, and the same principles may be applied to the transmitter with an increase of distance covered and traffic handled. The reason many of the present-day sets are not more efficient is that the parts are laid out without regard to system. The radio-frequency current, which should go to the antenna, sneaks back into the power line, or gets lost in some of the "grapevine" wiring.

The ideal transmitter is one that is suspended in mid-air, with nothing denser near it. The next best thing is to place it as near in mid-air as possible by means of a skeleton rack set in the middle of the room. Inductive coupling should be used to minimize losses, eliminate swinging, deaden key clicks, and sharpen the wave.

The mounting rack can be made from scrap lumber. See the plans for assembling and the bill of material for pieces needed. Great care must be taken in joining. The set weighs close to 100 pounds, and a single weak place may mean two new tubes, to the tune of sixty dollars. Do not use nails, for they do not clinch and the rack will be rickety. Long wood screws are better. Put one in each joint and then fasten a small angle bracket on the inner side for added strength. It costs only a few cents more and the results are easily worth it.

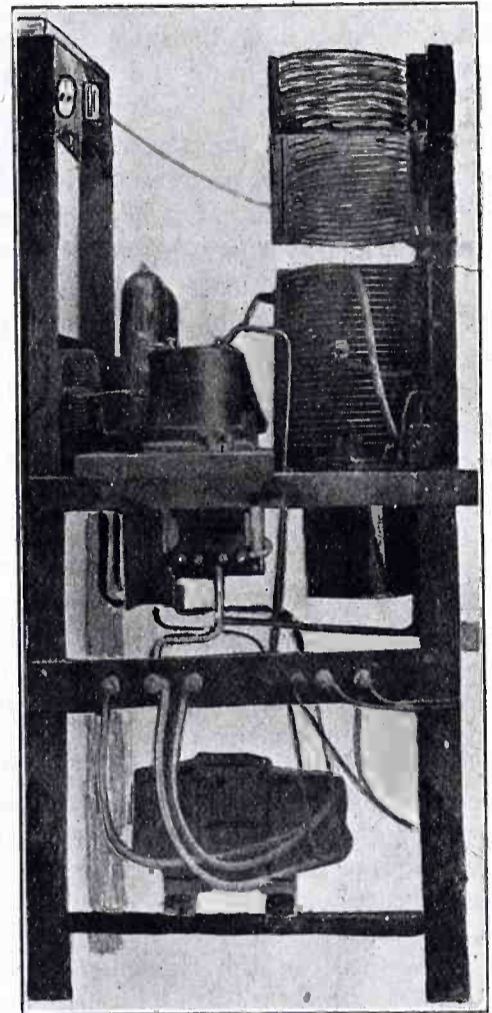
Bill of material:

1 2x2x42 in.	1 8x16x1 in. Maple.
2 2x2x26 in.	2 Panels 6x14 in.
5 1x2x16 in.	1 Panel 2x18 in.
2 1x2x18 in.	1 Panel 1x6 in.
2 1x2x19 in.	Screws.
2 1x1x25 in.	Angle Irons.

Black insulating paint such as is used on motors and outlet boxes is best. It should contain neither lead nor carbon. Beware of any paint of uncertain make; it may contain conductive minerals. Linseed oil or hot paraffin may be substituted. They will not look so pleasing, but they will exclude moisture, and that is the main object of the paint.

The following parts were used in building the author's set:

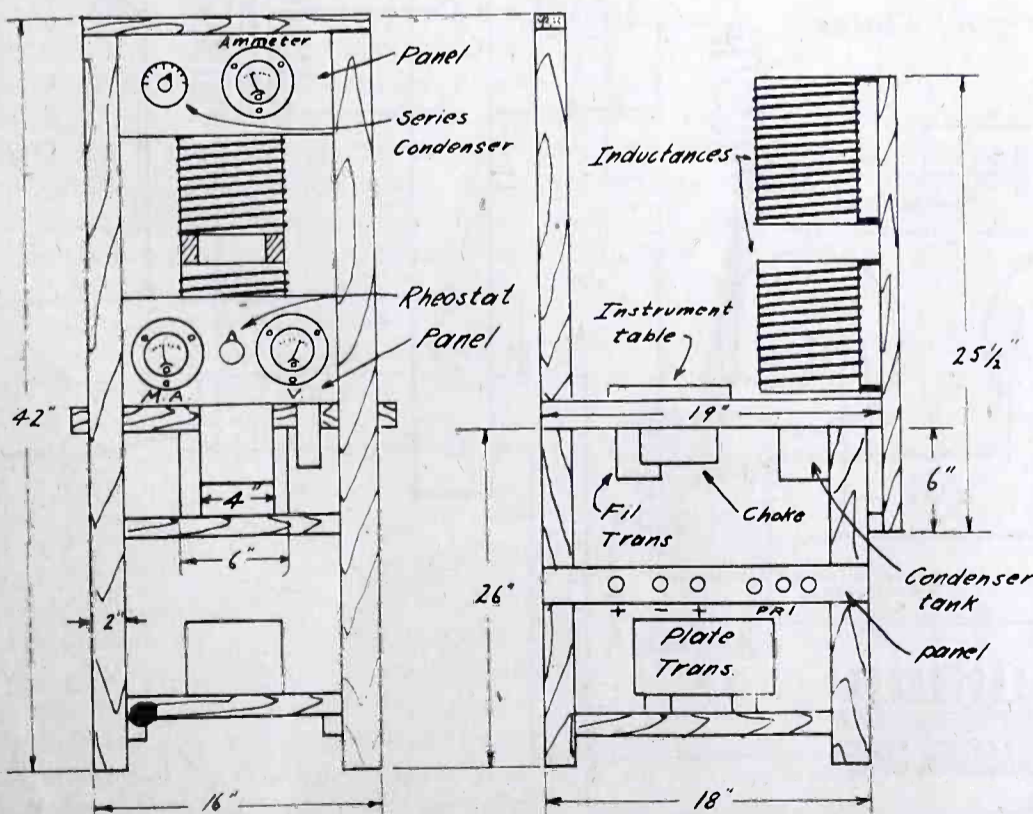
- 2 50-watt tubes.
- 2 RCA sockets.
- 3 UC 1014 condensers (grid and bypass).
- 1 UP 1718 grid leak.
- 2 UL 1655 Rf chokes.
- 2 Rca Inductances.
- 1 Coto Variable condenser (primary tuning).
- 1 Cardwell 21-plate condenser (antenna series).
- 2 .002 fixed condensers (filament bypass).
- 1 Acme 5-henry choke.
- 1 Thor. 300-watt, 12-volt fil. trans.
- 1 UP 1016 plate trans.
- 1 PT 557 rheostat.
- 1 0-10 Jewell T.C. ammeter.
- 1 0-15 Jewell A.C. voltmeter.
- 1 0-800 Jewell Milliammeter (safety first, hi).
- 1 Key.
- 1 S.P.S.T. knife switch.
- 1 Coffee can or battery jar.
- 1 quart transil oil.



Side View of Low-Loss Transmitter

There are others, which will give equal service, which may be on hand or more convenient to obtain. The best policy is to look for quality and careful workmanship, and not for bargains.

Two small panels are used,—one for the antenna ammeter and the series condenser, and the other for the voltmeter, rheostat and milliammeter. By this method the a.f. and r.f. circuits are kept still apart. Hard rubber panels are the best insulation and the easiest to drill. If the builder has access to an expansion bit, cutting the holes for the meters is a small job. If he has not, then he must resort to the slow and tiresome method of drilling around the circumference of a circle. Great care must be taken, as the rubber is liable to shatter if treated roughly. To drill a few holes and then rest a while, is the best plan, and, above all things, don't try to speed the drill. Cut out the core of the circle with a sharp knife and smooth the rough edges with a rat-tail file. The panels may be either sunk flush with the frame or set on the surface, depending on the ambition of the builder.

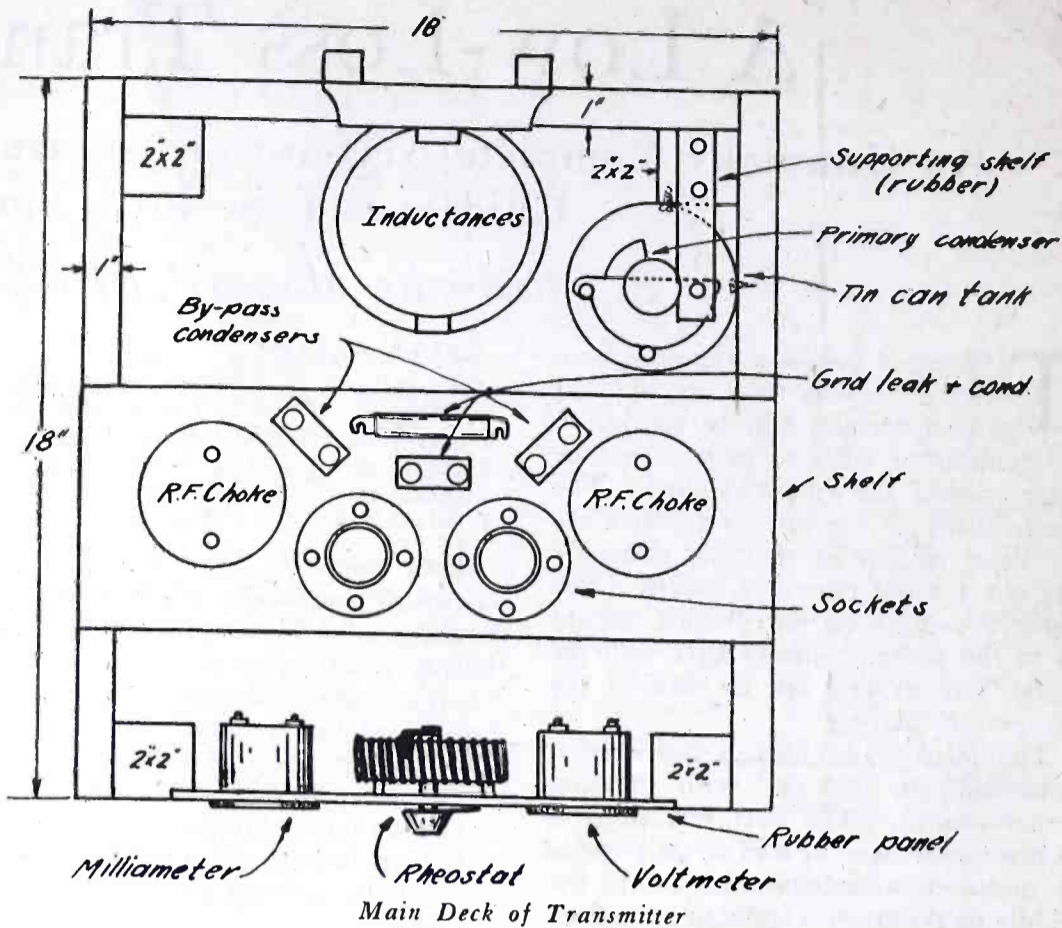


Constructional Diagram of Frame

The tubes are mounted on a shelf set on the framework just back of the a.f. panel, but far enough so that at least an inch of space is between the meters and tubes. For convenience, the grid condenser and leak, the by-pass condensers, and the r.f. chokes are placed there. For the same reason, the filament transformer is hung upside down on the under side of the shelf. As about twenty-five pounds are to be supported by the shelf, rubber is not to be trusted. Birdseye maple has a high dielectric constant. A piece of it boiled in oil and then dried is ideal.

The inductances are fastened to the backboard by means of screws driven in through the bottom. It is best to space them a little way apart, because the set works better with loose coupling, and then the operator won't be tempted to jam. There is no need of having one variable, because coupling may be changed by simply moving the clips on the secondary. Remember that here the o.t. is the same as in the old spark sets: the primary is the business end and the secondary is hooked to the aerial and counterpoise.

The primary tuning condenser is the only sloppy instrument in the set. If high power is used, and a triple-spaced condenser of sufficient capacity cannot be obtained, then the condenser used will have to be oil-immersed. The best container is a glass jar from an old primary battery, but a tin coffee can will do, if it is large enough to allow at least an inch clearance on all sides. The can or jar is mounted in the right-hand rear



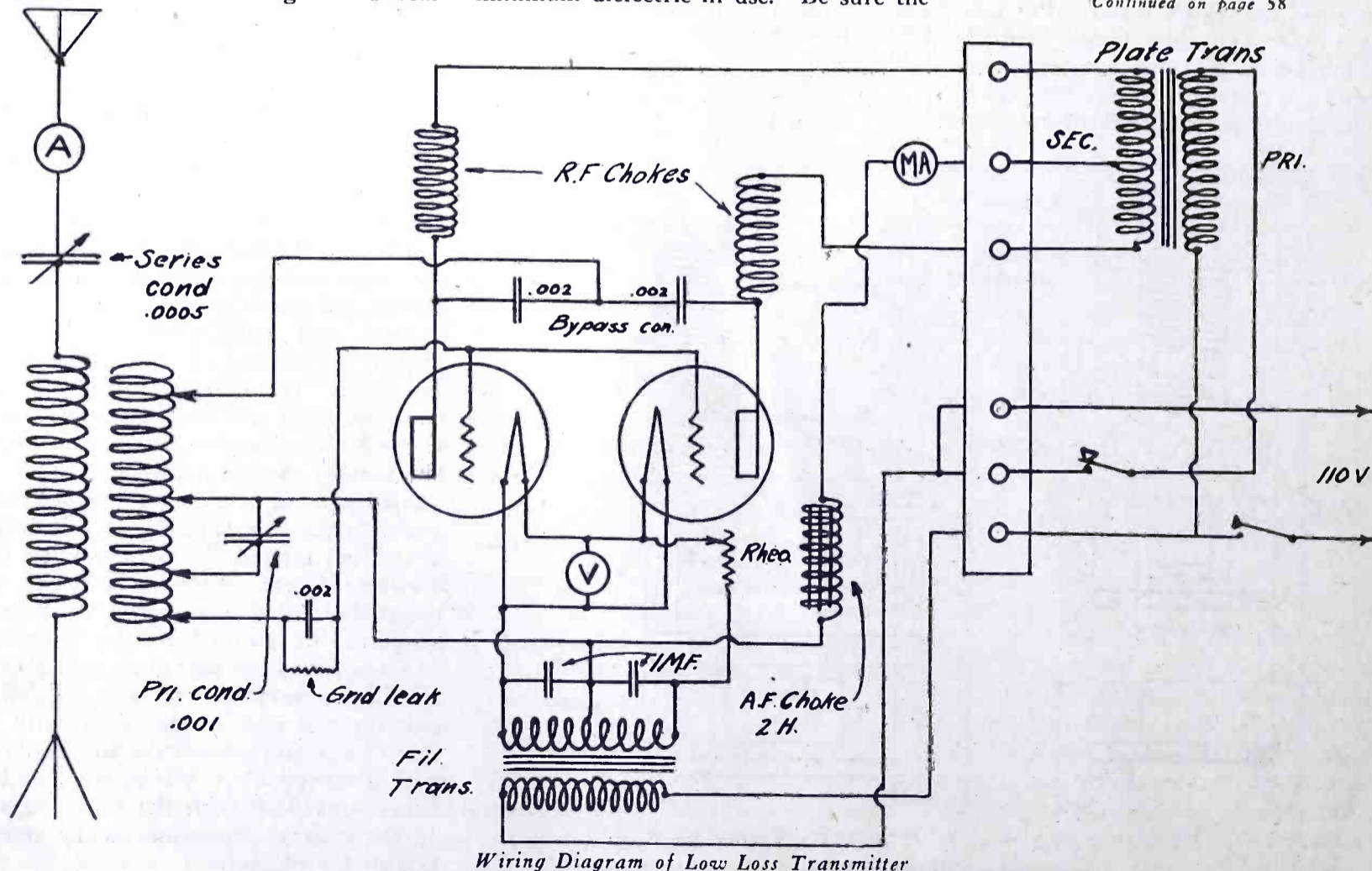
of the main deck. Here it is in such a position articles will not be liable to fall into it, and still it is close enough to the inductance to allow short leads to the condenser. The mounting for the condenser need not be elaborate. A single strip of hard rubber fastened to the condenser by means of one of the mounting screws, and then screwed to the wooden framework, is sufficient. This will hold it rigid and still have the minimum dielectric in use. Be sure the

connections are soldered well, for oil is a good insulator.

The plate transformer is mounted on the lower deck. Here it is out of the way, and also serves as ballast to the set.

The rubber strip extending across the starboard side contains all the binding posts. There are three for the 110-volt input, allowing one for keying in the primary of the plate transformer, and three for the high voltage. The leads

Continued on page 58



How to Install a Transmitter

Practical Directions for Tuning a Hartley Oscillator With a Dummy Antenna

By Richard F. Shea

MANY heart-breaking disappointments may be avoided in the installation of the transmitter by observing a few simple rules. First, assemble your apparatus as an oscillator with a dummy antenna, consisting of a variable condenser and a resistance. This means temporarily eliminating the regular antenna and the filter system.

Fig. 1 shows the Hartley circuit, a

we would have an easy time adjusting our inductance in accordance with the variation in capacitance in order to keep the same wave. However, we can just make a shot at it and get any combination of L and C .

The next step is to vary L_g and L_p until we finally get an indication on the antenna ammeter in series with C and R . If no value of L_g and L_p give us this radiation, we are tuned too high,

amperes at 1000 volts in the plate circuit, we are putting 100 watts into our set; and, if R is 10 ohms and the meter about 2 ohms, and we have a radiation of 2 amperes, then our output is $I^2R = 4 \times 12 = 48$ watts, and we are getting nearly 50% efficiency. This is the greatest efficiency obtainable, as the tube is only 50% efficient at its best, and so we can tell how good our set is by how close we come to 50% efficiency.

We can try various values of R and will note that the efficiency is practically the same with each one, the product of $I^2 \times R$ being practically constant.

Having constructed and tuned our oscillator, we now erect our antenna. Since the efficiency is independent of the antenna resistance, our best antenna will be one which will radiate the most energy for a given input, or, in other words, one which has the highest ratio of radiation resistance to total resistance. This would seem to indicate the use of a large antenna with a series condenser to bring the fundamental down below the working wave.

Having erected an aerial, the next step should be to measure its resistance and apparent capacitance at various waves. I favor a bridge circuit with which to make these measurements rather than the old resistance-variation method. The connections are shown in

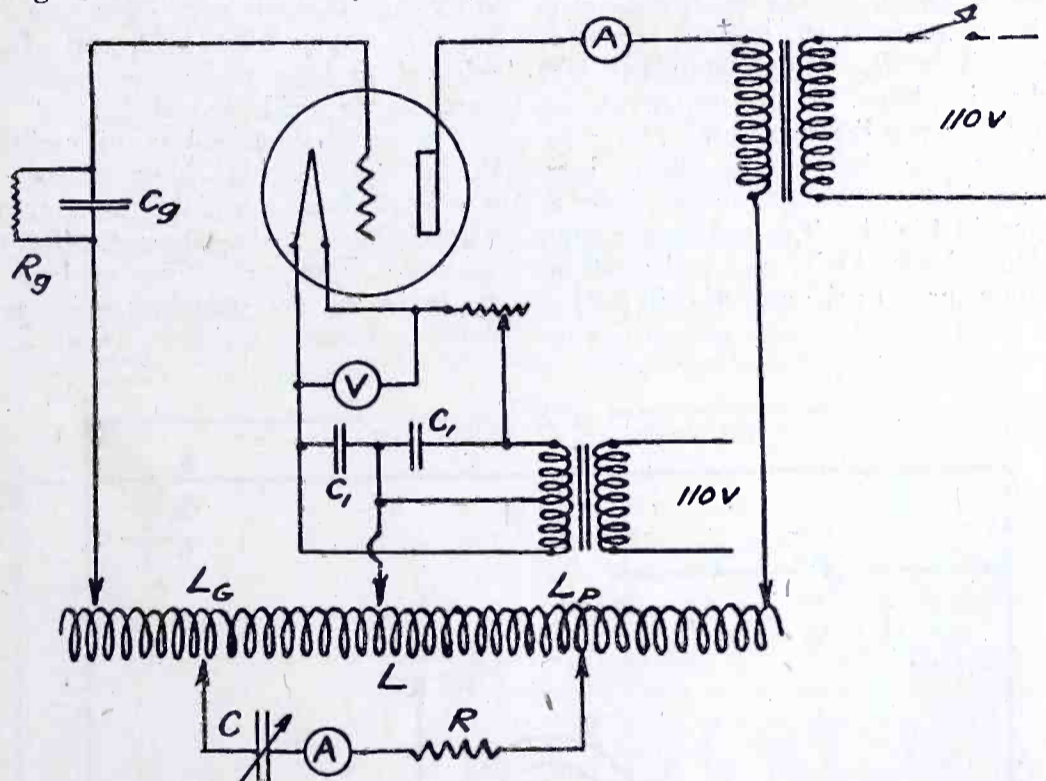


Fig. 1. Hartley Oscillator

good oscillator and easy to tune. L is the regular antenna-tuning inductance and C is any available variable condenser, preferably of 1000 micro-mfd. capacity. Both filament and plate supply are given by transformers, although a large A battery for the filament and high voltage direct current for the plate is preferable. A fixed condenser may be placed across the plate transformer to by-pass the radio-frequency oscillations, but it will consume some 60-cycle power.

The oscillator is started by the "cut and try" method, first setting the condenser at full capacitance and the inductance at any arbitrary value.

Suppose we are using an Acme helix. We can set the condenser at .001 mfd. and we will probably find that a few turns on the helix will give us resonance on 200 meters. If we cut down the condenser, we must increase the inductance. If we knew the values of the inductance of the coil in each position

and either L or C must be decreased until we can get radiation with our available plate reactance. Now we can tell our wave with any available wavemeter. It can be adjusted to any desired value by adjusting L or C , or both, and retuning L_g and L_p .

After the oscillator has started to "perc", several interesting experiments may be performed. The grid condenser and leak may be varied to find best values, and you can compute your efficiency if you know the value of R . This resistance is the only thing not commonly found in an amateur's station. It can be made by winding some high resistivity Manganin wire on strips of mica, and can be calibrated with direct current by use of your filament voltmeter and plate milliammeter. If a set is adjusted for best radiation and the plate current is known, we can figure its efficiency if we know R , and have an idea of the resistance of the radiation meter. Thus, if we have 100 milli-

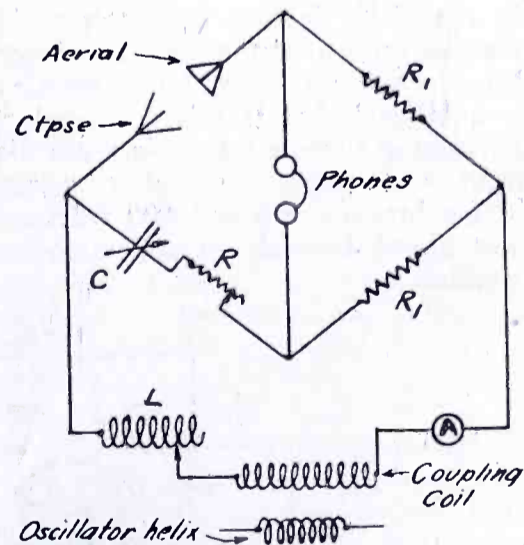


Fig. 2. Bridge Circuit

Fig. 2. One arm is formed by the regular antenna and counterpoise leads; another arm is a dummy antenna; the other two arms being equal resistances. A pair of phones is used here because we use a.c. on our oscillator, and its output is hence modulated, and consequently there is a low frequency current

Continued on page 60

The Generation and Measurement of Short Waves

Suggestions for the Construction of a 20-Meter Transmitter or Wavemeter

By L. J. N. du Treil

WITH certain modification, due to apparatus limitation of the amateur, the short wave oscillator devised by the U. S. Bureau of Standards may be used as 20-100 meter amateur transmitter and also as a set for the standardization and calibration of wavemeters. With a one-turn oscillator coil it gives a 20-meter wave and with a five-turn coil, it gives 100 meters, intermediate frequencies being obtainable with intermediate coils.

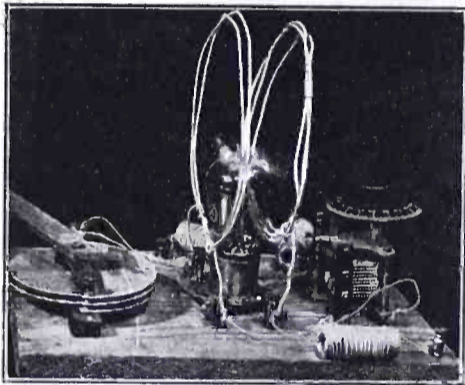


Fig. 1. Short-Wave Oscillator

The oscillator shown in Fig. 1 and the diagram of connections in Fig. 2. The oscillatory circuit consists of coils L_1 and L_2 and the condenser C_2 . C_1 is a variable by-pass condenser which may be used to change the wavelength between narrow limits. The oscillator is a UV202, 5-watt tube, operated on alternating current supply for both filament and plate. The plate voltage ranges between 350 and 600 volts and was passed through an aluminum-lead rectifier.

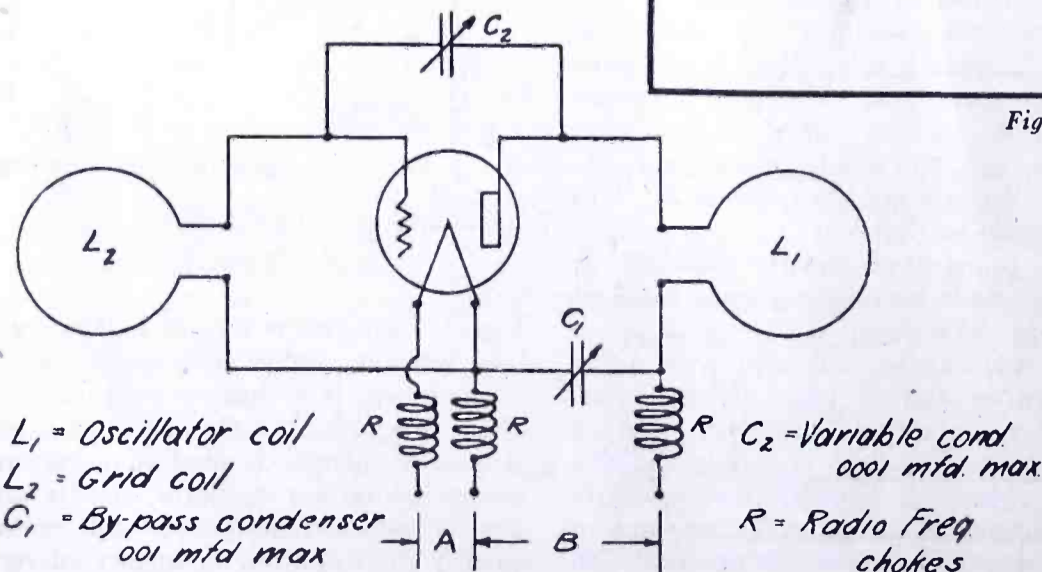


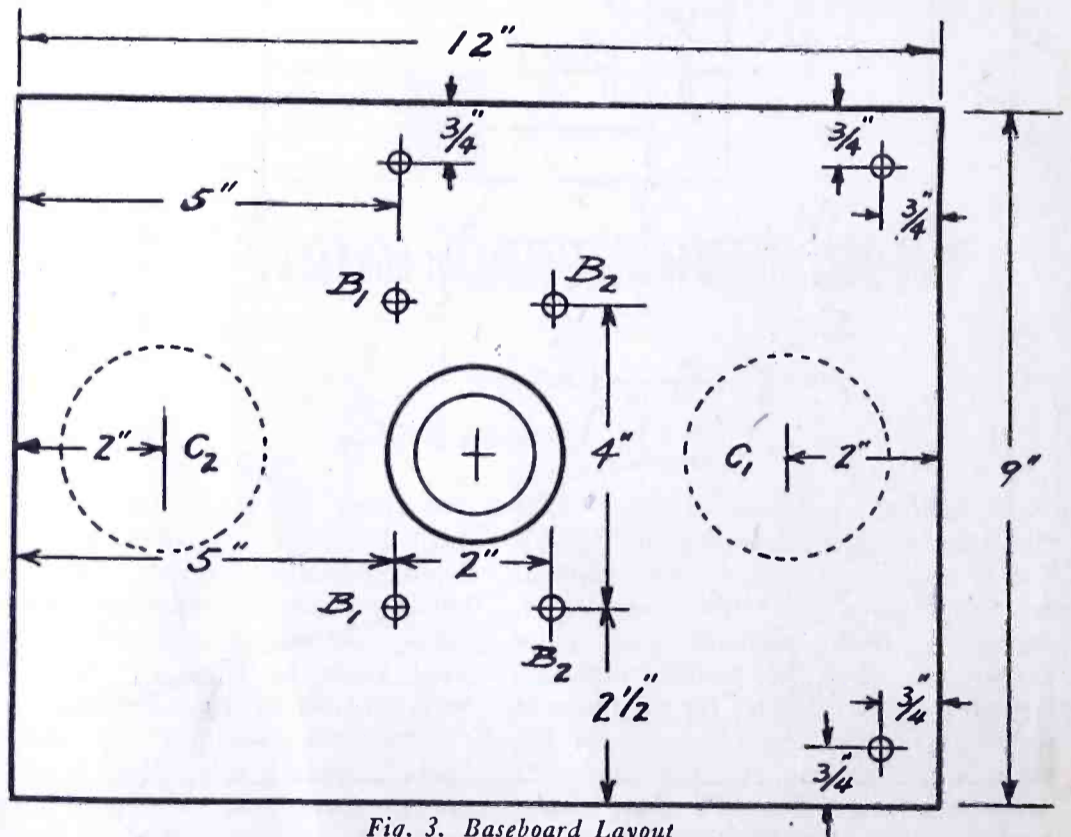
Fig. 2. Circuit Diagram for Short-Wave Oscillator

The apparatus was mounted on a baseboard shown with dimensions in Fig. 3. Slight alterations may be made without loss of efficiency provided that all connections in the oscillatory circuit are made as short and direct as possible. Double binding posts are placed in the holes B_1 and B_2 . The oscillator coil is to be placed in B_1 , B_1 and the regenerative coil in B_2 , B_2 . A standard VT socket is placed in the center of the board between the two coils.

After the instruments have been mounted, the wiring may be done as shown in Fig. 4. The coils are wound of No. 12 B&S DCC wire and are 6 in. in diameter. In the case of coils having two more turns, the turns may be tied to-

gether at several points with linen thread. Fig. 5 shows a one-turn coil with the terminals properly bent to go into the binding posts. One each of the following coils will be required for a range of 20 to 100 meters: One-turn coil, two-turn coil, three-turn coil, four-turn coil, five-turn coil, six-turn coil, eight-turn coil, ten-turn coil. The grid coil L_2 is selected to have twice the number of turns as the oscillator coil L_1 .

The waves generated by this oscillator can be measured with great accuracy on a pair of wires terminating in a loop. Fig. 6 shows the arrangement for this purpose. Two bare wires at least 40 ft. in length are stretched 4 in. apart between suitable supports. Coil L_2 of



the oscillator is coupled to coil L_3 of Fig. 6. A radio-frequency milliammeter having a 0-100 MA scale is mounted on a piece of wood or insulating material about 8 in. in length and 3 in. in width as shown at MA, Fig. 6.

The small rectangles are pieces of brass fastened to the terminals of the meter and contact is made with the wires by means of these pieces. It will probably be necessary to shunt the meter while making observations.

The oscillator is placed in operation and the milliammeter is slid back and forth near the loop end of the parallel wires until the point of maximum reading is found. A marker should be placed on one of the wires at this point. The milliammeter is slid slowly toward the open end of the wires until a point of maximum deflection is again obtained. This point should also be carefully marked and the distance between the markers measured with a steel tape. This distance if read in feet should be converted to meters by dividing by 3.281 and the quotient multiplied by two. This result will be the wavelength of the oscillator in meters.

If the parallel wires are of sufficient length, several points of maximum deflection of the milliammeter will be found. These points will be separated by exactly the same distance. A wavemeter may be calibrated for a limited range by this method but due to practical limitations in stretching the parallel wires (wires over 300 ft. long being required for a wavelength of 200 meters) another method has been devised for calibrating wavemeters above 30 meters.

To calibrate the wavemeter for higher

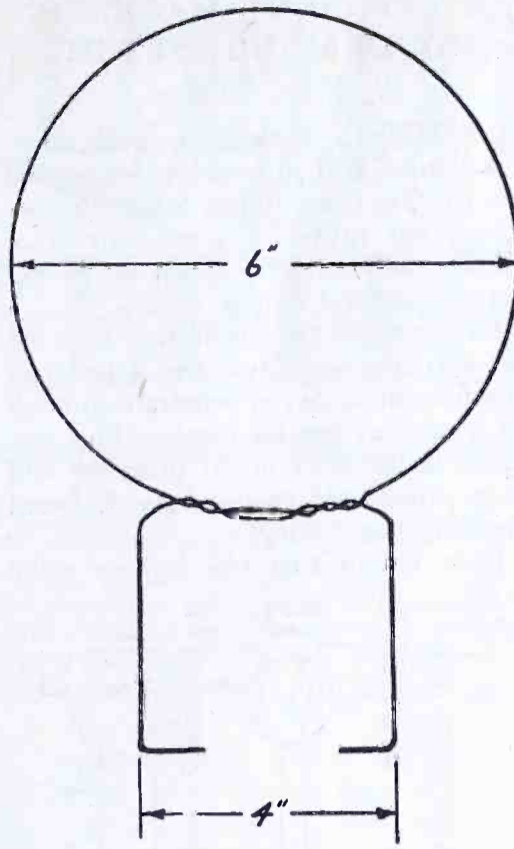


Fig. 5. One Turn Coil

the parallel wires. There will also be required a short wave receiver which can be constructed simply of a one-turn

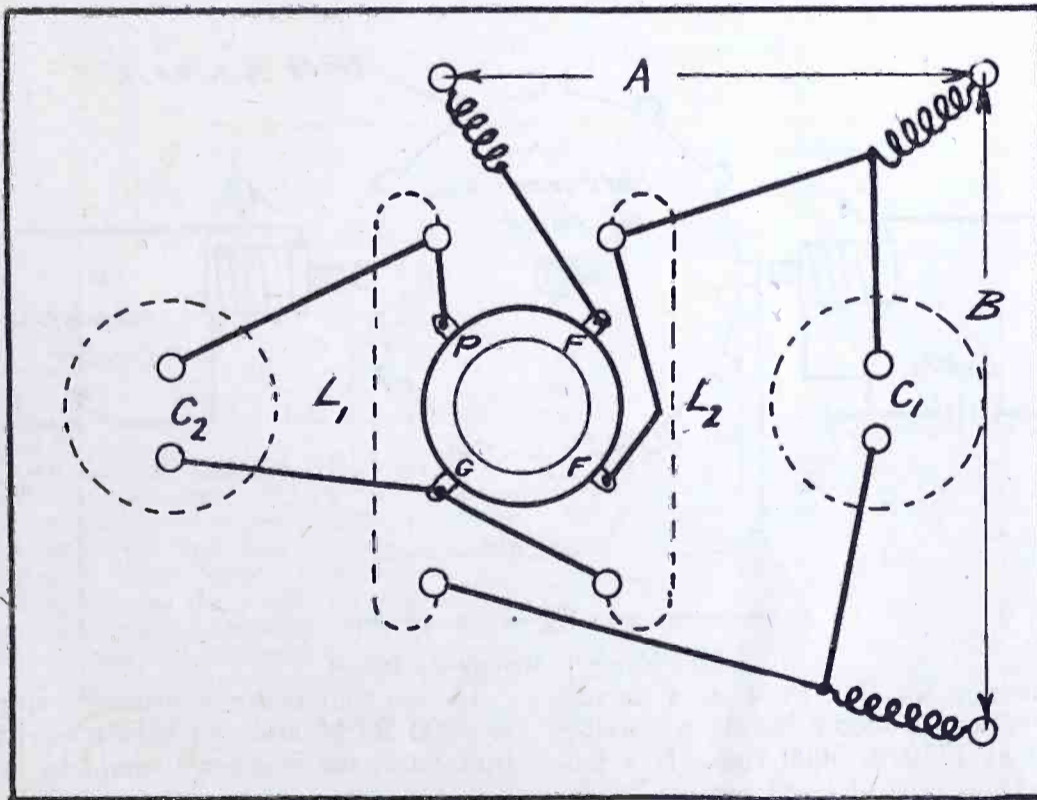


Fig. 4. Baseboard Wiring

wavelengths than 30 meters another oscillator will be required. For convenience the two oscillators will be called *a* and *b*, respectively. The method employed consists of adjusting oscillator *a* to a wavelength which is measured on

coil in series with a small variable condenser, connected to a detector and amplifier as illustrated in Fig. 7.

Assume that this adjustment is 20 meters and is obtained with a one-turn coil in L_1 . Oscillator *b* is equipped

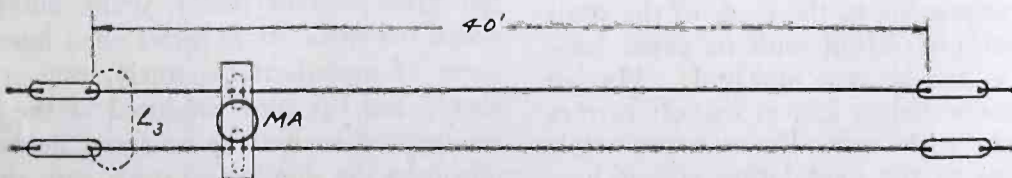


Fig. 6. Wavemeter Arrangement

with a one-turn coil in L , is set into operation, condenser C_2 is varied until the wavemeter indicates that oscillator *b* is also tuned to the same wavelength as oscillator *a* or 20 meters. Slight variation of C_2 in oscillator *b* will cause a beat note to be heard in the telephones of the short wave receiver. Capacity of C_2 of oscillator *b* is increased until another beat note is heard which is the first harmonic of oscillator *a* or 40 meters. This point is found and marked on the wavemeter. Oscillator *b* may now be equipped with a two-turn coil and the process continued as outlined above until the second, third and fourth harmonics are reached.

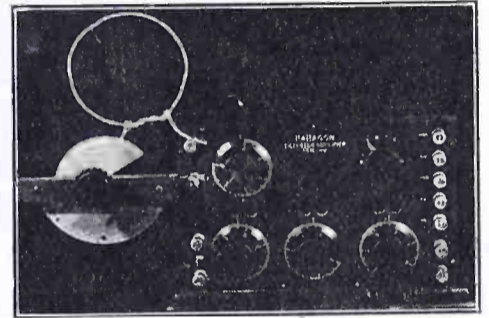


Fig. 7. Arrangement for Harmonic Calibration

For the sake of convenience the oscillator *a* is adjusted to the fourth harmonic, 100 meters, and the process can be continued up to 200 meters or higher.

It may be of interest to note that the writer compared a wavemeter calibrated by this method with the first coil of a Kolster decimeter and he found that the discrepancy in reading between the two instruments was less than 0.5 per cent.

HOW TO BUILD A SPEECH AMPLIFIER

By R. MCGINNIS

The amplifier here described is a low-cost outfit giving good modulation and greatly increasing the range of a phone transmitter. In the case of 8 DJT at Pittsburgh it extended the range to Florida, whereas without it Virginia was the best distance.

The reason for the increased distance is that the modulator is able to modulate more of the oscillator's energy than it could previously. If we take a set of the usual power, say one 50-watt tube as the modulator and a like tube for the oscillator, we may experience difficulty in making the modulator modulate enough of the energy supplied to it by the oscillator to make it effective at distant points unless some means are taken to step up the voltage that is being impressed upon its grid. The only position for this needed unit is after the microphone, but before the modulator grid. The placing of this unit here not only steps up the current of the microphone before it is applied to the modulator's grid, but also increases the microphone's sensitivity to a remarkable degree.

By following the diagram, no trouble should be encountered in building up such an amplifier and in obtaining a distortionless output. A UV-201a tube makes a satisfactory amplifier and the writer recommends that they be used throughout in the construction of the unit. All American push pull transformers are also used, but others will no doubt work equally as well. One precaution that must be taken is to reduce the voltage in the microphone circuit from the usual 6 volts to 2 or 3 before starting any experiments with the unit. If this precaution is overlooked, I am afraid that your microphone will develop such intense heat that its day of usefulness will be short lived. "HI.' HI."

AN EFFICIENT MAGNETIC MODULATING SYSTEM

By F. L. ULRICH

A SIMPLE, efficient magnetic modulation method which gives a good tone varying from 300 to 600 cycles per second, has proven a great success at 2BDF, modulating as much as 90 per cent of the total output.

To construct the apparatus, first obtain a round, soft iron disc (the magnetic lines of force can penetrate through soft iron with greater ease). This disc should be about 5 in. in diameter and $\frac{1}{4}$ in. thick, and should have 12 teeth extending out $\frac{1}{4}$ in.

Then obtain two old bell or relay

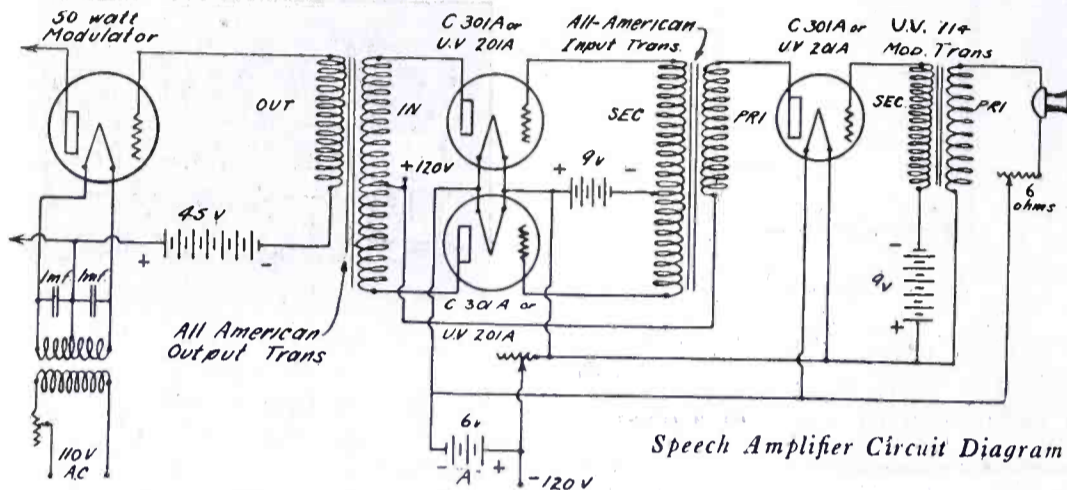
permit the rotor may be connected to the extending shaft of the motor generator, thereby saving the cost of an extra machine.

The two leads to the modulating circuit can be connected to the modulating tube, or to the primary of the modulating transformer so that the modulation can take place in the grid circuit or elsewhere. Several methods worked well, although the one preferred was connecting the leads to the modulator tube. A modulation transformer is not necessary. These leads would connect to the same places as would the secondary of the modulation transformer.

The twelve-stud disc rotating at a high speed between two magnets breaks up the magnetic field between them at a high rate of speed, thereby inducing in coil A_1 a current of various frequencies from 300 to 600 cycles. This machine works on the principle of the inductor alternator used for spark sets where high frequency is desired.

The frequency of the system can be found as follows: Multiply the revolutions per minute by the number of studs on the rotor and divide by 60 (sixty seconds making one minute).

$$F = \frac{\text{RPM} \times \text{Nr/St.}}{60}$$



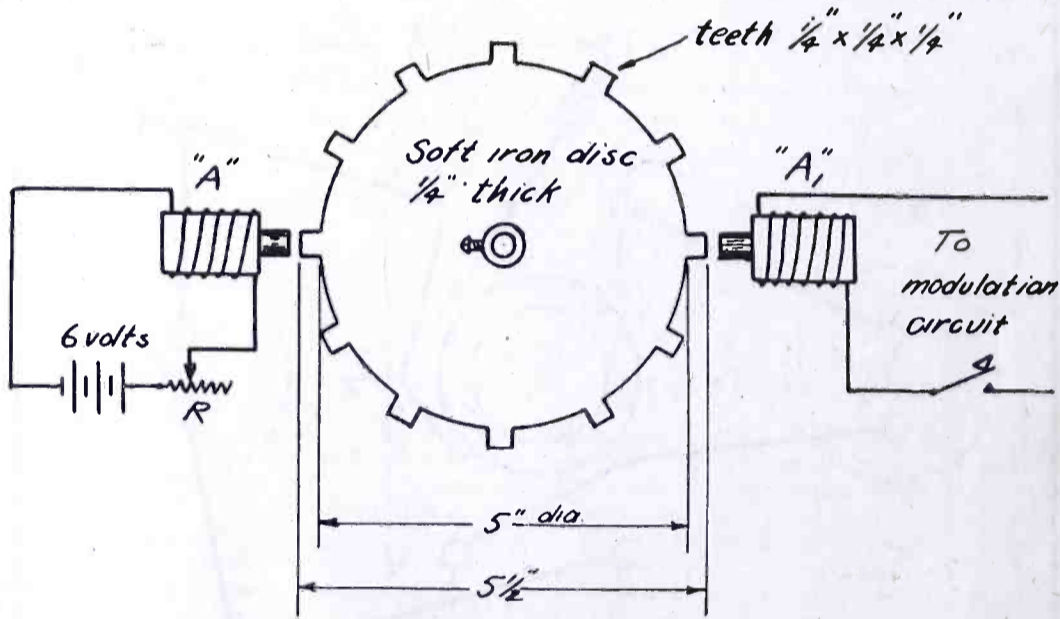
Speech Amplifier Circuit Diagram

Of course the reduced voltage will decrease the output of the microphone, but with the speech amplifier doing its bit, the difference will be scarcely noticed. Better modulation will result from lowered voltages, so that it is really an advantage in two ways to use the lower value of current.

The microphone may now be placed in any position about the room and it will be found to reproduce sound from a distance as though it were but against the mouthpiece of the microphone. Great care must be used, however, to keep the microphone from picking up external or undesired noises as they will be amplified to an enormous degree by the amplifier and may cause considerable displeasure to the listener, both far and near. Such disturbances would likely fall under the clause regarding unnecessary interference, which is strictly forbidden by the radio laws of 1912.

"Radio can weld all humanity together so that they can face their common differences in a spirit of co-operation and mutual trust."—Sir Oliver Lodge.

British regulations require a separate aerial and a separate license for radiocast reception on board their ships. No connection is allowed between the radiocast receiver and the ship's communication equipment, nor can the operator listen to radiocasting when on duty.



Ulrich Magnetic Modulation System

magnets, a six ohm rheostat, a six-volt battery and a motor having a variable speed of 1750 to 3000 rpm. If a motor of this type of speed can not be obtained, a variable resistance (of the field rheostat type) may be placed in the field circuit of the machine to bring up the desired speed, or the number of teeth or studs on the rotor may be increased.

The motor is mounted on a suitable base and the disc connected to its shaft. The two magnets A and A_1 are mounted diametrically opposite each other, as close as possible to the studs of the rotor without interfering with its rapid rotation, as can be seen in Fig 1. Magnet A is connected to a local six-volt battery in series with a six ohm rheostat, while A_1 goes to the modulating circuit having a key in series. If circumstances

In case your motor is making a speed of 3000 RPM and you have a twelve-stud rotor, the frequency would be

$$\begin{array}{l} \text{RPM} - 3000 \\ \text{Nr/St.} \quad 12 \\ \text{Const.} \quad 60 \\ \hline 3000 \times 12 \\ \quad \quad 60 = 600 \text{ Cycles} \end{array}$$

When the system is operating at its best, it can be noticed by the increase in antenna current or the steadiness of the space current meter, while holding down the key. It is better than buzzer form of modulation, namely, that it is steady and the tone produced at the receiving station will be constant, depending upon the number of studs and speed of the disc,



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.

Can you give me a good hook-up for a super-heterodyne using 3,000 meter air core transformers and UV-199 tubes? Please give me the hook-up of the R. C. of A. super-heterodyne.

—A. C. C., Dos Palos, Cal.

to get the best results. If more volume is required the *B* battery may be increased to 160 volts and the *C* battery on the last tube increased to 131-2 volts. This would require a tube capable of withstanding such a high voltage, such as the Western Elec-

grid to be kept positive with respect to its filament, the latter condition being necessary in order to operate the tube at its point of greatest detector action. A crystal will work satisfactorily in the second detector of a super-heterodyne, although it will

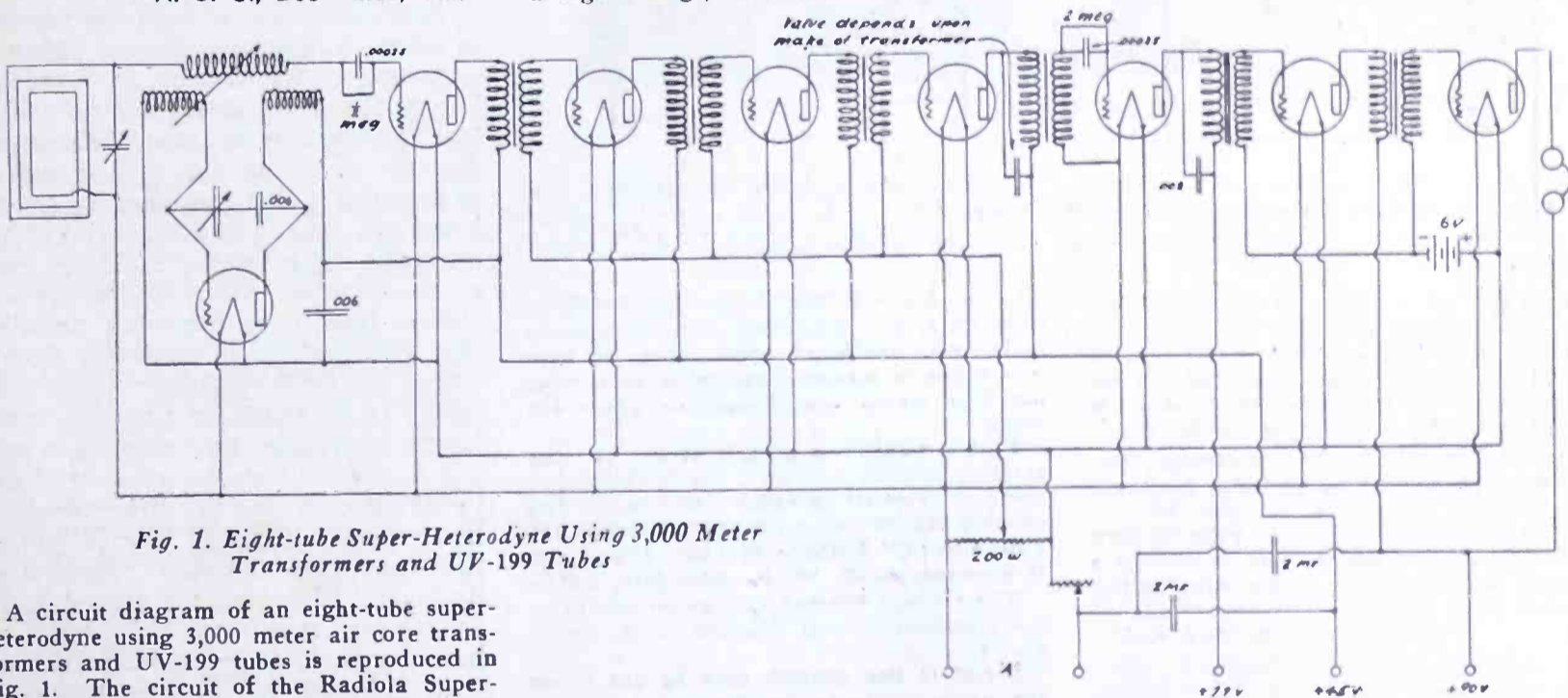


Fig. 1. Eight-tube Super-Heterodyne Using 3,000 Meter Transformers and UV-199 Tubes

A circuit diagram of an eight-tube super-heterodyne using 3,000 meter air core transformers and UV-199 tubes is reproduced in Fig. 1. The circuit of the Radiola Super-Heterodyne was published on Page 37, Fig. 6, June RADIO.

I am very anxious to add a three stage resistance coupled amplifier to my present 45,000 cycle super-heterodyne. Can you show me how this may be properly done? —H. V. K., Towanda, N. Y.

Fig. 2 shows the circuit of a three-stage resistance coupled amplifier. It is highly important that the voltages, *C* batteries and resistances specified be employed in order

tronic 216-A, General Electric UV-202 or tube of similar characteristics.

What is the function of the grid leak? Can a crystal be used with much success in a super-heterodyne, as the second detector? Can any of the tubes be reflexed in a super-heterodyne?

—H. S. Jr., Red Bluff, Cal.

The grid leak provides a path for the grid condenser discharges and enables the

probably not give as great a power output as the tube. One or more of the intermediate frequency amplifiers can be reflexed so as to amplify the incoming high frequency, but it is doubtful whether satisfactory results can be had from reflexing the intermediate amplifiers at audio frequencies, with the apparatus generally available at present.

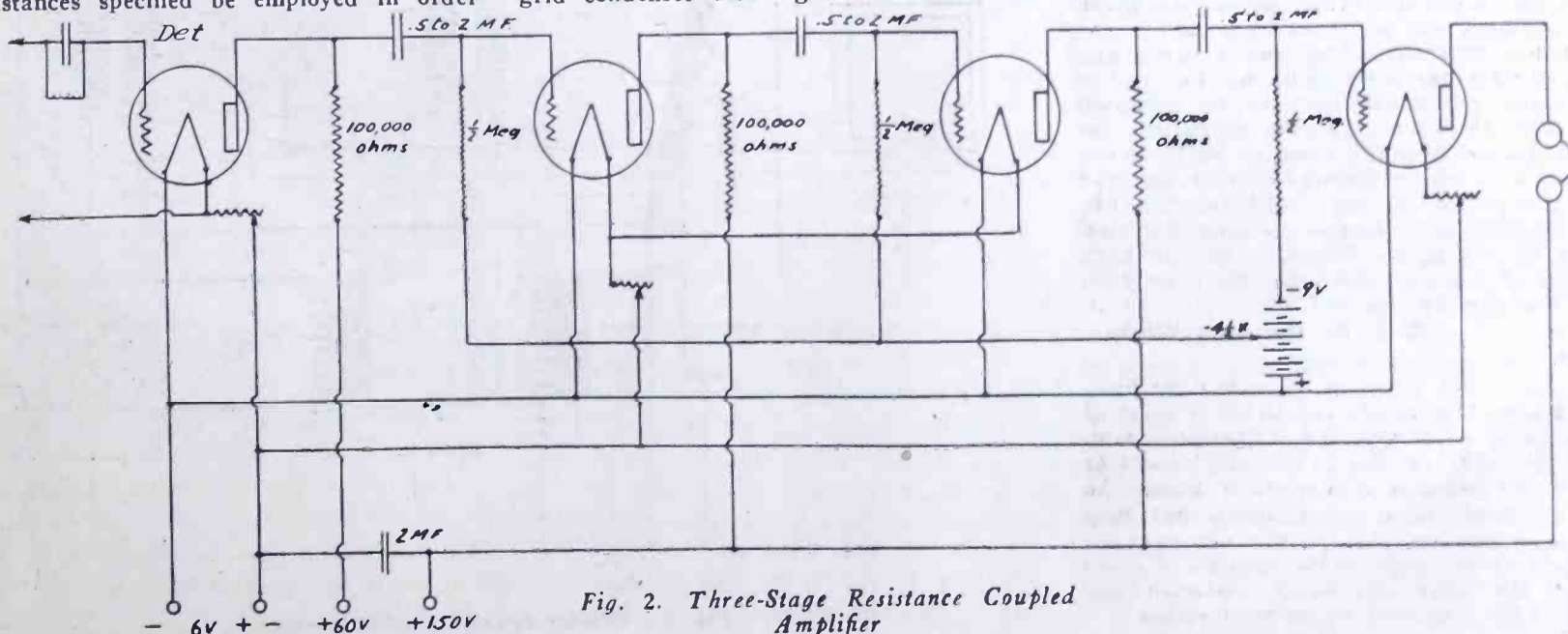


Fig. 2. Three-Stage Resistance Coupled Amplifier

Please publish a circuit for a one-tube receiver, using a Remler oscillator-coupler to control regeneration, and two variable condensers for tuning.

—E. W., Fair Oaks, Cal.

A circuit such as you describe is shown in Fig. 3. It will be necessary to have other apparatus than mentioned in your question.

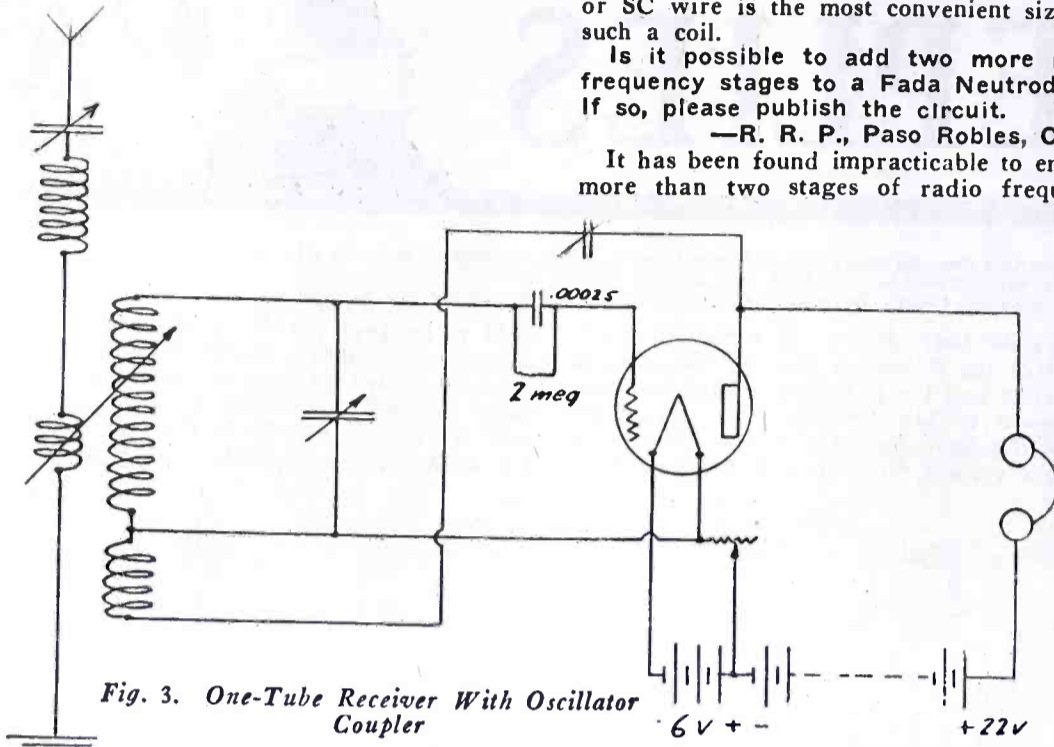


Fig. 3. One-Tube Receiver With Oscillator Coupler

A load coil of 75 turns, in series with the antenna condenser and rotor of the coupler, and an additional winding of 5 turns of No. 24 DCC wire, will be required. A receiver employing the same circuit was described by G. M. Best in October RADIO.

In October RADIO an article by Wm. Jackson describes how to build a chemical rectifier. Would a rectifier of this type be suitable in the automobile battery business, where I would wish to charge a number of batteries in series, varying the current from three to ten amperes?

—H. C. A., Oakland, Cal.

A chemical rectifier, unless very carefully made, and maintained, is unreliable for commercial work where it will be operated for long periods of time with considerable power. A good make of Tungar rectifier, designed for commercial battery charging, would be the best thing for you to buy, in the long run. If you wish to try the chemical rectifier, it would require at least a five gallon jar, with large electrodes. The size can be computed from the formula given by Mr. Jackson, and works out as 200 sq. in.. Distilled water should be used for the liquid, as ordinary tap water will not do.

What size wire, how many turns and what diameter winding should be used in winding spiderweb coils to be mounted in a three-coil honeycomb mounting, for 100 meter broadcast reception? What resistance potentiometer should be used as a stabilizer on the grid return circuit, in a tuned radio frequency amplifier similar to the Grebe RORN? Should both sides of the potentiometer be connected to the battery circuit?

—C. E. B., Pullman, Wash.

For the antenna circuit, wind 10 turns of No. 16 DCC wire on a spiderweb form. The secondary should consist of 15 turns of the same wire, and the tickler should be wound with 15 turns, although less may be found desirable after trial. The potentiometer should have approximately 200 ohms resistance. One side of the potentiometer should be connected to the negative filament lead, the other side being left open, and the slider connected to the grid return.

Referring to the diagram in September RADIO, showing the connections of an antenna tuner for the Radiola Super-Heterodyne, how many turns of what size wire on a 3 in. tube would you recommend for the stator of the coupler?

—M. M., Butte City, Cal.

Two sections of 25 turns each should be provided, for the 3-in. tube. No. 24 DCC or SC wire is the most convenient size for such a coil.

Is it possible to add two more radio frequency stages to a Fada Neutrodyne? If so, please publish the circuit.

—R. R. P., Paso Robles, Cal.

It has been found impracticable to employ more than two stages of radio frequency

amplification with the Neutrodyne circuit, in commercial practice. You might be able to make one additional stage work, if care was taken to properly neutralize each tube, but four stages would certainly prove too much.

Please publish a circuit of the Grimes Inverse Duplex receiver, using two tubes and a crystal detector the radio frequency stages being untuned. Please indicate the "C" battery for 90 volts plate, if necessary.—R. W. F., Glendale, Cal.

The Grimes Inverse Duplex circuit, using the combination you describe is shown in Fig. 4.

What is the easiest way to cut down the noise produced by floating a Tungar battery charger across the storage battery, while the receiver is operating?

—S. G. B., Scranton, Pa.

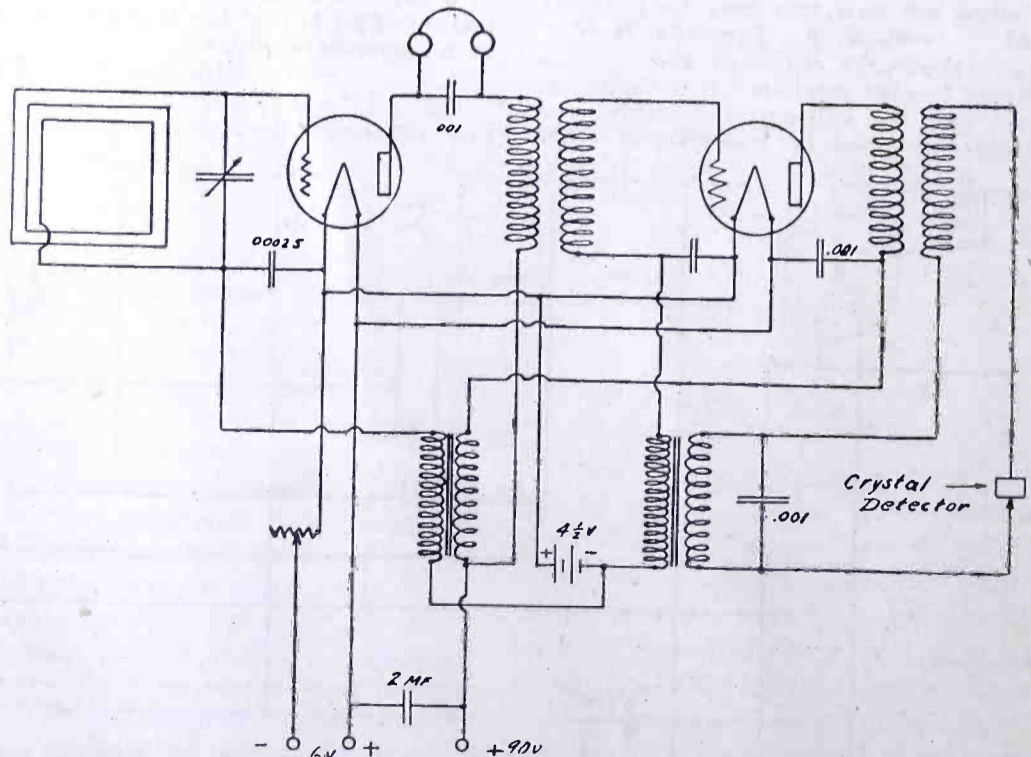


Fig. 4. Grimes Inverse Duplex Circuit

Shunt the filament battery leads with one or more 2 microfarad condensers.

I have a great deal of trouble from body capacity, using my super-heterodyne for the 97 meter wave length of KDKA. How may this be eliminated? An antenna coupler is used instead of a loop.

—J. J. H., River Rouge, Mich.

Probably your antenna and oscillator condensers are not effectively shielded. It is important that a shield of sheet copper or similar metal be placed on the back of the panel holding the condensers, connecting the shield to ground.

ERRATA NOTICE: In O. B. Scott's article on "The Regenerative Reflex," page 19, October RADIO, the circuit diagram does not show a connection between the positive A and the negative B batteries. If this connection is made no trouble will be experienced.

RADIO ANTENNAS NOT LIGHTNING MENACE

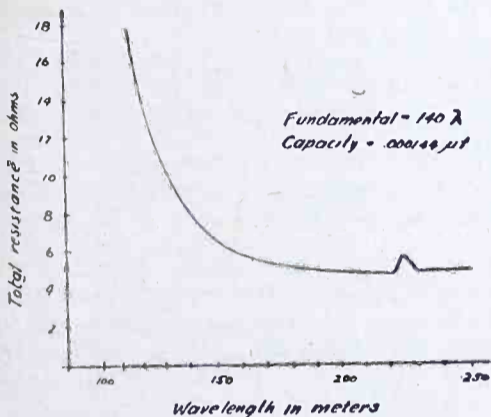
Radio antennas are not to be regarded as effective protection against lightning, according to the Bureau of Standards, but on the other hand, their limited extent prevents them from becoming a menace. They need not be considered as potential inviters of lightning strokes, being in a class with other metal objects normally found about buildings, such as metal gutters, down spouts, and wire clothes lines. As commonly installed, they are of relatively small size, both in extent and in the diameter of the wires used. If grounded, or provided with a lightning arrester, they may effect gradual drainage of electricity as well as a lightning rod, but a direct stroke is likely to fuse them or tear them from their fastenings on account of their small diameter. Moreover, the ground lead of an antenna constitutes a lightning rod having a single down conductor, whereas good lightning rod practice requires at least two down conductors electrically parallel, but as widely separated as possible.

With the Amateur Operators

RADIO STATION 11V

Radio 11V, owned and operated by C. H. Campbell, Bridgeport, Conn., is a consistent relay station of the A.R.R.L. and one of the first to establish two-way communication with Europe. Mr. Campbell is one of the old-timers, his pre-war call being 1ABW.

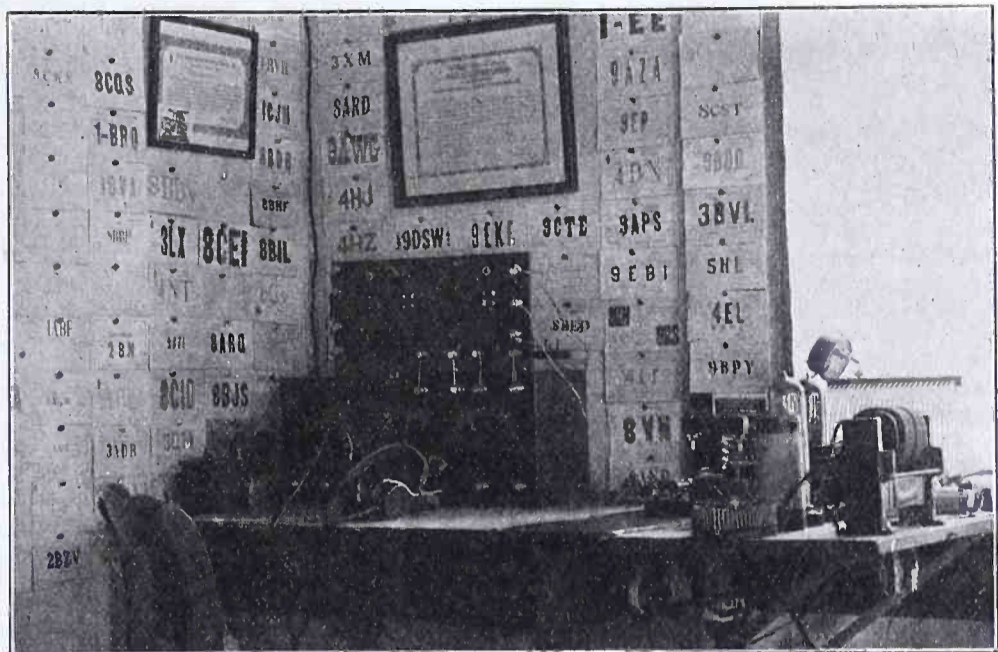
The present antenna is a two-wire inverted "L" 85 ft. long and 40 ft. above the earth. The counterpoise is fan-shape, 100 ft. long and 5 ft. high. It is 25 ft. wide at the far end. The total resistance is fairly low as the curve shows. The hump at 225 meters is probably due to a power line or



Antenna Resistance Curve at 11V

guy wire resonant at that wavelength, but, as the transmitter is never operated on that wave, no steps have been taken to eliminate it. The natural period of the system is 140 meters and the effective capacity is .000144 microfarads.

The circuit diagram explains the transmitter. One 50-watt tube is used, but the set is built to accommodate two tubes. You



Radio Station 11V

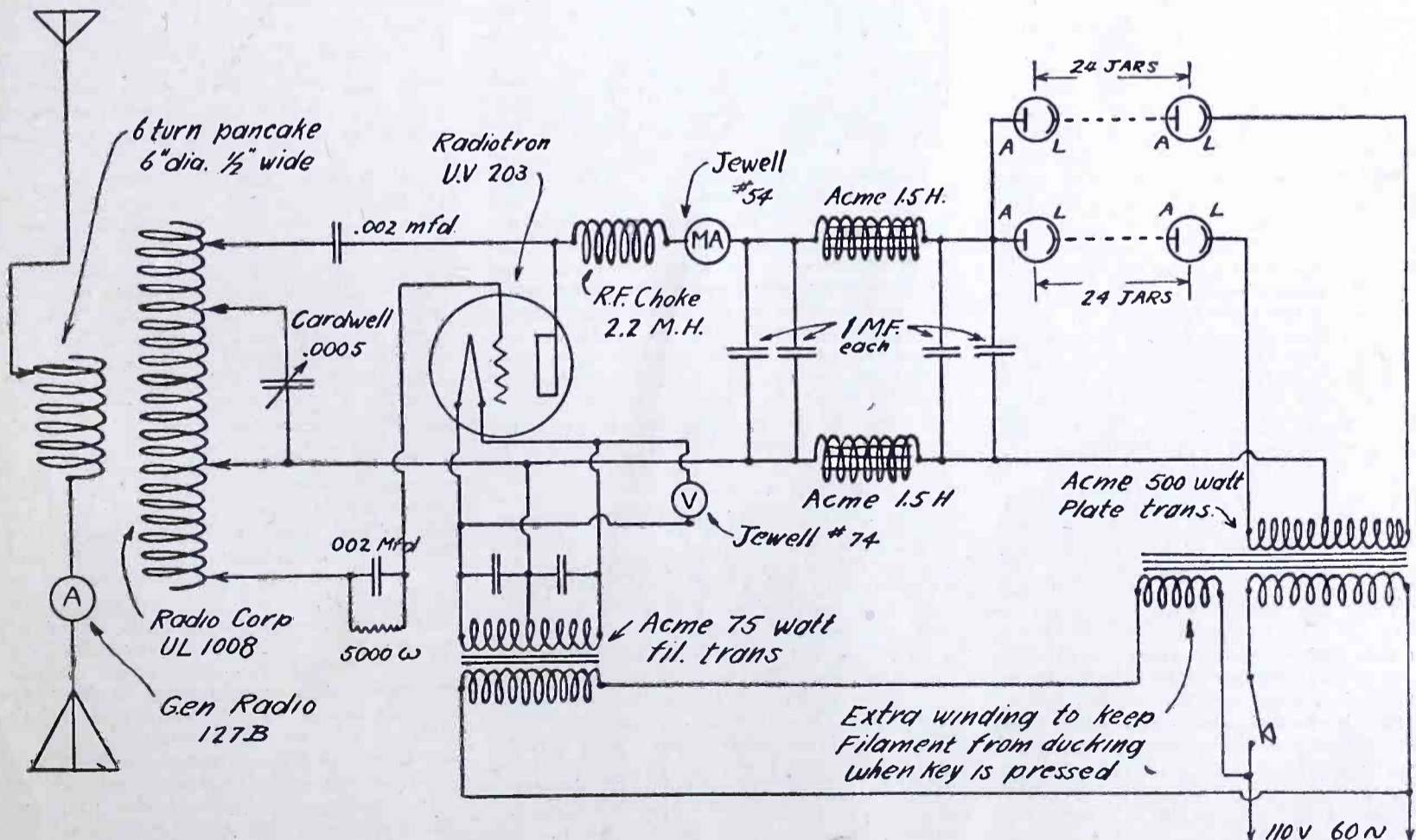
will recognize the circuit as an inductive-coupled Hartley. Plate supply is obtained from a 500-watt Acme transformer and 48-jar chemical rectifier. The filter system is composed of 2 1.5-henry chokes and four 1-mfd. condensers. On 150 meters, with 175 watts input, the antenna current is 3.3 amperes, representing about 76 watts output.

Due to the increased use of short waves, a 25 to 220-meter "low-loss tuner" is now used instead of the Chicago Radio Laboratory variometer receiver shown in the picture. The detector and two-stage amplifier unit is home-made, while the phones are Baldwin,

type C. Only a single stage of amplification is necessary with phones. Foreign and west coast stations are copied consistently.

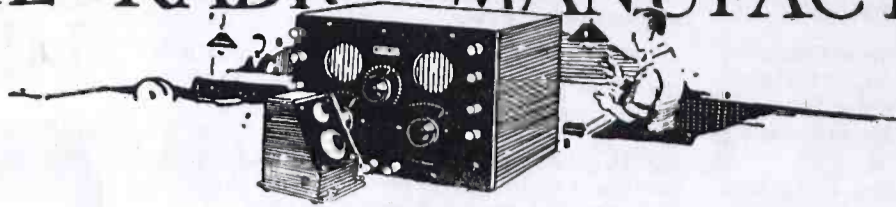
The DX has been very encouraging. Dutch PCii, British 20D, and British 2SZ have been worked and messages exchanged. The signals have been reported by French 8AB, British 2KW, and British 5KO. On this side of the Atlantic, DX includes all U. S. and four Canadian districts, Panama, Porto Rico, and Bermuda—also many reports from ships at sea.

11V is now operating on 78 meters and will appreciate reports on the signals.

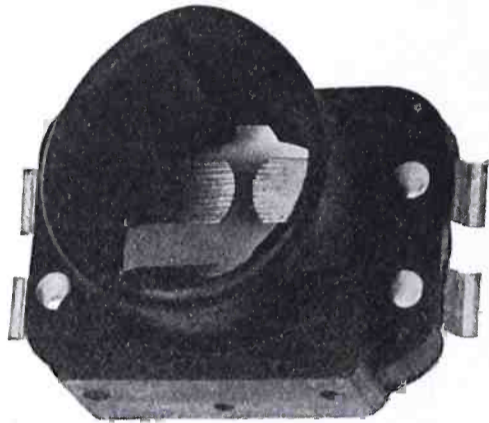


Circuit Diagram of Transmitter

FROM THE RADIO MANUFACTURERS

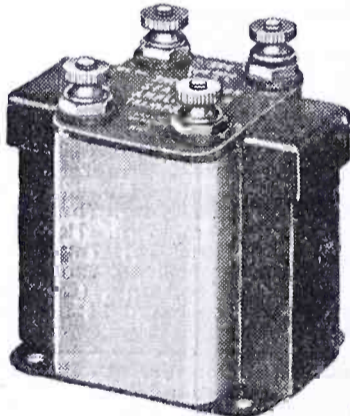


The Crosley Hard Rubber Socket for vacuum tubes has recently been further improved by the use of extra wide contacts riveted to the base. These tips are designed to furnish the maximum tension on the prongs and are serrated so as to close the prongs when the tubes are inserted. Extension of the four contact springs from the



side of the socket permits soldering connections. A stop to keep the tube from being inserted too far tends to lengthen the life of the spring clips. The socket has also been strengthened by the use of more and stronger material.

The New 2-1 Thordarson Audio Frequency Transformer has the same type of layer wound square coil, snugly fitting around the square core, as is used in the 3½-1 and 6-1 model. It is claimed that this construction eliminates the layers' slipping so as to cause open circuit and also elim-



inates air spaces between coil and core, thereby preventing losses of energy which decrease volume on low notes especially and avoiding leaks which might cause the set to howl. Other exclusive construction features are claimed to greatly improve the electrical efficiency. It is reported to be ideally suited for three stage amplifiers and reflex purposes.

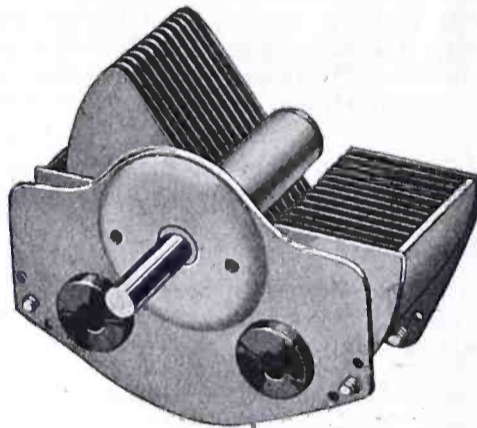
The A-C Dayton XL-5 is a five tube set using tuned radio frequency, detector and audio-frequency amplification, belonging to



the three-dial control type with the three radio-frequency transformers tuned with

variable condensers. The transformers are of special design and are one of the set's outstanding features. Exceptionally clear reception and consistently satisfactory performance are claimed.

The Bradleydenser is a new low loss variable condenser using brass plates soldered at all joints. A unique feature is the one-end plate construction. The rotor is supported on a long bearing sleeve, secured to the stator end plate, and thus does not depend upon the rotor shaft for alignment. A



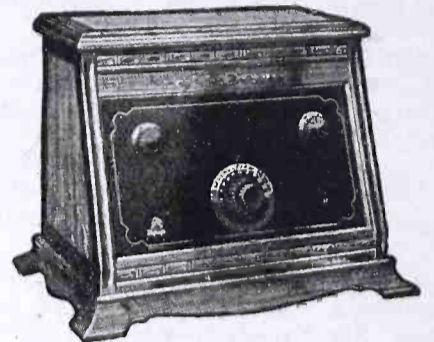
spring tension in the uniquely designed bearing takes up the slightest wear and keeps the rotor in accurate alignment. The rotor plates are grounded to reduce the body capacity effects when tuning. A removable shield encloses the stator plates and protects them from dust.

The Dulce Tone is a device for utilizing a phonograph as a radio sound reproducer. It is attached to the set like a loud-speaker or 'phones and is placed on the talking machine turn-table so that the phonograph



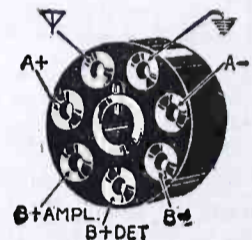
needle rests on the vibrating reed of the Dulce Tone. It is made in two models, one for Victrolas, the other for any other type of talking machine.

The Mohawk is a new receiving set employing but one tuning control. It has two stages of radio frequency amplification detector and two stages of audio frequency amplification. Great selectivity is secured



with a single high ratio vernier dial. Synchronized condensers and balanced transformers are used to eliminate distortion. It has a tuning range from 150 to 650 meters. It is made in several types of cabinets.

The Jones Multiplug and Cable is a handy device for instantly and simultaneously connecting or disconnecting the ground, antenna, *A* and *B* batteries to or from a set. All leads are coded by colors so as to insure proper connection. By means of an 8-ft. cable the set may be connected to distant



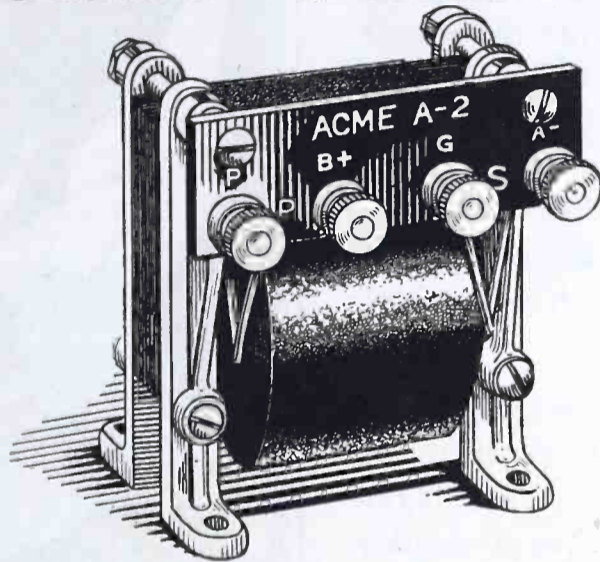
batteries or moved about without disturbing battery connections. It is furnished with bracket mounting for convenient placing in the set.

The France Multi-duty Super-charger embodies a new application of the push-pull principle which eliminates sparking contacts. It is designed to charge 2, 4 or 6



volt batteries at a 5 or 7 ampere rate and also *B* batteries in series up to 120 volts at a desired varying rate. It is simple and easy to handle and silent in operation.

This Transformer Has Improved Thousands of Radio Sets - - -



ACME A-2
—for volume

"... YOUR letter answering mine of December 10 came just as I got home with an ACME A-2 in my pocket. I installed it in my reflex set in place of the — and believe me you cannot exaggerate its good qualities. . . ."
From Winnetka, Illinois.

"... Am using your four-tube Acme circuit, using three audio and three radio transformers, and can pick up any 50 watt station in the U. S. A. . . ."
From Fitzsimmons, Colorado.

These are just typical samples of testimonials picked out at random from our files. If we tried to show

them all to you, we'd have to publish a book. You couldn't read them through in a day.

But right here and now today you can, if you will, get the benefit of ACME Transformers. Use them in the set you build. Insist on them in the set you buy. Then your loud-speaker will have a chance to reproduce loud and clear without distortion.

Send 10 cents for 36-page book, "Amplification Without Distortion," containing many practical wiring diagrams and many hints for getting the best out of your set.

ACME APPARATUS COMPANY

Transformer and Radio Engineers and Manufacturers

Dept. 84, Cambridge, Mass.

ACME

~ for amplification

ACME APPARATUS COMPANY,
Dept. 84, Cambridge, Mass.

Gentlemen: Enclosed find 10 cents for copy of "Amplification without Distortion."

Name.....

Street

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

How many radio miles did you go last night?

HOW many radio miles did you travel last night—that's the up-to-the-minute question. Did you voyage from New York to Chicago? Did you look in on Boston fifty seconds after, and on Philadelphia half-a-minute after that? If you *didn't*, why didn't you? There's fun and excitement, too, in a De Forest Radio—and it's ready to "get to work" five minutes after it enters your home.

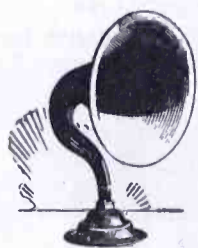
Here is a Radiophone so astonishingly simple for the work it does that it's your best introduction to the marvels of radio space. Here is one so perfectly developed that it invites graduation from other less efficient instruments.

Here is a receiving set sponsored by the very genius who made radio, as we know it, possible—an instrument which offers a really remarkable demonstration in radio performance at a price far less than any instrument whose achievements compare with it. Here is a practical, a modern Radiophone, depending upon no out-strung wire to obtain results, but which, with a simple loop the size of a picture frame, opens to you a far-flung range of concert, speech and lecture—and all with a tonal purity, a sensitiveness of choice that is rare to any but De Forest users.



DE FOREST RADIOPHONE

For Beauty and Clear Reproduction



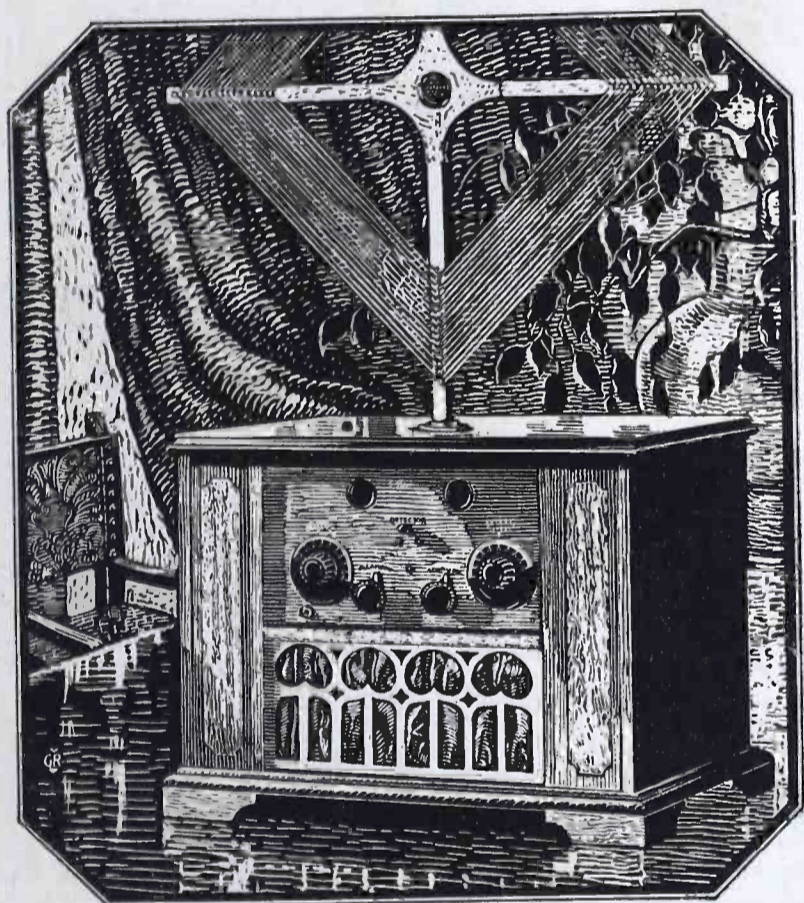
Use the De Forest Loud Speaker. It reproduces naturally, brilliantly, without distortion. The adjustment of the reproducing unit assures uniform response over entire range of audible frequencies. Its horn is shaped to retain the full brilliancy of the original sound, and also to

add volume. The complete unit is free from rattles. No rattles can ever develop. Every De Forest Loud Speaker is thoroughly tested and is guaranteed free from defects.

Sold by authorized De Forest dealers only. Price, with 6 feet of cord, \$25.00.

The De Forest Radiophone is a complete four-tube receiver, built on the best reflex principle. Its four tubes and crystal detector do the work of seven tubes with four-tube economy of operation.

We could be extremely technical in telling you how the four tubes do the work of seven and why the crystal detector gives both power and economy to this instrument. If you are technically inclined we shall be glad to do so if you will write us. Technical or not, however, know this: You can get splendid results from a De Forest D-12 Radiophone. Its upkeep is low. Its tone is clear and pure. It can be moved easily from room to room.



DE FOREST D-12 RADIOPHONE
Seven-tube efficiency with four-tube economy.
Ask the De Forest agent to demonstrate.

Why it pays to look for the De Forest agent

De Forest from first to last stands for all that is substantial and thorough and fundamentally right in radio. De Forest agents are qualified to give you sound and practical advice and help in radio. When you find a De Forest agent you find a man who knows radio—a man who has given us his word that he will see that every instrument he sells is thoroughly inspected and properly serviced after the sale. He has been carefully picked and schooled in the operation and care of De Forest Radiophones. He will install your instrument and explain to you simply how to get the fullest satisfaction and enjoyment from it.

Avail yourself fully of his help. You will find it valuable.

Prices on De Forest D-12 Radiophones

COMPLETE

Including loop, self-contained loud speaker, four De Forest tubes, A and B batteries, and all equipment ready to operate.

With Dry Batteries

In two-tone gray and black Fabrikoid cabinet	\$161.20
In two-tone Mahogany cabinet	176.20

With Storage Batteries

In two-tone gray and black Fabrikoid cabinet	180.00
In two-tone Mahogany cabinet	195.00

De Forest D-14 Radiophone

In burl walnut cabinet with loop and loud speaker built in. Price, including five DV-2 tubes, four B batteries, and storage batteries.	371.50
--	--------

DE FOREST RADIO COMPANY
Jersey City, N. J.

DE FOREST RADIOPHONE

Your Set Deserves De Forest Tubes

The original De Forest three-electrode vacuum tube was the first of many millions of De Forest tubes that have never been excelled in quality of workmanship, or performance. Today, as in the past, De Forest tubes are unsurpassed for giving volume and beauty of tone.

They are non-microphonic. They can be used with all standard circuits. The DV-3 is for use with dry batteries, the DV-2 with storage batteries. They are guaranteed against defects in material and workmanship. Sold only by authorized De Forest dealers. Price, \$4.00 each.

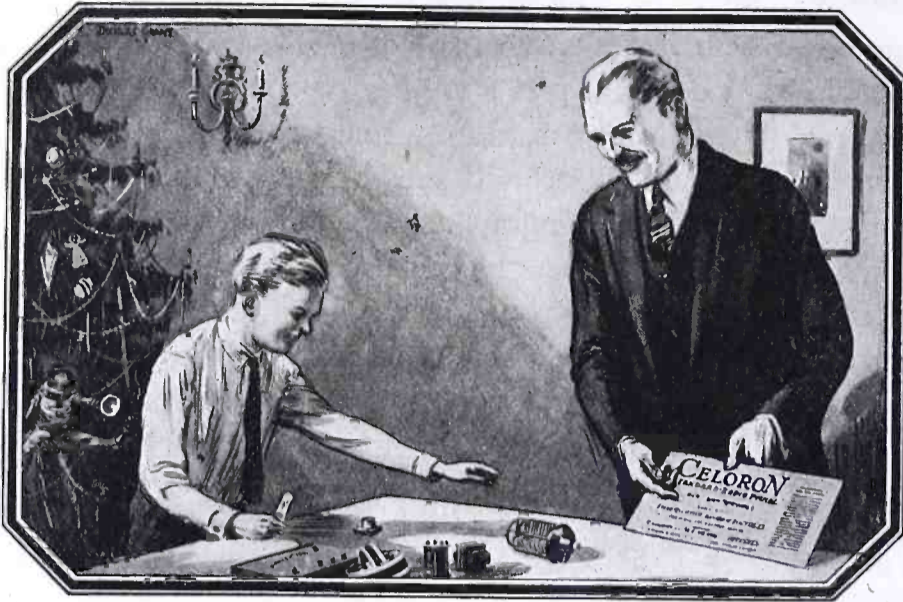
De Forest DV-3 Tube for use with Dry Cell Batteries



De Forest DV-2 Tube for use with Storage Batteries



CELORON



"Gee, dad, that's a peach!"

CHRISTMAS morning — and with it gifts that make the radio fan's heart skip a beat or two. There are tubes, batteries, a tuning-coil and beside them a beautiful, glossy-black panel. The best part about the panel is that it is a Celoron panel.

Dad used his old bean when he selected a Celoron panel. He picked Celoron because it is a bakelite panel and furnishes the insulation that delicate instruments need to give the best results. He knows that it doesn't pay to skimp in buying a panel.

Celoron has high dielectric strength and it is practically indestructible. You can drill, tap, saw and bore a Celoron panel without fear of its chipping or cracking. It is not affected by atmospheric changes, and it never softens, warps or buckles.

You can buy Celoron in black or mahogany finishes. These never lose their lustre or become discolored. They improve with age.

Celoron has been tested and approved by the U. S. Navy, the U. S. Signal Corps, by leading radio manufacturers, and by thousands of radio fans all over the country.

Ask your dealer to show you his assortment of Celoron bakelite panels.

CELORON A Bakelite Panel

Diamond State Fibre Company
Bridgeport, Pa., and Chicago, Ill.
Branches in Principal Cities
Toronto, Canada London, England

Send for FREE booklets

We have prepared two interesting booklets, "Getting the Right Hook-up with Celoron" and "Vulcaewood—the New Cabinet Material," which contain many valuable suggestions for building and operating a radio set. Send for your copies, now. They are free.

Diamond State Fibre Co., Bridgeport, Pa.

Please send me without charge copies of "Getting the Right Hook-up with Celoron" and "Vulcaewood—the New Cabinet Material."

My radio dealer's name is

Name

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Pacific Bldg., San Francisco, Cal.

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Per Copy

Continued from page 41

(9awm), (9ctr), 9der, 9ccs, (9caa), (9bdu), (9drx), (9cee), 9aog, (9hez), 9cfr, 9cee, 9bji, 9ayq, 9cjc, 9dtd, (9bvn), 9arj (9clq), 9beg, 9bis, 9cyk. Can. 4aa, 5bf, 5bz, 5cn.

By Melvin A. Russell, Box 271, Brea, Calif.

1xz, 1xav, 2xd, 2brb, 2kj, 3bg, 3bdo, 3hh, 3bsb, 4fg, 4cv, 5nj, 5lh, 5oq, 5alh, 5rh, 5ak, 5ph, 5aec, 5ame, 5afn, 5mi, 5if, 5ot, 5ov, 5's too numerous, 7ack, 7gv, 7ahs, 7qc, 7ok, 7ald, 7ajy, 7gr, 7lq, 7fr, 7lj, 7mf, 7no, 7ot, 7sy, 7qd, 7afo, 8bpv, 8cdd, 8ada, 8bpa, 8zah, 8dhw, 9amp, 9ahy, 9arj, 9aaj, 9bk, 9bm, 9bvo, 9bjk, 9bpy, 9bkx, 9bnf, 9bcd, 9cht, 9cdv, 9cju, 9clq, 9cdo, 9cjc, 9ccx, 9cfe, 9cii, 9efi, 9dq, 9dun, 9ddp, 9ddc, 9dxn, 9exy, 9eam, 9em, 9efv, 9ekf. Can. 4cr.

By G.I.V., Alameda, Calif.

1axa, 1sf, 2bd, 2rk, 2fy, 2sy, 4xe, 5aex, 5dw, 5jf, 5ov, 5acr, 5alj, 5ajl, 5amo, (5akm), 6ceu, 6als, 6any, (7mn), 8ced, 8cei, 8cid, 8crc, 8bau, (8do), 8bm, (9aed), 9amb, 9amo, 9aog, 9avv, 9bfd?, (9bdu), 9bjk, 9bmk, 9bmx, 9buk, 9bvw, (9caa), 9bsz, 9cbf, 9ccx, 9cii, 9cjc, 9cld, 9ctr, 9dkv, 9dky, 9dic, (9dun), (9ded), 9eae, 9efy, 9eky, 9eld, 9zt, (nerk), fz?, digcs?, digcs,—qra?, ad9?, lpz. Can. 4aa, 4cr, 4hf, 4hs, 4io, (5ak), (5an), (5ba), (5cn), 5ct, 5ds, (5ef), (5gg), 5fi, 5go, hag???

By 2BUY, Bradley Park, N. J.

(4jr), (4kk), (4mb), (4pd), (4sl), (5bf), (5qh), (5tn), (5abn), (5air), (5ajh), 5akn, 5alz, 5amb, 5amh, 6gt, 6gv, 6hs, (6rn), (6adt), (6ahp), 6bcp, 6cef, (6cgw), (6cje), (6cqe), 6crx, 6csw, 7mf, 7nz?, (9ach), (9ah), (9aic), (9arf), (9beg), (9bis), (9bkx), (9big), (9bmv), (9bna), (9bva), (9cee), (9cej), (9cek), (9cfs), 9cgr, (9cjc), (9ckm), (9clz), (9cnb), (9cov), (9ctr), (9ctu), (9dlm), (9ejl), (9ejr), (9ejy), (9ep). Can. 1ei, 2ax, (3ad), (3co), (3he), (3ly), 3wa. Reports on my sigs appreciated and all cards answered.

At 8DHW, 37 Cresson St., Pittsburg, Pa.

75-80 meters: (1aap), (1aez), (1ajp), (1ajg), 1alj, (1are), (1atj), (1avj), (1bfq), (1bgq), 1bgl, (1bdt), 1bkr, (1cak), (1ckp), (1cmx), (1cre), (1fd), (1my), (1kc), (1ou), (1pa), (1zz), 1xw, (2abd), (2ahn), (2anm), (2apy), 2adj, 2ana, (2aqh), (2awf), (2brb), (2cjj), (2cyw), (2ku), (2mu), (2pk), (2po), (2zq), (3aae), 3arl, (2avk), (3bfe), (3bdd), (3bhv), (3bsb), (3chg), 3cej, (3bb), (3bz), (3ca), (3mb), (3vw), (3wb), (4al), 4bq, (4du), (4mi), (4pl), 4rr, (4tj-qra?), (4vn), 4xe, (5aaq), (5ags), (5ajh), (5ame), 5cn, (5ko), (5li), (5ph), (5wy), (5zas), 6age, (6apw), 6arb, 6bnu, (6bqr), 6civ, 6cmu, 6gg, (6vc-qra?), (7fd), (7fr), (8hos), (8atp), (8ekl), (8bfe), (8bpl), (9aad), (9ahf), (9apd), (9ad), (9axt), (9axx), (9bet), (9bkr), (9bm), (9brx), (9buk), (9bvz), (9clq), (9cfr), (9cov), (9dfz), (9dy), (9dxn), (9egu), (9eky), (9ell), (9efy), (9em), (9es), (9mn), (9nu), (9th), 9zd, nkf, wgh. Wd. appreciate rpts. on sigs fm. 8DHW. All qsl'd. Would like to hear more traffic on the low waves instead of so much testing.

By "XD" of 9JO, 725 Oakton St., Evanston, Ill.

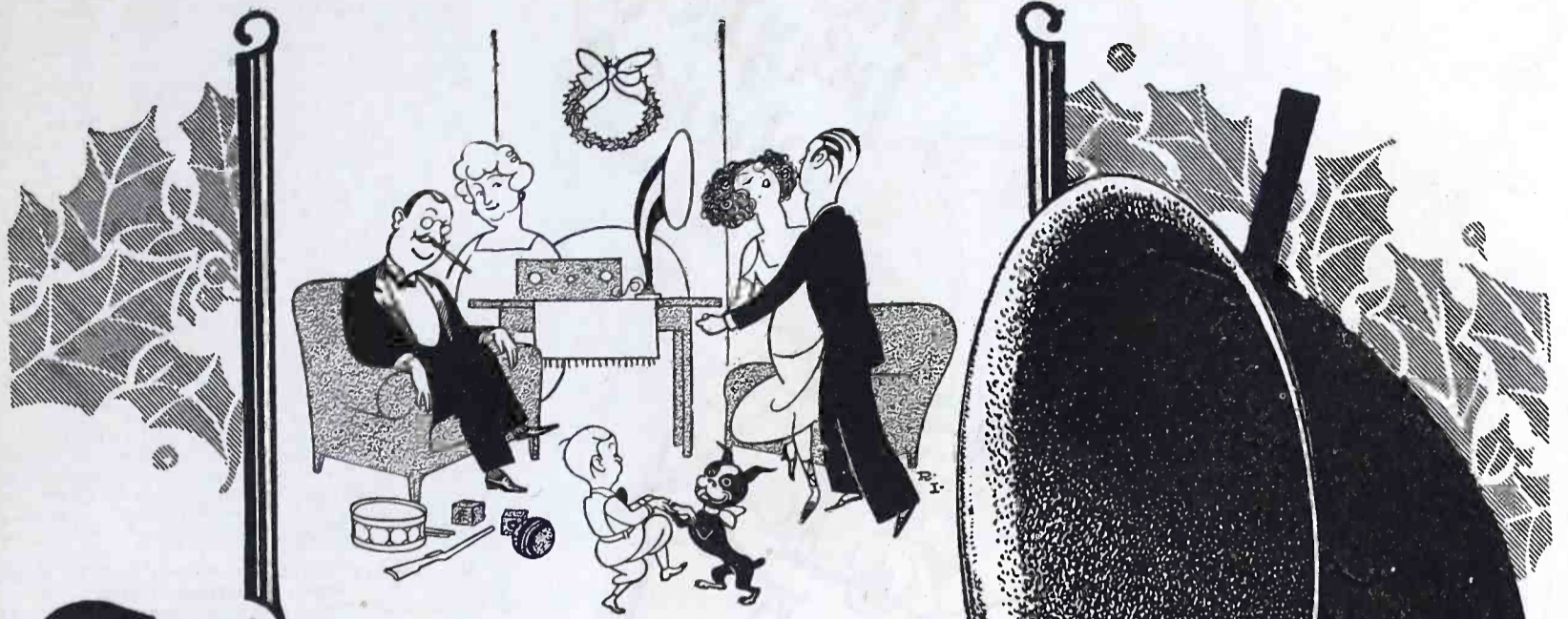
1apw, 1bjm, 1brr, 2ads, 2aao, 2azz, 2bcy, 2bmr, 2cbg, 3acy, 3aoj, 3avm, 3bmz, 3bqj, 3hta, 3ccv, 3hu, 3ga, 3gt, 3od, 3uy, 3zo, 4eg, 4ft, 5aqy, 5ka, 5nb, 5mb, 5rh, 5xa, 6acv, 6amo, 6awt, 6hcl, 6hwl, 6chl, 6cly, 6cjr, 6cnl, 7zo, 8aap, 8aee, 8aef, 8anb, 8akk, 8axf, 8bet, 8hls?, 8blr, 8bjt, 8hoc, 8hoc, 8hoq, 8boy, 8hss, 8btr, 8bvr, 8bxd, 8cjp, 8cw, 8daa, 8dmf, 8dmx, 8dnk, 8aq, 8ga, 8tt, 9dte, 9dun.

By Albert E. Scarlett, Jr.,

Mount Vernon, N. Y.

1awq, 1btt, 1fb, 4ac, 4af, 4bl, 4bx., 4du, 4dx, 4fg, 4ft, 4io, 4kk, 4kq, 4my, 4pv, 4qf, 4rr, 4sa, 4ua, 4ux, 4zd, 5aa, 5acm, 5aer, 5aex, 5agv, 5air, 5aly, 5akn, 5akp, 5amh, 5aqy, 5be, 5da, 5fs, 5ka, 5mi, 5nt, 5qh, 6arb, 6cgw, 8aaj, 8abk, 8abm, 8ac, 8ada, 8aeb, 8aeg, 8alg, 8air, 8ajm, 8ald, 8ale, 8alf, 8aly., 8anb, 8aow, 8apl, 8pn, 8apo, 8app, 8apr, 8apu, 8apy, 8arl, 8aro, 8ars, 8art, 8aru, 8atp, 8atz, 8aub, 8avx, 8awa, 8axa, 8axd, 8axf, 8axn, 8ayb, 8bal, 8bbf, 8bdh, 8bdw, 8bdy, 8ben, 8bgn, 8bgz, 8bhj, 8bjt, 8bjy, 8blb, 8blg, 8blp, 8blr, 8bmb, 8boe, 8boq, 8bos, 8bnh, 8bp, 8bpa, 8bpu, 8bqn, 8bqs, 8brc, 8brj, 8bsu, 8bt, 8buc, 8bvr, 8byn, 8hzd, 8hzf, 8chm, 8ccl, 8cet, 8cdc, 8cdk, 8ced, 8ceo, 8cgv, 8cix, 8cnl, 8cnw, 8com, 8con, 8cpk, 8crv, 8cta, 8ctu, 8cvh, 8cwu, 8cxm, 8dal, 8dbm, 8dea, 8dfm, 8dfo, 8dft, 8dc, 8dga, 8dgt, 8dgv, 8dha, 8dhw, 8dmr, 8dqf, 8dqn, 8dqt, 8dki, 8dsm, 8eb, 8er, 8es, 8gh, 8gp, 8ku, 8qb, 8rb, 8rj, 8rv, 8ry, 8sf, 8si, 8sk, 8tt, 8uf, 8ut, 8vq, 8wx, 8zz, 9aaw, 9acd, 9acv, 9adk, 9ado, 9ads, 9aeu, 9afi, 9agz, 9ahe, 9ahq, 9aic, 9aim, 9aio, 9akd, 9ao, 9aor, 9arj, 9arr, 9asa, 9atm, 9ato, 9avg, 9awp, 9axh, 9ayq, 9azj, 9bbj, 9bbk, 9bbr, 9bco, 9bdq, 9bdu, 9beg.

Continued on page 48



More Christmas Fun!

For a fan who has only headphones—or “just a horn”—a Radiola Loudspeaker is a Christmas inspiration! It means *everybody* listening in—dancing—getting the fun. It means music that is music—voice that is human voice—not “radio voice.” It means getting the best out of any set.

Remember, if you are buying a complete radio set—that no receiver can be better than its loudspeaker. And if you really care about tone quality, insist upon the Radiola Loudspeaker.

Radiola

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Radiola Loudspeaker
Type UZ-1325
Now \$25.00

This symbol
of quality



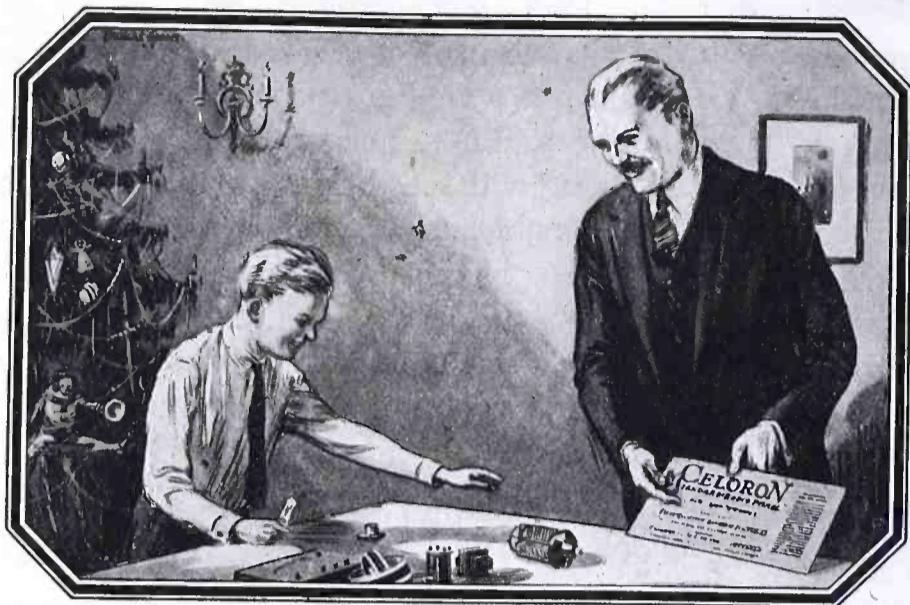
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protection

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OF AMERICA

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28 Geary St., San Francisco, Cal.

CELORON



"Gee, dad, that's a peach!"

CHRISTMAS morning — and with it gifts that make the radio fan's heart skip a beat or two. There are tubes, batteries, a tuning-coil and beside them a beautiful, glossy-black panel. The best part about the panel is that it is a Celoron panel.

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Celoron has been tested and approved by the U. S. Navy, the U. S. Signal Corps, by leading radio manufacturers, and by thousands of radio fans all over the country.

Ask your dealer to show you his assortment of Celoron bakelite panels.

CELORON A Bakelite Panel

Diamond State Fibre Company
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Continued from page 41

(9awm), (9ctr), (9der), (9ccs), (9caa), (9bdu), (9drx), (9cee), (9aog), (9bez), (9cfr), (9cee), (9bjl), (9ayq), (9cjc), (9dtd), (9bvn), (9arj), (9clq), (9beg), (9bis), (9cyk). Can. 4aa, 5bf, 5bz, 5cn.

By Melvin A. Russell, Box 271, Brea, Calif.
1xz, 1xav, 2xd, 2brb, 2kj, 3bg, 3bdo, 3hh, 3bsb, 4fg, 4cv, 5nj, 5lh, 5oq, 5aih, 5rh, 5ak, 5ph, 5aec, 5ame, 5afn, 5mi, 5if, 5ot, 5ov, 5's too numerous. 7ack, 7gv, 7ahs, 7qc, 7ok, 7ald, 7ajy, 7gr, 7lq, 7fr, 7lj, 7mf, 7no, 7ot, 7sy, 7qd, 7afo, 8bpv, 8cdd, 8ada, 8bpa, 8zah, 8dhw, 8amp, 9ahy, 9arj, 9aaj, 9bk, 9bm, 9bvo, 9bjk, 9bpy, 9bkk, 9bnf, 9bcd, 9cht, 9cdv, 9cju, 9clq, 9cdo, 9cjc, 9ccx, 9cfy, 9cll, 9efi, 9dqn, 9dun, 9ddp, 9ded, 9dxn, 9exy, 9eam, 9em, 9efv, 9ekf. Can. 4cr.

By GAY, Alameda, Calif.
1axa, 1sf, 2bd, 2rk, 2fy, 2sy, 4xe, 5aex, 5dw, 5jf, 5ov, 5acr, 5ajj, 5ajl, 5amo, (5akm), 6ceu, 6als, 6any, (7mn), 8ced, 8cel, 8cid, 8cre, 8bau, (8do), 8bm, (9aed), 9amb, 9amo, 9aog, 9avv, 9bfd?, (9bdu), 9bjk, 9bmk, 9bmx, 9buk, 9bvw, (9caa), 9bsz, 9cbf, 9ccx, 9cil, 9cjc, 9cld, 9ctr, 9dkv, 9dky, 9dlc, (9dun), (9ded), 9eae, 9efy, 9eky, 9eld, 9zt, (nerk), fz?, digcs?, digcs,—gra?, ad9?, lpz. Can. 4aa, 4cr, 4hf, 4hs, 4io, (5ak), (5an), (5ba), (5cn), 5ct, 5ds, (5ef), (5gg), 5fi, 5go, hag???

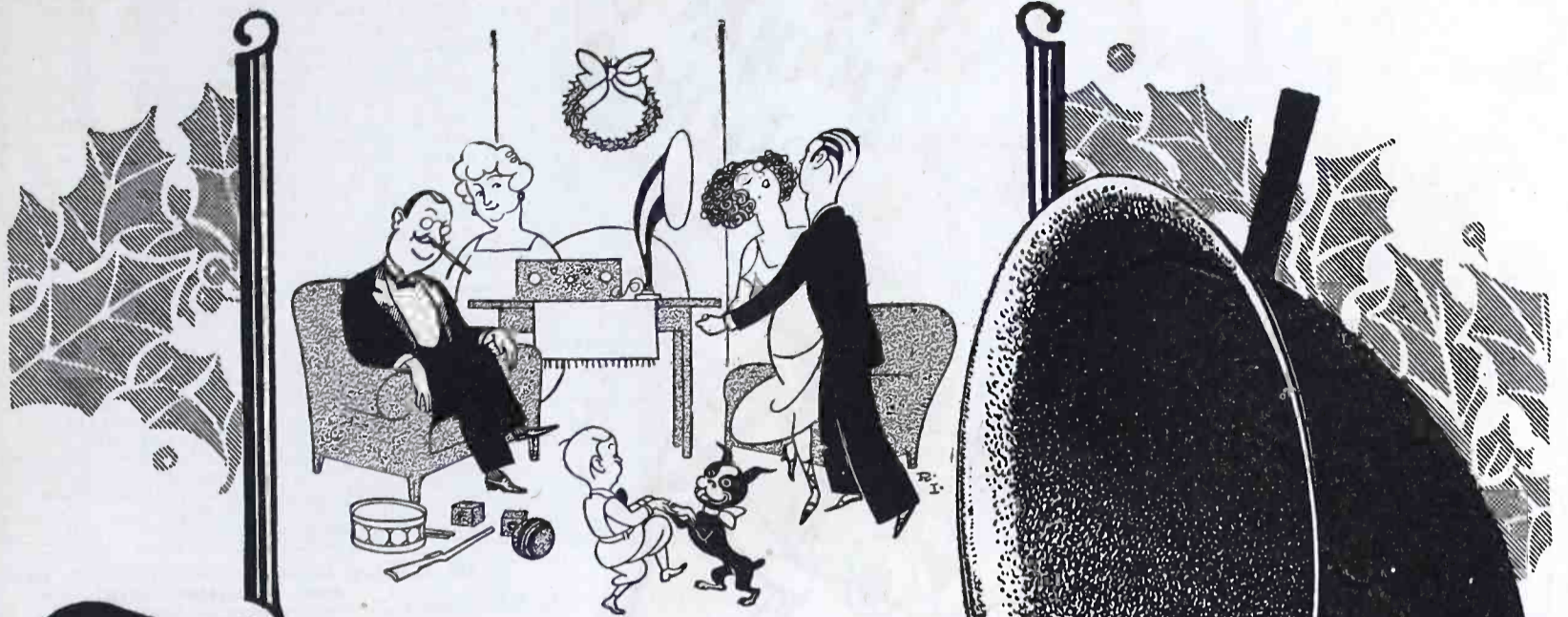
By 2BUY, Bradley Park, N. J.
(4jr), (4kk), (4mb), (4pd), (4sl), (5bf), (5qh), (5tn), (5abn), (5air), (5ajh), (5akn), (5alz), (5amb), (5amh), (5at), (5av), (5bn), (5ad), (5ahp), (5bcp), (5cef), (5cgw), (5cje), (5cqe), (5crx), (5csw), (5mf), (5nz?), (5ach), (5ahe), (5alc), (5arf), (5beg), (5bis), (5bkk), (5big), (5bmv), (5bna), (5bva), (5cee), (5cej), (5cek), (5cfs), (5cgr), (5cjc), (5ckm), (5clz), (5cnb), (5cov), (5ctr), (5ctu), (5dlm), (5ejl), (5ejr), (5ejy), (5ep). Can. 1ei, 2ax, (3ad), (3co), (3he), (3ly), 3wa. Reports on my sigs appreciated and all cards answered.

At 8DHW, 37 Crenson St., Pittsburg, Pa.
75-80 meters: (1aap), (1aex), (1ajp), (1ajq), (1ajr), (1are), (1atj), (1avj), (1bfq), (1bgq), (1bgi), (1bdt), (1bkr), (1cak), (1ckp), (1cmx), (1cre), (1fd), (1my), (1kc), (1ou), (1pa), (1zz), (1xw), (2abd), (2ahn), (2anm), (2apy), (2adj), (2ana), (2aqh), (2awf), (2brb), (2cjj), (2cyw), (2ku), (2mu), (2pk), (2po), (2xq), (3aae), (3ari), (2avk), (3bfe), (3bdd), (3bhv), (3bsb), (3chg), (3cej), (3bh), (3bz), (3ca), (3mb), (3vw), (3wb), (4ai), (4bg), (4du), (4mi), (4pi), 4rr, (4tj-qr?), (4vn), 4xe, (5aaq), (5ags), (5ajh), (5ame), 5cn, (5ko), (5li), (5ph), (5wy), (5zas), 6age, (6apw), 6arb, 6bnu, (6bqr), 6civ, 6cmu, 6gg, (6vc-qr?), (7fd), (7fr), (8bos), (8atp), (8ekl), (8hfe), (8bpl), (9aad), (9abf), (9apk), (9ad), (9axt), (9axx), (9bet), (9bkr), (9hm), (9hrx), (9buk), (9hvz), (9clq), (9cir), (9cov), (9dfz), (9dy), (9dxn), (9egu), (9eky), (9eli), (9efy), (9em), (9es), (9mn), (9nu), (9th), 9zd, nkf, wgh. Wd. appreciate rpts. on sigs fm. 8DHW. All qsl'd. Would like to hear more traffic on the low waves instead of so much testing.

By "XD" of 9JO, 725 Oakton St., Evanston, Ill.
1apw, 1bjm, 1hrr, 2ads, 2aao, 2azz, 2bcy, 2bmr, 2chg, 3acy, 3aoj, 3avm, 3bmz, 3bqj, 3hta, 3ccv, 3hu, 3ga, 3gt, 3od, 3uy, 3zo, 4eg, 4ft, 5aqy, 5ka, 5nb, 5mb, 5rh, 5xa, 6acv, 6amo, 6awt, 6chl, 6bwl, 6chl, 6cly, 6cjr, 6cnl, 7zo, 8aap, 8aee, 8aef, 8anb, 8akk, 8axf, 8bet, 8hls?, 8htr, 8hjt, 8hoc, 8boe, 8hoq, 8boy, 8bss, 8btr, 8bvr, 8bxo, 8cjp, 8cwu, 8daa, 8dmf, 8dmx, 8dnk, 8aq, 8ga, 8tt, 9dte, 9dun.

By Albert E. Scarlett, Jr., Mount Vernon, N. Y.
1awq, 1btt, 1fb, 4ac, 4af, 4bl, 4bx., 4du, 4dx, 4fg, 4ft, 4io, 4kk, 4kq, 4my, 4pv, 4qf, 4rr, 4sa, 4ua, 4ux, 4zd, 5aa, 5acm, 5aer, 5aex, 5agv, 5air, 5aly, 5akn, 5akp, 5amh, 5aqy, 5be, 5da, 5fs, 5ka, 5mi, 5nt, 5qh, 6arb, 6cgv, 8aaj, 8abk, 8abm, 8ac, 8ada, 8aeb, 8aeg, 8alg, 8air, 8ajm, 8ald, 8ale, 8alf, 8aly., 8anb, 8aow, 8apl, 8pn, 8apo, 8app, 8apr, 8apu, 8apy, 8arl, 8aro, 8ars, 8art, 8aru, 8atp, 8atz, 8aub, 8avx, 8awa, 8axa, 8axd, 8axf, 8axn, 8ayb, 8bal, 8hhf, 8bdh, 8hdw, 8hdy, 8hen, 8hgn, 8bgz, 8bhj, 8bjt, 8bjy, 8hbb, 8blg, 8blp, 8blr, 8bmb, 8hoe, 8hoq, 8hos, 8hnh, 8hp, 8bpa, 8bpu, 8bqn, 8bqs, 8hrc, 8brj, 8bsu, 8bt, 8buc, 8bvr, 8byn, 8bz, 8bzf, 8chm, 8cei, 8ctc, 8cdc, 8cdk, 8ced, 8ceo, 8cgv, 8cix, 8cnl, 8cnw, 8com, 8con, 8cpk, 8crv, 8cta, 8ctu, 8cvh, 8cwu, 8cxm, 8dal, 8dbm, 8dea, 8dfm, 8dfo, 8dft, 8dc, 8dga, 8dgt, 8dgv, 8dha, 8dhw, 8dmr, 8dqf, 8dqn, 8dqt, 8dki, 8dsm, 8eb, 8er, 8es, 8gh, 8gp, 8ku, 8qb, 8rb, 8rj, 8rv, 8ry, 8sf, 8si, 8sk, 8tt, 8uf, 8ut, 8vq, 8wx, 8zz, 9aaw, 9acd, 9acv, 9adk, 9ado, 9ads, 9aeu, 9afi, 9agz, 9ahe, 9ahq, 9aic, 9aim, 9aio, 9akd, 9ao, 9aor, 9arj, 9arr, 9asa, 9atm, 9ato, 9avg, 9awp, 9axh, 9ayq, 9azj, 9bbj, 9bbk, 9bhr, 9bco, 9bdq, 9bdu, 9beg.

Continued on page 48



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Continued from page 46

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By SDAH, H. L. Pearson, 1028 Morrison Ave., Pittsburg, Pa.

1aad, 1abf, 1aeg, 1ajo, 1ams, 1bbx, 1odx, 1bhm, 1bie, 2bni, 1cav, 1ccz, 1crj, 1cue, 1he, 1nt, 1oz, 1py, 1rf, 1zp, 1zv, (2agq), 2agw, (2aig), 2axf, 2bck, 2bkr, 2boo, 2brb, 2cee, 2ub, 2xd, (3bdo), 3bvl, (3cdk), (3gc), 3nf, 4dx, 4eb, 4eg, 4hw, 4my, 4tj, 4un, 5apc, 5cn, 5ek, 5ka, 5mi, 5wo, 5zal, 6ahw, 6anb, 6cgu, 6chi, 6pl, 7bvi, 7ij, 7qc, 9aad, 9adp, 9amp, 9aoo, 9bkj, 9bmx, 9bqh, 9bsz, 9bvn, 9cee, 9cgc, 9coc, 9cro, 9dga, 9dgy. Can., 1ar, 2be (3aa), 3ad, 3cd, 3he, 3wv, 4cb.

By Robert Amsbury, 6CIX, 317 N. Friends Ave., Whittier, Calif.

Below 100 meters—1aac, 1abf, 1ajp, 1awe, 1bgq, 1xav, 1er, 1gv, 1kc, 1my, 1om, 1sf, 1te, 1xw, 1xz, 2aay, 2aea, 2agb, 2brb, 2cjj, 2csc, 2cvu, 2if, 2wr, 3adb, 3adp, 3aha, 3auy, 3bdo, 3chm, 3bb, 3hh, 3sf, 4bq, 4cg, 4ia, 4in, 4io, 4ku, 4mi, 4oa, 4qf, (4sa), 4tw, 5aai, 5agl, 5ajh, 5ame, 5amo, 5apg, 5zai, 5zas, 5ba, 5id, (5dw), 5jf, 5ka, 5kq, 5mi, 5oa, 5ot, (5ov), 5ph, 5wu, 5wy, (6aww), (6bft), (6clp), 7abb, 7aci, (7aim), 7ajy, 7ai, 7al, 7cw, 7eo, 7fd, 7fr, 7gd, 7gk, (7gr), 7ij, 7ik, 7lq, 7mf, (7pz), 7qd, 7rk, 7sq, 7zm, 8bv, 8cel, 8cyl, 8dhw, 8cj, 8hn, 8pl, 8ve, 8vq, 8wx, 8zz, 9aad, 9abf, (9aju), 9agl, 9avv, 9bjl, 9bmx, (9bvz), (9ccx), 9cer, 9cfl, 9cfy, 9cii, (9cjc), 9cju, 9cjs, 9com, 9cro, 9cta, (9ctr), (9cxx), (9ded), 9dmj, 9dqu, 9dyn, 9dyt, 9efy, 9egu, (9eht), 9xbg, 9bm, (9em), 9es, 9qi, 9nv, 9ny, 9wv, 9yb, 9zb, 9zt, kdka, (nerk), ndf, nfv, nkf. Can.—(3ly), 5wn. Mex.—1b. N. Z.—4ag, pse, qsl, if, u, hr, me. All cards answered.

By E. O. Knoch, 6BJX, 2823 E. 6th St., Los Angeles, Calif.

75-80 meters; all over 700 miles—1fd, 1sf, 1xw, 2brd, 2gk, (2mu), 2pd, (3ajd), 3be, (3bsb), 3bta, (4fg), 4tj, 5aai, (5adv), 5aij, (5ajh), (5ak), 5ame, 5amo, 5amw, 5cn, (5gk), 5ka, 5mi, (5ot), (5ph), 5zas, (7aci), 7acm, 7ahs, (7aip), 7akk, (7bj), 7du, 7eo, 7fd, (7fr), (7fk), (7gq), (7gr), 7ij, (7lq), 7ls, 7pz, 7rd, 7sf, 7so, 8bjd, (8bpa), 8cel, (8cyl), (8gz), 8pl, 8xg, 8zz, 9abf, 9agl, 9ahq, 9amb, (9arj), 9auv, 9av, (9avg), 9awm, 9axx, 9bkx, 9bm, (9bmx), 9bqy, 9brx, 9bvz, (9bxq), 9cbf, 9cbk, 9ccx, 9cdo, 9cdv, 9cfl, (9cfy), 9cii, (9cip), 9cjc, (9cjs), (9cju), 9ded, 9dfz, (9djd), 9dqm, (9dqu), 9dpx, 9drq, 9dvl, 9dvz, 9dwk, 9dxq, (9dxw), 9dxy, (9efy), 9ehk, 9eht, 9eky, 9ih, 9xbb, 9xw, 9zb, (9zd), 9zk, (9zt), kdka, nkf. Can.—3bq, 5go. All cards answered.

At 2CYX, 1104 Clay Ave., New York City

(1agt), (1ain), (1ajg), (1aou), (1bbo), (1bcu), (1bjg), (1bo), (1btt), (1bu), (1cjr), 1da, 1oe, (1gh), (1nt), 1py, (1qv), (1rb), (1ve), (1vr), 1yb, (1zj), (3ach), (3aih), (3aoj), (3auv), (3bay), (3bta), (3bva), (3bvz), 3ccv, (3cfc), 3chc, 3chg, 3hg, 3wx, 4af, (4dx), 4eg, 4fg, 4gs, (4gw), 4hr, 4io, 4lj, 4my, 4oa, 4on, 4pd, 4rg, (5aek), 5aeq, (5agv), (5air), 5akd, 5alz, 5amh, (5apc), 5apj, 5aqy, 5zal, 5aw, 5ck, 5fs, (5fv), 5ge, (5ka), 5nc, 5nj, 5nw, 5po, 5qh, 5qk, 5sg, 5uk, 6aao, 6arb, 6awt, 6cgs, 6xad, 6pl, 7aab, 7em, 7ry, 7qc, 8aeb, (8aga), (8ali), 8alw, 8ase, (8avx), 8bbf, 8ben, (8bgn), (8bhj), 8boy, (8bqn), (8brc), 8cci, (8ced), (8ced), (8cej), 8cmt, (8cxm), (8dfm), (8dga), 8dmr, (8dmx), 8drc, (8dsn), 8iz, (8rt), 8rv, (8sf), (8ut), 8wo, 9adq, (9aoo), 9ayq, (9ayx), (9bcd), (9bdu), 9bbh, (9biq), 9biz, (9bmk), 9bmu, 9bnk, 9bpd, 9brx, (9bsz), 9bqh, 9caj, 9cap, (9cof), 9cee, 9cii, 9ckb, 9ctr, 9cwc, 9del, 9dhl, 9dhz, 9djd, 9dlj, 9dms, (9dnp)gra? (9eji), 9ekf, 9eky, 9elv, (9xbe)gra? 9bk, 9co, 9ep, 9es, 9hk, 9hm, 9ny, 9pq, 9tw, (9vc), 9vm, Wud apte reports on mi 50 on 45 es 80 meters. All crds answered.

By 6BBV, J. Barsby, 518 W. 50th St., Los Angeles

1aac, 4tj, 5ak, 5ba, 5rh, (6aof) Hawaii, 6arb, 6fy, 6cfy, 7aih, 7alk, 7fg, 7gr, 7gy, 7ij, 7mf, (7ok), 7qc, 7qy, 7ry, (7to), 7uv, 8cel, 8vq, 9ado, 9ahy, 9aim, 9awm, 9bm, 9bmk, 9bv, 9cbf, 9cdo, (9cdv), 9cht, 9cro, 9elk, 9cju. Can.—5ea.

Continued on page 50

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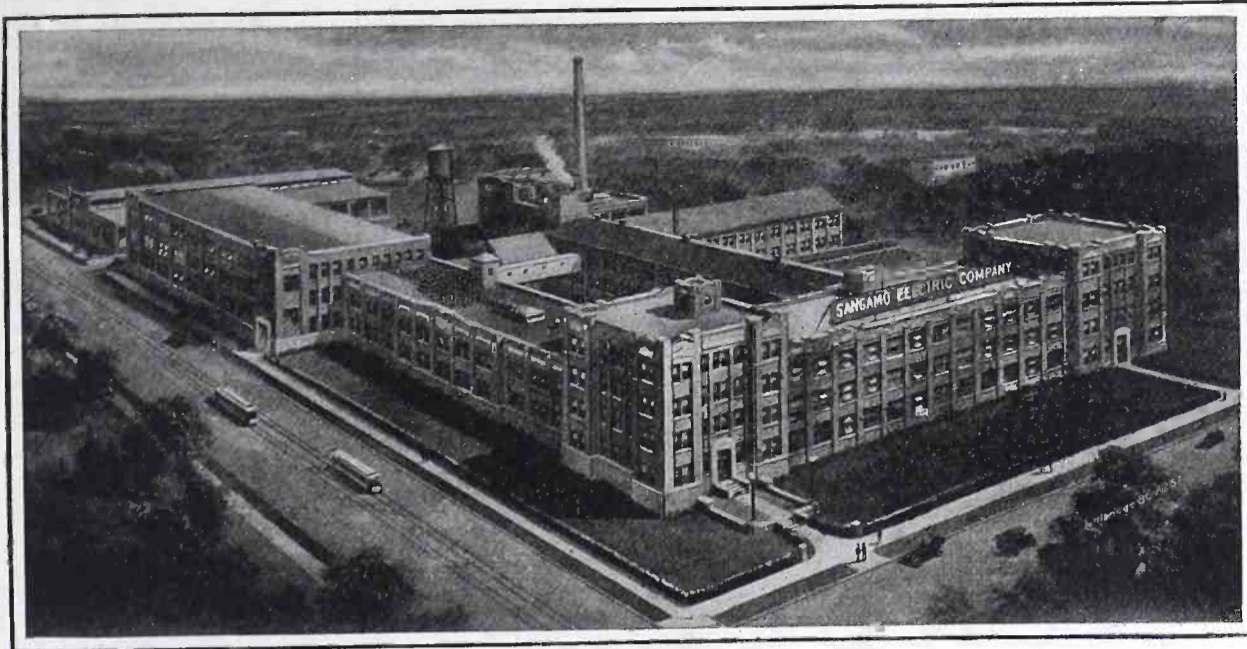
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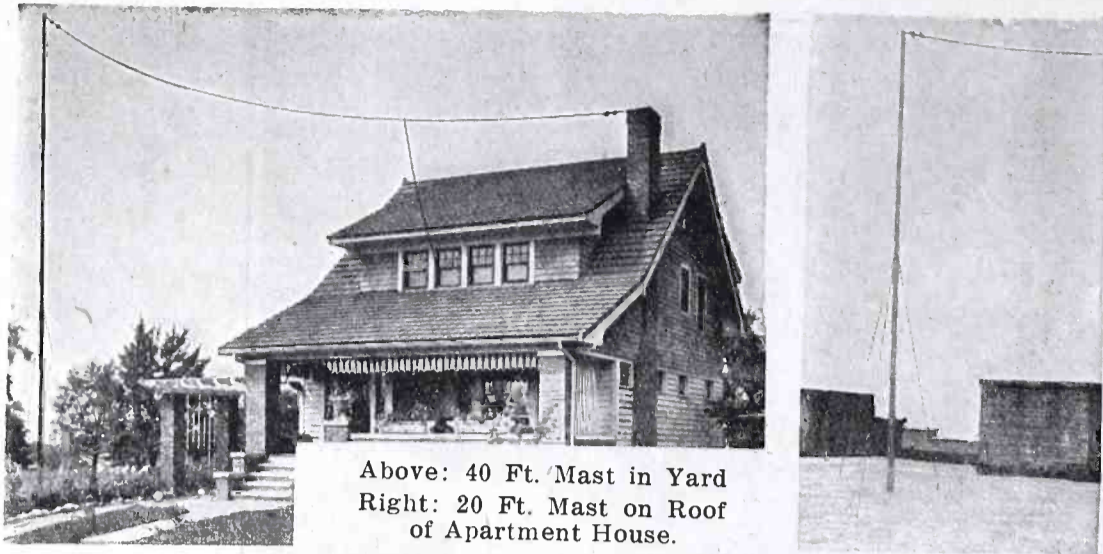
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Above: 40 Ft. Mast in Yard
Right: 20 Ft. Mast on Roof of Apartment House.

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It has been said time and again that the best results are obtained only by the intelligent use of the best apparatus procurable. This applies not only to the receiving set proper, but also to the antenna system. **THE AERIAL MUST BE EFFICIENT** if the reception of long distance stations, theoretically within range of the receiver, is desired.

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Continued from page 48

By **6CIX, 317 N. Friends Ave., Whittier, Calif.**

All below 80 meters—10a, 1cf, 1sf, 2brb, 2ca, 3bta, 3cp, 3bq, 4ai, 4fs, 4io, 5ajh, 5ame, 5amo, 5ot, 5wy, 5zal, 5zas, 7acl, 7bj, 7eo, 7gk, 7gr, 7lj, 7lq, 7pz, 7rd, 8bpa, 8gz, 8pl, 8vq, 8wx, 8xs, 9abf, 9agl, 9awm, 9bmx, 9caj, 9cbr, 9cbf, 9cdv, 9cil, 9cip, 9cjc, 9cju, 9cve, 9ddp, 9dfz, 9dqu, 9dvp, 9efy, 9egu, 9emu, 9bm, 9em, 9xw, 9zd, 9zt, kdka, kfn, Can.—5cn. Anione hrng '6CIX pse qsl. All crds ansd.

By **2AEY, R. E. Groebe, 338 El Mora Ave., Elizabeth, N. J.**

1aac, 1abp, 1abt, 1acr, 1aea, 1aer, 1aex, 1ahi, 1ahl, 1aid, 1aja, 1ajl, 1ajp, 1akz, 1aql, 1are, 1asu, 1atj, 1aur, 1avj, 1awq, 1aww, (1axz), 1azl, 1bai, 1ban, 1bdx, 1bfq, 1bgt, (1bhr), 1bip, 1biz, 1bkr, 1blx, 1bpb, 1bqe, 1bqk, 1bqt, 1bsd, 1bvl, (1caz), 1ccx, 1ccz, 1ckp, 1cln, 1cpo, 1cpv, 1xak, 1xam, 1aj, 1an, 1bx, 1dd, (1ee), 1er, 1fd, 1fm, 1gs, 1il, 1ml, 1my, 1nr, 1om, 1ou, 1pd, 1pe, (1qm), 1qv, 1sf, 1te, 1ts, 1ud, 1um, 1xw, 1ze, 1zt, 1zz, 3acn, 3acy, 3adp, 3ady, 3aek, 3ahp, 3alh, 3aqr, 3ari, 3arz, 3ats, 3auv, 3avk, 3bbv, 3bdi, 3dbo, 3bfe, 3bif, 3bkl, 3blu, 3bml, 3bmz, 3bnu, 3bof, 3bpb, 3bsb, (3btq), 3btu, (3buy), 3bva, 3bwj, 3bwt, 3ccv, 3ccx, (3cdu), 3cdv, 3cel, 3cfc, 3cgc, 3chg, 3civ, (3xan), 3bg, 3bz, 3ds, 3du, 3eh, 3fs, 3hd, 3hg, 3hm, 3hq, 3jo, (3kl), 3kq, 3lg, 3lr, 3mb, (3mf), 3mk, 3mo, 3oo, (3qw), 3rg, 3rs, 3tf, 3ti, 3tj, 3uy, 3vw, 3wb, 3wf, 3xr, 3zm, 3zo, 4ai, 4cu, 4du, 4dy, 4ea, 4eh, 4ep, 4eq, 4fs, (4ft), 4fy, 4io, 4ka, 4kk, 4kl, 4lp, 4mb, 4ml, 4oa, 4og, 4pi, 4pv, 4ql, (4rz), 4si, 4su, 4tj, 4un, 4us, 4ux, 4vl, 4xe, 4zd, 5aa, 5acm, 5all, 5air, 5ajn, 5ame, 5amh, 5aw, 5cn, 5ek, 5er, 5gk, 5ka, 5kq, 5nj, 5ot, 5qh, 5qi, 5rh, 5vv, 5xa, 6ajf, 6arb, 6cef, 6cfe, 6cgw, 6xbn, 7abb, 7gq, 8aa, 8aan, 8abm, 8acm, 8acu, 8add, 8aeg, 8aey, 8afq, 8agw, 8ah, 8ajf, 8ajn, 8akk, 8akr, 8ali, 8alk, 8alx, 8aly, (8anf), 8apn, 8apo, 8apt, 8aqu, 8ard, 8atp, 8atz, 8avj, 8avl, 8axn, 8ayd, 8bce, 8bcu, 8bdw, 8ben, 8bfe, 8bff, 8bfh, 8bgn, 8bgw, 8bhy, 8bit, 8bjc, 8bjt, (8bkm), 8blg, 8bmb, 8bml, 8bmy, 8bnh, 8boa, 8boc, 8boe, 8boq, 8bos, 8boy, 8bpa, 8bpl, 8bpu, 8bpv, 8bqi, 8bqn, 8brb, 8bst, 8bsw, 8btf, 8buk, 8bvr, 8bvp, 8byn, 8bzf, 8cci, 8cdt, 8ced, 8cei, 8cgr, 8cjp, 8cke, 8ckl, 8cko, 8ckp, 8clc, 8cm, 8cnl, 8cnw, 8con, (8cpk), 8cse, 8cve, 8cwl, 8czo, 8daa, 8dal, 8dat, 8dbl, 8dfb, 8dfk, 8dfo, 8dfs, 8dft, 8dgl, 8dgo, (8dgt), 8dhs, 8dhw, 8die, 8dlx, 8dme, 8dmh, 8dmx, 8dnk, 8doq, (8doo), 8dpa, 8dqf, 8drc, 8dsn, 8dte, 8ah, 8ak, 8aq, (8bo QRA?), 8eo, 8gz, 8hb, 8jq, 8kj, 8lo, 8mc, 8nz, 8pl, (8qb), 8qr, 8rv, 8tj, 8up, 8ut, 8vx, 8vy, 8xc, 8yx, 8zd, 8zf, 8zg, 9aad, 9aal, 9aas, 9aaw, 9abf, (9adq), 9aei, 9aen, 9afi, (9ahy), 9akd, 9ana, 9apd, 9apk, 9asw, 9atn, 9ats, 9aul, 9aay, 9awf, 9awg, 9azp, 9baz, 9bcc, 9bdu, 9beg, 9bhb, 9bjg, 9bkr, 9bks, 9bmk, 9bmu, 9bna, 9bnk, 9boy, 9bpy, 9brx, 9buk, 9bva, 9bvn, 9bvw, 9bww, 9bye, 9cab, 9cci, 9ccm, 9cdq, 9cee, 9cfl, (9cgr), 9cjc, 9cjs, 9cks, 9cog, 9cro, 9ctr, 9cub, 9cvs, 9cwz, 9cyh, 9cyl, 9cyg, 9day, 9ddl, 9ddp, 9del, 9dfq, 9dfz, (9dng), (9dhl), 9dhw, 9dhz, 9dkn, 9dkt, 9dlj, 9dlw, 9dmi, 9dpl, 9dpx, 9dqu, 9dsa, 9duj, 9dvp, 9dvv, 9dww, 9dwx, 9dwy, 9dxn, 9dyn, 9dyv, (9eas), 9eky, 9eld, 9xbb, 9bk, 9bm, 9cp, 9ej, 9em, 9ep, 9es, 9hk, 9hp, 9ih, 9jg, 9jm, 9mn, 9my, 9nu, 9ny, 9qr, 9su, 9th, 9vc, 9wu, 9yn, 9zw, nkf, wvv, wgh.

Canadians—lar, lie, 2be, 2bg, 2cg, 3aa, 3bi, 3bp, 3bq, 3fc, 3kq, 3nf, (3ud), 3vh, 3vw, 3afp, 4hh, 4io, 9bw.

Italian—IHT.

Porto Rico—4ja, 4oi, 4sa, 4rl.

2AEY has a supply of 2000 QSL crds, so don't be afraid to ask for a QSL. Anyone hrng me pse let me know. Tnx vy.

By **7GR, P. O. Station A, Vancouver, Wash.**

(1bbo), 1bgq, 1bvl, (1cpv), 1er, (1sf), 2brb, 2cee, 2cqz, (2gk), 2ku, 2pd, 3abw, (3adp), (3bfe), 3bsb, (3hq), (3hs), 4cr, 4eq, 4io, (4oa), 4rr, 4sa, (4tj), 5alj, (5ajh), 5akn, 5ame, (5cn), 5ka, (5kq), 5ot, (5ph), 5wy, 8axf, (8bpa), 8ced, 8cel, (8cjd), (8con), (8gz), (8nb), (8pl), (8wx), 8vq, 9aad, 9abf, 9agl, (9aog), (9awm), (9bdu), (9bet), (9bib), 9biq, 9bkk, 9bmk, 9bmu, (9bmx), (9bnu), (9bpy), (9bqv), 9brx, 9bso, (9bvz), 9bye, (9ccs), (9cdv), 9cfl, (9cfy), (9cil), (9cip), (9cjs), (9cju), 9clq, 9cro, 9cvs, (9ddp), (9ded), (9djd), (9dpx), (9dqa), 9dqm, (9drx), (9dzn), 9dvp, (9dxy), (9dun), 9eam), (9efy), (9eld), 9ej, (9ql), (9zb), 9zd, (9zt).

Can.—(3aa), 3bq.
N. Z.—4aa.

By **5AQW, 223 S. 3rd St., Enid, Okla.**

U. S. C. W.—1aac, 1abc, 1ael, 1aid, 1ajp, 1anad, 1are, 1asl, 1aur, 1avf, 1axk, 1ayt, 1bbo, 1bdh, 1 bdx, 1bgq, 1 bjp, 1bkk, 1bzb, 1ccd, 1ccz, 1cg, 1ckp, 1cmv, 1cpn, 1cpr, 1da, 1fd, 1gv, 1js, 1ka, 1mo, 1oa, 1rf, 1sf, 1sv, 1uf, 1xau, 1xah, 1xam, 1xax, 1xc, 1zt, 2aay, 2aao, 2bck, 2bgm, 2bgo, 2brb, 2bse, 2cac, 2cu, 2cu, 2cyq, 2fp, 2gk, 2ku, 2mo.

Continued on page 89

At Last! Radio That Satisfies The Music Critic

THE DAILY NEWS, SATURDAY
Easton, Martinelli, Danise,
Strong Trio in "La Tosca"
BY MAURICE ROSENFELD
High standards were maintained
the artists at Ravinia last
their first performance
of Puccini's "La Tosca"
lux methods and
from the first
the en-



THE
CHICAGO DAILY NEWS
EDITORIAL ROOMS
August 6, 1924.

E. N. Rauland, Pres.
Rauland Manufacturing Co.,
2650 Coyne Street., Chicago, Ill.

My dear Mr. Rauland:

I want to express my great pleasure in witnessing the recent test of amplifying transformers in your laboratory, and in selecting, from different instruments tested, the one which seemed to me to reproduce most exactly the artist's original tones. I was indeed gratified to learn, after the tests, that the instrument which I had repeatedly selected as by far the most successful in reproducing, not alone the music, but even the very personality of the artist, was none other than your own new "Rauland-Lyric" Transformer.

I feel confident that music lovers everywhere will appreciate the contribution you have made to their enjoyment in the creation of this reproducing instrument.

Very truly yours,
Maurice Rosenfeld
Music Critic, Chicago Daily News



Price, \$9.00

In placing his mark of approval upon Rauland-Lyric, Mr. Maurice Rosenfeld has invested Radio with a new beauty and dignity. His words carry positive assurance, to music-lovers and trained musicians, that they can now admit Radio to their field of appreciation and enjoyment, with the certainty that all voices and instruments will be reproduced with their original and distinctive Tone Quality.

Mr. Rosenfeld, a veteran among metropolitan music critics, selected Rauland-Lyric, upon the sole basis of Tone

The RADIO KEY BOOK contains the clearest explanation ever given of the nature of audio amplification and equally valuable discussion of many other subjects in Radio. Sent for 10 cents, coin or stamps.

Quality, from a group of the world's best audio transformers.

Karleton Hackett, famous critic of the Chicago Evening Post, pronounced Rauland-Lyric a "distinct advance in the musical quality of radio reproduction."

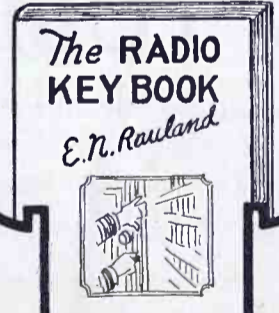
You can have, in your home, the amplifying instrument which has been commended by eminent critics.

Rauland-Lyric can be installed in your present set, or one that you may buy, to replace any ordinary audio transformer.

Ask your dealer.

RAULAND MANUFACTURING COMPANY
Pioneers in the Industry
2654 Coyne St. Chicago, Ill.

Rauland-Lyric
AN
ALL-AMERICAN
TRADE MARK
TRANSFORMER



Standard Audio Frequency Transformers
"All-American for Reliability"
Ratio 3 to 1 . . . R-12, \$4.50 Ratio 5 to 1 . . . R-21, \$4.75
Ratio 10 to 1 . . . R-13, \$4.75

Build by precision methods in a modern plant, All-American Standard Audios meet the demand of the public for a dependable, high-quality transformer at a price made possible only by enormous production.

Long Wave Transformer
For highest amplification of intermediate frequencies and perfect reproduction of side bands; 4,000 to 20,000 meters (75 to 15 kilocycles) R-110, \$6.00

Power Transformers
For Tone Quality in a Third Stage, or for Loud Volume with Clearness.
Input type . . . R-30, \$6.00 Output type . . . R-31, \$6.00

Self-Tuned Radio Frequency Transformers
"Wound to Suit the Tube"
Effectively amplifying all frequencies within the radiocast range. For "199" Tubes R-199, \$5.00
For "201A" Tubes. R-201A, \$5.00

10,000 Meter Transformer
(Filter or Input). It gives superior results in beat reception, filtering out a 30 kilocycle frequency with high selectivity and no side-band distortion R-120, \$6.00

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(Oscillator Coupler). A uniform output at 150 to 650 meters R-130, \$5.00

Universal Coupler
Sets a new standard of efficiency as an antenna coupler. As a radio frequency transformer in tuned stages it is unsurpassed R-140, \$4.00

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WHEN you own a Radiodyne you can hear singers' voices and orchestral harmonies faithfully reproduced thru the loud speaker. The Radiodyne brings these enjoyable programs into your home so clear and distinct that you lose nothing by not being at the opera. With the Radiodyne you will not be troubled by interference from nearby stations. The Radiodyne selects and holds the program you wish to hear.

Tunes Through
New York
Local Stations

Radiodyne

Gets Over 109
Stations
Loud and Clear

"We have tuned in Kansas City, Jefferson City, Hastings, Elgin, Chicago, Dallas, Atlanta, Pittsburgh, Philadelphia and many other stations in the last three nights right thru local stations."

Clarence I. Goldman,
N. Y. City.

Write for Illustrated Folder, Which Describes the Radiodyne in Detail.
If You Buy a Radio Before You Have a Demonstration of the Radiodyne
You Will Surely Regret It.

"Have received over 100 different stations, loud and clear. I can tune out Cincinnati and tune in Oakland without interference. I tuned in Oakland when it was just getting dusk here."

John W. Porter,
New Butler, Wis.

Western Coil & Electrical Co., 311 Fifth St., Racine, Wis.



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With the new highly developed dielectric moulded Bakelite base which eliminates all kinds of electrical losses.

AIRTRON TUBES

Speak for quality, volume, and allover characteristics demanded of a Radio Tube. Designed and manufactured to give the highest efficiency that a Tube at the present time can possess.

Type 201A

TYPE 200 —6 Volt. 1 Amp. Detector.

TYPE 201A—5 Volt. .25 Amp. Det. & Ampl.

TYPE 12 —1.5 Volt. .25 Amp. Det. & Ampl.

TYPE 199 —3-4 Volt. .06 Amp. Det. & Ampl. Standard Base.

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Western Representative:

LESTER'S RADIO SHOPPE, 140 South Spring Street, Los Angeles, Calif.

We Are Still Repairing All
Types of Radio Tubes at \$2.50

ON THE TRAIL OF THE TUBE SHARKS

Continued from page 14

man from California. "I advertise money back, and I mean it! When I repair a tube or sell a tube, direct or by mail, I say to the customer—'Yep, here she is; take her home, try her out, if you like her, keep her, if you don't, bring her back and get your money, spot cash!'"

The response revealed the true colors of the tube sharks—

"Well—if you want to do business that way."

They don't.

Yet there are lots of good new and repaired tubes to be had. I personally helped one dealer to test through a shipment of 165 tubes, new and exchange repairs. Eighty of them were type 199s. These, of the popular types, are the hardest in the world to make or repair. They require the very best of materials, equipment, and men. After a sixteen-hour endurance test, these tubes all came out absolutely OK, except two, and these were replaced without question.

When sending in tubes for repair, select only concerns that advertise plainly a money back guarantee, in order to protect yourself from unsatisfactory work. Remember, however, that no concern on earth can in reason be expected to make good on tubes that you burn out by switching the B battery or by using too high filament current. A large number of individual tests prove that burning the filament of a good type 199 tube one volt too high for five minutes shortens its effective life 25 hours. Some sets are hard on tubes. Be honest. Tube filament breakage in mail-order shipments is incredibly small, about one per cent on gyp tubes, and practically zero on good strong high-grade repairs, well packed.

Tubes with bakelite bases can be repaired as well as those with metal bases. If the work is done right, they will come back with new glass and new brass bases.

Beware of postoffice box addresses. Don't overlook the fact that a mail order concern is not necessarily reliable because it has been operating a long while. I have had an experience with a fraudulent mail sales concern that operated successfully for nearly six years. Of course, you *may* get a fair tube repair or new tube from any one of the gyp concerns; but the ratio seems to run about one good tube to eight raspberries. Be thoughtful when you write testimonials. Your story of the splendid results of a tube in your audio frequency amplifier may cause another fellow to get stung on seven for his super-heterodyne. Don't fall for cut prices. The rock-bottom "bargain" is the tube-shark's favorite bait. Don't be an "egg."

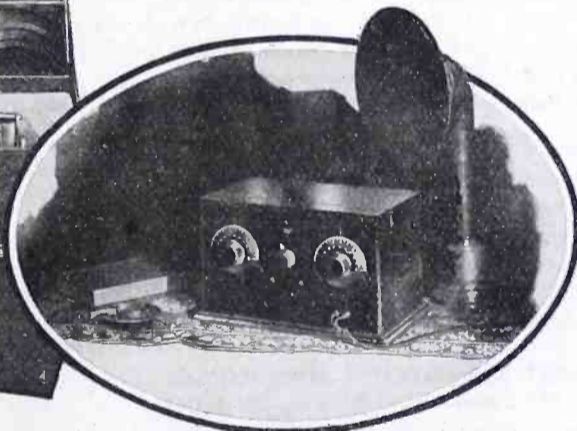
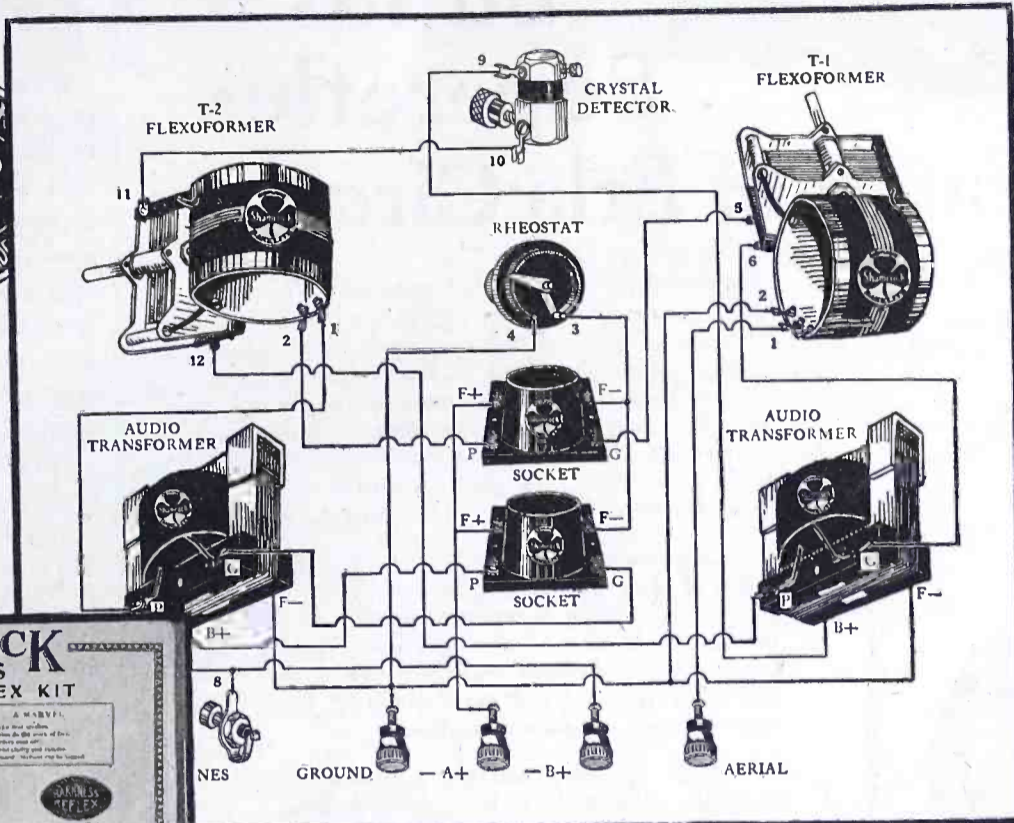
Enjoy the best radio in your neighborhood

The Shamrock-Harkness Two Tube Reflex



Licensed under U. S. Patent Office Serial No. 719,264 for Radio Receiver Systems.

PRICE
\$35



Combines Best Features of
Leading Circuits

NEUTRODYNE DISTANCE

+

REFLEX CLARITY

+

REGENERATIVE VOLUME

That's the Shamrock-Harkness Two Tube Reflex which has created such a sensation among experimenters and amateurs by its amazing performances. It combines the best features of the leading circuits in use today.

FEATURES

- Operates a loud speaker.
- Two tubes do the work of five.
- Cuts battery cost 60%.
- Does not squeal, howl or radiate.
- Stations can be logged.
- Amazing clarity and volume.

The set for the masses
as well as the classes.

Distance and Selectivity From the Neutrodyne: Radio frequency controlled by variable condensers mounted on air core transformers gives the Neutrodyne its remarkable distance and selectivity.

Clarity From the Reflex: Just one unit is responsible for the reflex's well-known tone clarity. This is the crystal detector.

Volume From the Regenerative: The two audio transformers found in the regenerative are responsible for its powerful loud speaker volume.

The Shamrock Kit Contains all parts necessary to build this marvelous set. Enjoy the best radio in your neighborhood this winter. Buy this Shamrock Kit and make your own set at half the cost.

Buy Only Shamrock-Harkness Licensed Parts: True Harkness reception can only be achieved by using genuine licensed parts.

Avoid imitations. Accept only the genuine.

Before Building Your Set mail coupon for "Shamrock Radio Builders' Guide Book."

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Department 57

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SHAMROCK

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I enclose 10 cents (U. S. stamps or coin) for copy of "Shamrock Radio Builders' Guide Book," containing diagrams and complete instructions for building 10 sets at prices ranging from \$15 to \$50.

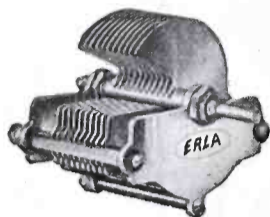
Name.....

Address.....

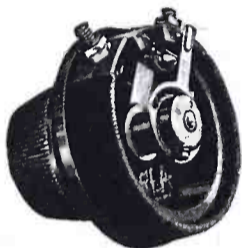
Dealer's Name.....



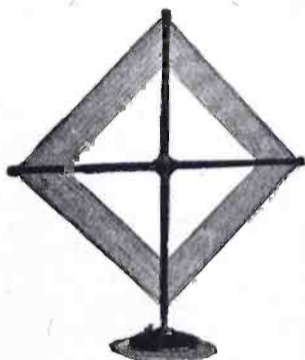
CIR-KIT builds Supereflex —Greatest of Erla Circuits



Exclusive features give Erla Miniloss Condensers highest efficiency. Dielectric and resistance losses minimized. Compensating plate form. 5 to 41 plates. \$3.50 to \$5.50.



Uncanny smoothness and sensitiveness bespeak the advanced design of Erla Precision Rheostats. Single hole mounting. 6, 25, or 40 ohm. Price, \$1.10 each.



Adding to receiver efficiency is the advanced Erla Loop. Rigidly erected—compactly folded—easy in rotation—beautifully finished. Standard and DeLuxe, \$7.50, \$10.

Erla exclusive circuit ideas made radio history because they have kept Erla circuits in advance. Thousands of seasoned experimenters, once attracted to Erla circuits, stick to Erla. So there is a note of finality in Erla Supereflex Circuits, representing highest development of the inherently superior Erla principles, responsible for the most powerful circuits, tube for tube.

Bringing these finest circuits within the reach of everyone is the Erla CIR-KIT, effecting not only extreme economy, but also greatest ease of construction. Just screwdriver and pliers transform any Erla CIR-KIT quickly and skillfully into the most efficient of radio receivers.

CIR-KIT provides everything, including specially designed Erla Synchronizing Transformers, Erla Certified Capacity Condensers, Erla Cushion Sockets, and finally Erla famous Solderless Connectors, banishing solder. Full-size blue-prints; drilled, lettered panel; and stenciled baseboard unerringly locate each unit and connection.

With Erla CIR-KIT you yourself can confidently and proudly put into finished form the highest achievement of Erla radio engineers—Erla Supereflex Circuits. CIR-KIT receivers of one to five tubes are available, in loop and antenna types. See the Erla dealer, or write, mentioning your dealer.

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Dept. H, 2500 Cottage Grove Avenue, CHICAGO
Coast Representatives: Globe Commercial Co.
Los Angeles, San Francisco, Seattle

ERLA

Circuits of Certainty

MY FIRST TRIP

Continued from page 20

I had hardly fallen off to sleep before I was awakened by a bumping and scraping of the ship. While I was getting up to investigate, a seaman rushed into the room crying "Send SOS we're on the rocks." I soon had the motor generator started and turning to the man said, "Where is the Captain?" "On the bridge," he replied. "Go and ask him what our position is" I said. "There is no use in sending an SOS without giving our position so that we can be found." The man hurried off and soon returned with the Captain, who told me to send our position as "Off Tatoosh," and after a moment's reflection added "Send on Duncan Rock off Tatoosh."

The vessel was lurching terribly and it was all I could do to send, as I was compelled to hang on to my bunk with one hand and brace my feet against the switchboard to keep from being thrown about the room. My signals were acknowledged by the Canadian station VAE, who informed me that ships in that vicinity were on the lookout for us. It was too dark to see the shore and I began to wonder what the crew were doing and if they were getting lifeboats ready.

Some one passed along outside with a life belt on, which reminded me that I had forgotten to put on my own, so I dug it out of the corner where it was kept and put it on. The Captain, who had gone out in the meantime, returned again to the radio room with good news. "She won't sink" he said. Just three words but oh what a change it seemed to make. The mess boy, who before had been about frightened out of his wits, walked in smoking a cigar and the Captain went to his room and returned with a box full of the same brand, which he passed around, and we all had a smoke.

By this time the engine room was so full of water that the ship's power was out of commission, and as the radio set was not equipped with an auxiliary source of power, I was unable to send out any more information regarding our plight. Daylight was now breaking, and we all gathered on the port side to stare at the bleak and rocky coast which loomed up ahead of us. The tide was coming in and it was evident that if we stayed on board much longer, we would be washed overboard by the high breakers that were already dashing over the forward end of the ship. The shore was quite a distance away and due to the rough sea and sharp rocks, was a dangerous swim for even a good swimmer. A young seaman agreed to make the attempt, however, and was successful in bringing a line to shore, which was rigged up as

Continued on page 56

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TRAINING IN ALL COMMERCIAL BRANCHES OF RADIO

If you cannot attend the Radio Institute of America in person the same instruction can come to you through our recently inaugurated "HOME STUDY COURSE"—Investigate.



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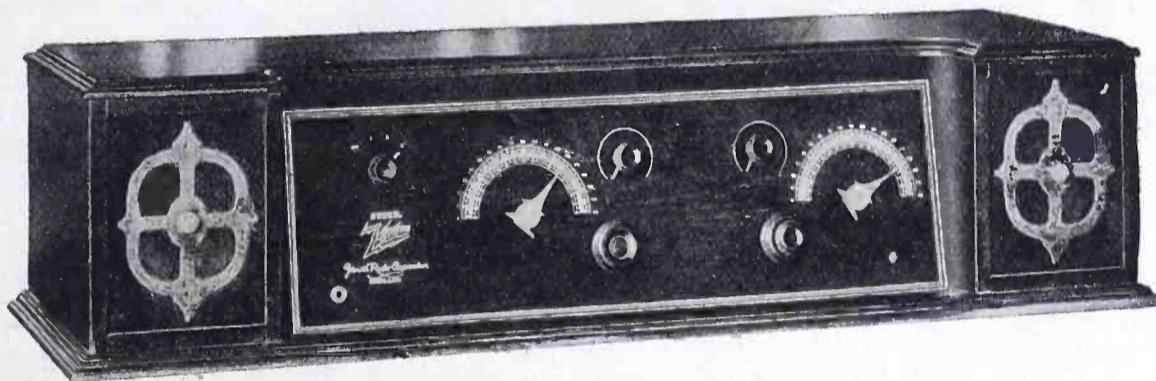
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ZENITH RADIO

TRADE MARK

it tunes
through everything

Super-Zenith VII



The New SUPER-ZENITH

for people who take pride in their homes

ONE glance at the new Super-Zenith and you are instantly impressed with the sheer artistry of its design, the excellence of its craftsmanship, the superb beauty of its finish—you know that within its case is a receiving set capable of the most extraordinary performance—a receiving set entitled to the place of distinction in the finest home.

Radio enthusiasts: Note that the new Super-Zenith is NOT regenerative. It is a six-tube set in four different models ranging from \$230 to \$550, with a new, unique and really different patented circuit controlled exclusively by the Zenith Radio Corporation. Amplification is always at a maximum in each stage for any wave-length. *The Super-Zenith line is not affected by moisture.* For the first time, you have here a set that—

- 1—tunes through *everything* and selects the station you really want.
- 2—requires only *two* hands—not *three*—to operate.
- 3—brings in each station at *only one point on the dial.*
- 4—affords such mathematical precision and simplicity that you can run over the entire dial in 1½ minutes and pick up *more* stations with greater clarity and volume than any other set on the market. Direct comparisons invited.

Write for the name of the nearest dealer from whom you can obtain a demonstration of this outstanding marvel of the radio world.

Dealers and Jobbers: Write or wire for our exclusive territorial franchise.

Zenith Radio Corporation

Eastern Office: 1269 Broadway, New York Executive Offices: 332 South Michigan Ave., CHICAGO

ZENITH—the exclusive choice of MacMillan for his North Pole Expedition
—Holder of the Berengaria Record

Super-Zenith VII (Not regenerative)—
tubes—2 stages tuned frequency amplification—detector and 3 stages audio frequency amplification. Installed in a beautifully finished cabinet of solid mahogany—4¼ inches long, 16¾ inches wide, 10½ inches high. Door panels inlaid. Slanting panel of sheet bronze, mahogany finish, with scales and indicators in metallic relief. Gold plated pointers, to prevent tarnish. Compartments at either end for dry batteries. Can be operated on either wet or dry batteries. Either inside or outside antenna. Price (exclusive of tubes and batteries) **\$230**

Super-Zenith VIII Same as VII except—
built with mahogany legs of well-proportioned appropriate design, converting model into console type. Price (exclusive of tubes and batteries)..... **\$250**

Super-Zenith IX Same as VII except—
with legs and additional compartments containing built-in Zenith loud speaker on the one side and generous storage battery space on the other. Price (exclusive of tubes and batteries)..... **\$350**

Super-Zenith X Contains two new features superseding all receivers. 1st—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. 2nd—Zenith Battery Eliminator, distinctly a Zenith achievement. Requires no A or B batteries or charger. Price (exclusive of tubes)..... **\$550**

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Zenith Radio Corporation

Dept. 12H
332 South Michigan Avenue, Chicago, Illinois

Gentlemen: Please send me illustrated literature giving full details of the Super-Zenith.

Name.....

Address.....

a "breeches buoy" and on which the remainder of us slid to safety.

After a two-mile hike over a rough trail and through snow and mud, we arrived at the small village of Cloose, Vancouver Island. Here we were divided up among four or five Canadian families who gave us food and shelter until we were able to leave. We were on the island two days before the Coast Guard Cutter *Algonquin* and *Snohomish* arrived. We were then taken aboard the *Snohomish* and along with the crew of a British ship, the *Tuscan Prince*, that had met with the same fate, were taken to Port Angeles. We were met at the dock by newspaper reporters and photographers and after posing for flashlight pictures, arrangements were made for us to stay in town until the next day. In the morning we left for Port Townsend by rail and from Port Townsend we proceeded to Seattle by steamer.

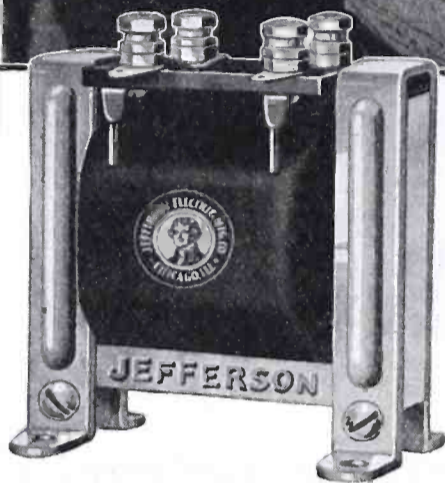
Thus ended my first trip as a commercial radio operator.

In concluding I might add that the danger of shipwrecks on Vancouver Island has been greatly reduced by the erection of a radio compass station at Pachena Point so that cross bearings can be obtained from this station and the one on Tatoosh Island.

DON'T miss the January issue of "RADIO." It will contain an article on Best's new and improved SUPER. Full size panel and sub-base templates will also form a supplement to the issue.

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WHENEVER you hear of anyone having trouble with a circuit, nine times in ten it is because of the parts. Penny skimping does not pay.

Take the grid leak for instance. It is the heart valve of your set. Unless it provides a perfectly smooth electric path for the current to escape from the grid of your detector, miniature thunder storms crackle and rumble within the tube, smothering weak signals, distorting and muffling strong ones.

Electrad engineers specialize on important parts which are scientifically accurate and dependable. Every item is certified to give absolute satisfaction.

On sale at most good radio dealers. If your dealer cannot supply you, send us his name, and the purchase price of the item you want. We will supply you direct.

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When you build your set, don't take chances. Know your important parts will perform properly. Use and insist on getting Electrad Lead - Ins, Variotoms, Audiohms, Lightning Arresters, Lamp Sockets, Antennas, Certified Grid Leaks, Glass Grid Leaks, Variable Grid Leak and Condenser Combined, Grid Leak Mountings, Hydrogrounds, Aerial Outfits, Fixed Resistance Units, Indorarial, Resistance Coupled Amplifier Kits, Verni Tuners.

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Full volume without sacrifice of clearness or naturalness. Reproduces true tones of voice or music. Equal to hearing the original.

- No. 100 Speaker Unit supplied for phonograph use—fits any make.
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- No. 205D—Shell pyralin flare..... 25.00
- No. 100 —For phonograph use..... 10.00

Manufactured by
American Electric Company
State and 64th Streets, Chicago

LOW LOSS TRANSMITTER

Continued from page 32

are brought up to these direct from the terminals on the transformer, doing away with superfluous posts, and making it easy to introduce a rectifier if one is wanted. The two positive taps are bridged. That is the only change needed.

The lead from the counterpoise is brought direct to the inductance, and the one from the aerial is fastened to one terminal of the antenna ammeter. It is best to use a separate aerial for receiving, for then losses in a change-over switch are eliminated, and breakin is possible, for this set makes no noise when the key is up.

Keying in the primary of the plate transformer is almost a necessity. The current in the closed circuit is close to 10 amperes, and if the key is placed here it will have to be opened at least $\frac{1}{4}$ in. or else have oil-immersed contacts, for it arcs something beautiful. Also it is very hot, and should the hand happen to touch the metal part a good demonstration of bloodless surgery will be obtained.

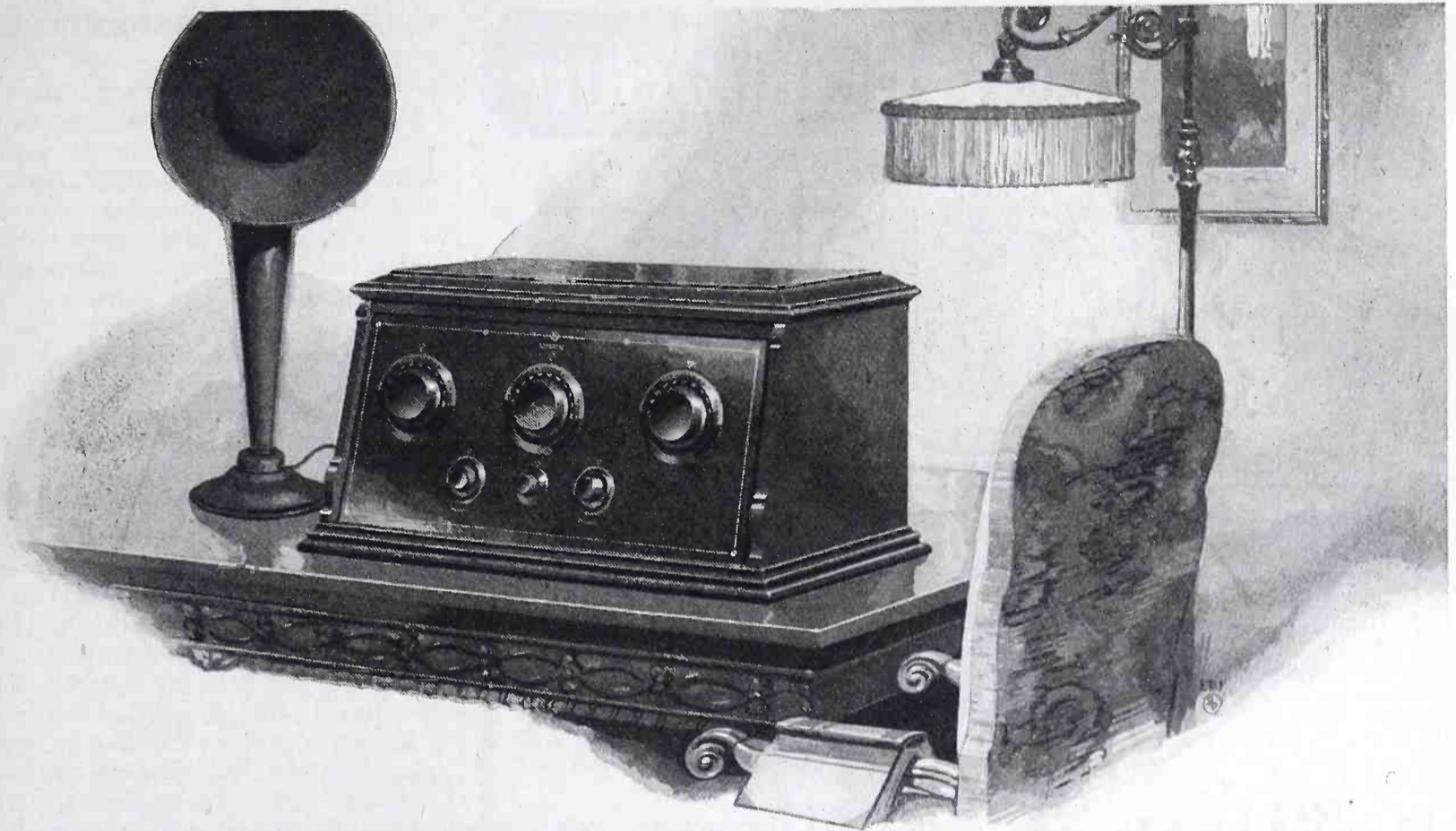
Use heavy wire, about No. 8 or 10. Solder all joints, and make all connections point to point. Ribbon antenna makes good leads for the filament circuit, and also for the clips on the inductances. Ignition cable is fine for heavy-duty flexible leads, such as from the plate transformer to the set, and for the power wiring.

For tuning, first place the clips on the primary so that the plate is at the top, filament in the middle, and grid on the bottom. Set the primary condenser at half, bridging about six turns of inductance. Place the antenna and counterpoise clips on the primary for the time being, and tune for maximum radiation on wave desired. Now put antenna and counterpoise clips on the secondary, the same number of turns apart. Set the series condenser and readjust the primary condenser to maximum antenna current.

With an inductive coupled set, the point of greatest efficiency is not on the point of greatest antenna current. It is on the point of greatest antenna current with a quick pickup. By juggling, the meter can be made to go an ampere or so past this point, but the set is sluggish on oscillating, and often a number of the dots are inaudible, so go back a little and be satisfied. The nodal point may be ignored with safety, but no harm will be done in locating it in the center of the secondary. Anyway, it makes the operator think the set is working better, whether it is or not. A word of caution—don't lean on the key when one of the clips is off of the primary; it may cause a dangerous flashover. Also keep your hands off of the set when it is running.

A very long aerial with a relatively

Continued on page 60



The FADA Neutroceiver

will surpass anything you have expected of a radio receiver

VOLUME? The FADA Neutroceiver will give you all the controlled volume you can possibly desire. Designed to use powerful tubes and operate on either indoor or outdoor antenna, it is guaranteed to give powerful results.

Clarity? This wonderful, five-tube Neutrodyne offers you a tone quality which is unexcelled. It reproduces every tone of the human voice and of every musical instrument with lifelike fidelity.

Selectivity? Separates stations, tunes through powerful local broadcasting and brings in distant concerts—even when but a few meters apart.

Simplicity of control?

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

Anyone, without previous experience, can operate the Neutroceiver. You can turn your dials to previously located stations and bring them back night after night.

Beauty? As a piece of art-furniture, the FADA Neutroceiver is a masterpiece. The cabinet is solid mahogany, with the panel perfectly balanced and sloped gently to facilitate easy tuning.

Supplementing the FADA Neutroceiver and making a complete FADA line, are five other Neutrodyne receivers. Six models in all—three, four and five tube Neutrodyne receivers in plain as well as artcraft cabinets, at a price range from \$75 to \$295. See your dealer.

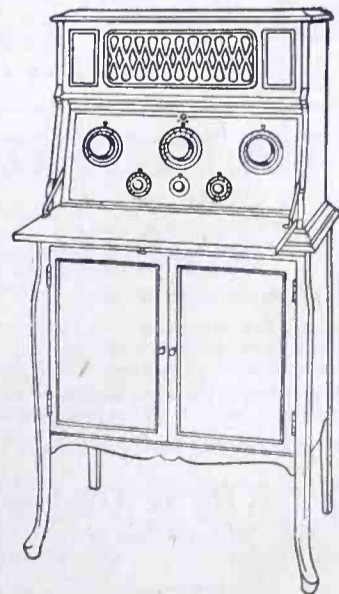


**FADA "One Sixty"
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"The receiver that has taken the country by storm." The best known of all Neutrodynes. Four tubes. Price (less tubes, batteries, etc.) \$120.

**FADA Neutrola Grand
No. 185/90-A**

The five-tube Neutrola 185-A, mounted on FADA Cabinet Table No. 190-A. Price (less tubes, batteries, etc.) \$295.

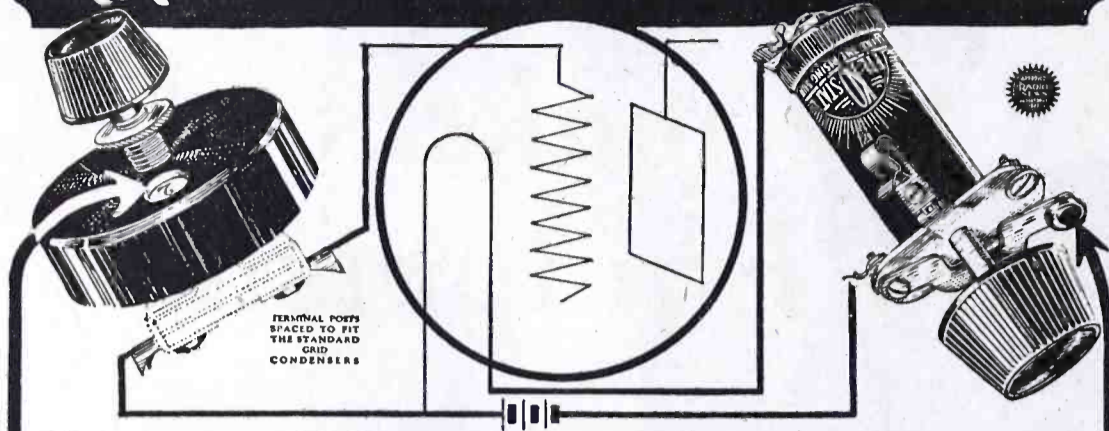


FADA Radio



Tell them that you saw it in RADIO

Stations You Never Heard Before



-thru scientific tube tuning

The most important (and most neglected) tuning unit on your set is the tube. It is the one thing you can adjust to bring weak stations to audibility—to eliminate distortion on local programs. Coils and condensers are easily tuned to incoming waves, but wave-length isn't everything. The antenna gets distant broadcasters but their signals never reach the phones unless you tune the tube to the different characteristics of the weak, distant stations. Here are two instruments distinctly designed to improve reception through their ability to control tube action—FIL-KO-LEAK to tune the grid by securing correct grid bias—FIL-KO-STAT to tune the plate-filament circuit by its control of electronic flow. Together they assure you maximum audibility, clearer signals and freedom from oscillations and other tube noises. *They bring in stations you never heard before.*

FIL-KO-LEAK \$2
SCIENTIFICALLY CORRECT
VARIABLE GRID LEAK
Individually Calibrated
In Canada \$2.75

FIL-KO-STAT \$2
SCIENTIFICALLY CORRECT RADIO RHEOSTAT
with Battery Switch
In Canada \$2.75

You will get stations you never heard before with Fil-KO-Leak. Clear up distortion and increase volume. You can "log" your Fil-KO-Leak as you do your other tuning units. Each Fil-KO-Leak is individually hand calibrated over the operating range of all tubes 1/4 to 5 megohms. Set it for specified resistance and adjust it for best results. Resistance read in megohms through panel peep-hole. (Base-board mounting furnished.) Resistance element constant, accurate, not affected by atmospheric conditions, wear or jarring. Assures smooth, gradual control of resistance and correct grid bias. *Unconditionally guaranteed.*

Tune your tube filament with Fil-KO-Stat and receive stations you never heard before, get greater distance, louder signals, sharper tuning, freedom from tube noises. Fil-KO-Stat is the only rheostat that permits adjustment over the entire operating range of all tubes and enables you to get maximum audibility in phones or loud speaker. And now the improved model is fitted with battery switch that attaches to the regular mounting screws. Distinctly signals "on" and "off" and enables you to break circuit without changing Fil-KO-Stat adjustment. Fil-KO-Stat fits any type tube in any hook up. *Unconditionally guaranteed.*

FIL-KO-SWITCH
SCIENTIFICALLY CORRECT
"A" BATTERY SWITCH
Simple
Sturdy
Sure
50¢
In Canada 70¢

150 stations were logged on a Fil-KO-Stat equipped set, at Harrisburg, Pa., using a 1 meg. fixed grid leak. A calibrated Fil-KO-Leak was substituted for the fixed leak and in two nights 27 new stations—never heard before—were added.

Joseph J. Scott of Ottawa writes, "Among the fifty-four new stations I tuned in with my Fil-KO-Stat was 6KW, Tuinucu, Cuba, which I consider exceptional as it is only a small 100 watt station." And we have hundreds of other testimonials on file!

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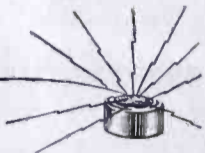
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on your crystal set will bring in greater distance, clearer reception and louder signals. Solid gold, will not corrode or oxidize. Ideal for reflex. PRICE 25 CENTS

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LOW LOSS TRANSMITTER

Continued from page 58

low capacity and a high radiation resistance, contrary to popular opinion, is very efficient. I used one of a single cable, 175 ft. long and 70 ft. high, cut down with a series condenser, and results were superior to a six-wire cage, 90 ft. overall, both in distance covered and in signal strength. The antenna current was less than half as great. I would like to hear from builders of this set on the results obtained.

TRANSMITTER INSTALLATION

Continued from page 33

through the fones. The coil *L* is used to tune the whole bridge to resonance in order that sufficient current may be passed to facilitate measurements.

The oscillator is tuned to any desired wave—say 200 meters—and the coil *L* is adjusted until *A* shows a maximum. The fones should be replaced by an ammeter until we come down to fine measurements. Now adjust both *C* and *R* to get a minimum current through the balance ammeter. This will detune the resonant circuit and *L* must be readjusted. This is rather a laborious process, but is an accurate and reliable one. When we have resonance and also least current in the balance circuit, we cut in the fones and balance *C* and *R* closely. At exact balance *R* equals the antenna resistance and *C* its apparent capacitance. This process is now repeated at other waves, and finally we are able to reproduce our antenna by a dummy at any desirable frequency. If we plot our antenna resistance, we can locate any humps, and thus tell if there is bad absorption in our antenna system.

We can now set the dummy antenna on our oscillator to the constants of our antenna at any desired frequency and tune the oscillator. When this is done, we substitute our real antenna system for the dummy and we are ready to reach out. We can now make our tone better by rectification and filtration, and, if we don't get out after that, we know where the trouble is.

"Elements of Radio Communication"

By Lieut. E. W. Stone

\$2.50 A Book that every radio fan should have.

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Pacific Bldg., San Francisco

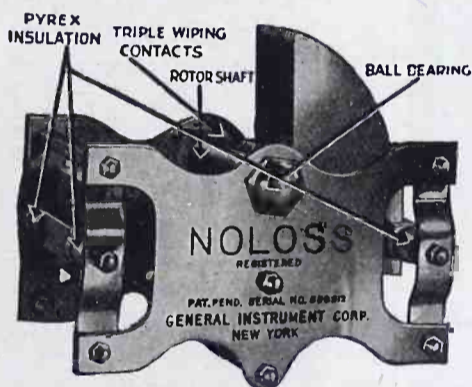
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It is now possible for the amateur to get results formerly reserved to laboratories.

The experimenter who requires every micro micro watt of energy to bring in heretofore inaudible signals must turn to General Instrument NOLOSS Variable Air Condensers.

They are constructed with laboratory methods, and insulated with laboratory insulations—Pyrex or Isolantite.

Products worthy of your purchase.

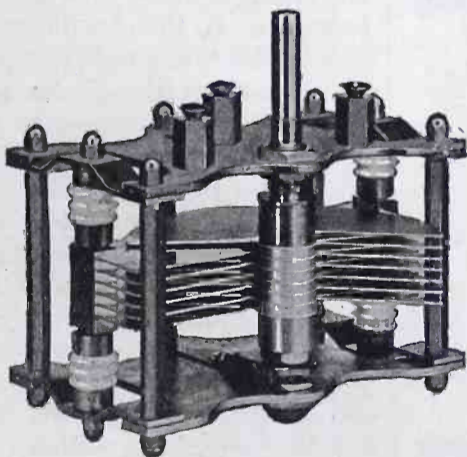
General Instrument apparatus costs a little more but is worth infinitely more.

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TYPE 56

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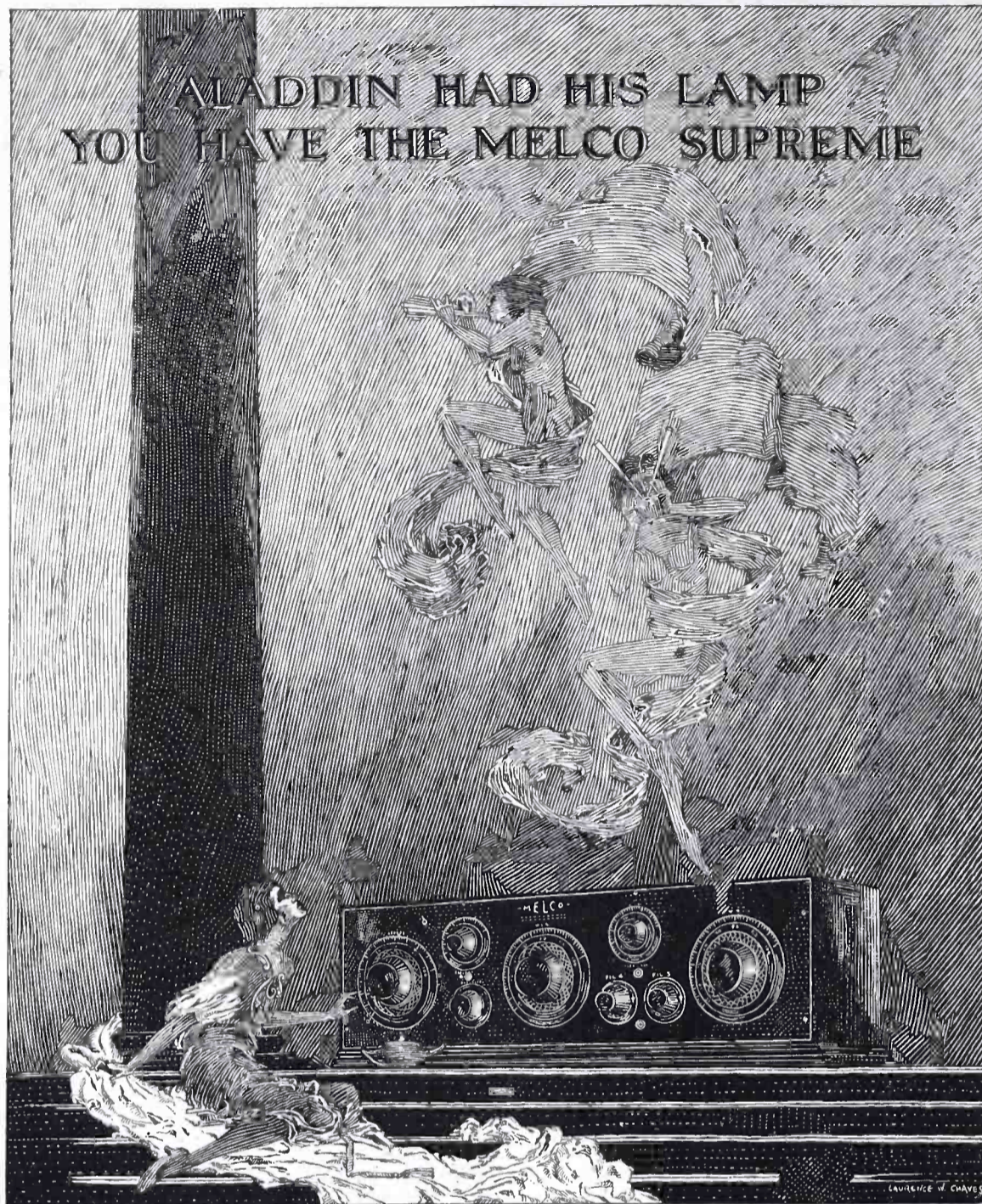
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ALADDIN HAD HIS LAMP
YOU HAVE THE MELCO SUPREME



MELCO SUPREME RECEIVER
TUNED RADIO FREQUENCY



AMSCO PRODUCTS INC. BROOME & LAFAYETTE STREETS N.Y.
Western Branch, 447 Pacific Bldg., San Francisco

SINGLE CONTROL SUPER

Continued from page 17

a similar wire on the first socket on the negative terminal to the last socket on the negative terminal and connect leads to this for the other socket. The pictures show this clearly. Next connect the plates and grid leads from the sockets to the super-multiformer. Wire in the potentiometer and rheostat and the jacks, and lastly place the coils in the proper position and wire them in also.

As will be seen in the diagram these jacks are of the filament control type. In Fig. 5, in front of the oscillator coils, is shown a small round instrument which is a combination choke and by-pass, necessary in this type of oscillating circuit. It is known as the Precise "Filter-former." If it cannot be obtained, a choke coil of approximately 200 millihenry and a .006-mfd. fixed condenser may be substituted.

After the set is completely wired, it is advisable to go over the connections thoroughly and check up to see that no errors have been made. Fig. 3 shows clearly how the wiring should be done. Run all battery connections near the baseboard, and the grid and plate leads from the tuner to the oscillator up in the air.

Connect the necessary batteries and insert one tube in the first socket. Plug the head phones into one of the jacks, the tube should light if the rheostat has been turned on. Take the tube out and place it in each socket to make sure that all filament circuits are O. K. If the tube has not blown out after being inserted in the sockets, it shows conclusively that the builder is one of the lucky ones, and has not got his B battery tangled up with the filament connections. If this be the case, it would be advisable here to slap yourself on the back, as generally somehow or other B batteries will insist upon getting connected into circuits where they do not belong. All the tubes then may be safely placed in their respective sockets.

Looking from the right hand side to the left with the panel in front of the operator, the first tube is the first detector, the next three are the radio frequency amplifiers. The next is the second detector. After this is the audio, and the last is the oscillator tube. This scheme is the reverse of the standard practice but is used this way because it simplifies the general layout.

After the tubes have been inserted, set the rheostat, which is the right hand knob, on about seven-eighths. If your battery delivers 6 volts, the tubes will be burning at approximately 5 volts.

The potentiometer should be turned in a clockwise direction and after it has been turned about three quarters on, a rushing sound will be heard. This will indicate that the long wave amplifier is in a state of oscillation. The poten-

Continued on page 64

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Gets stations Far and near Loud and Clear

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Ware

NEUTRODYNE

Receivers

The line of Ware Neutrodyne Receivers consists of three different circuits, each of which may be had in two styles of cabinets; one to be placed on the table, and the other a furniture model, resting on the floor.

Each of these circuits is designed to suit different needs and conditions, but all possess in the same degree the most desired characteristics in radio—Ware Tone Quality.



Type T

Mahogany cabinet, 10 3/4" high, 14" wide, 13 1/2" deep. Dry cell "A" and "B" batteries enclosed in cabinet. Reflex Neutrodyne circuit. Three dry cell tubes, one reflexed; equivalent to four tube circuit; one stage tuned radio frequency amplification, detector, two stages audio. Operates loud speaker. Outside antenna.

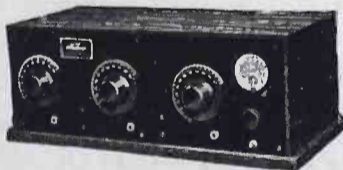
\$65.00 without accessories



Type X

Walnut cabinet, 8 1/2" high, 21 1/2" wide, 10 3/4" deep. Dry cell "A" and "B" batteries enclosed in cabinet. Reflex Neutrodyne circuit. Four dry cell tubes, one reflexed; two stages tuned radio frequency amplification, detector, two stages audio, equivalent to five tube circuit. Double-scaled voltmeter indicates voltages of "A" and "B" batteries. Indoor or outdoor antenna.

\$150.00 without accessories



Type W

Walnut cabinet, 8 1/2" high, 21 1/2" wide, 10 3/4" deep. Neutrodyne, not reflexed, using five vacuum tubes—two radio, detector, two audio—and storage battery. "B" batteries enclosed in cabinet. Double-scaled voltmeter indicates voltages of "A" and "B" batteries. Indoor or outdoor antenna.

\$175.00 without accessories

Ware Tone Quality means—not a different tone quality imparted by the receiver, but exactly the same tones as you would hear if you were actually present where the program is being given.

Type T, which is sold at the remarkably low price of \$65.00, has made a tremendous hit. We expected a big demand for it because we knew of no other receiver on the market that would give so much for the money. But the combination of low price, beauty of appearance, Ware Tone Quality, and simple and economical operation has exceeded our expectations. It is the first three-tube Neutrodyne ever made and the first Neutrodyne to be operated on dry cell tubes. One of the tubes is reflexed, on an entirely new principle devised and used only by Ware, giving the full equipment of a four-tube circuit.

Under each illustration is a brief description of the receiver, but to fully appreciate them, they must be seen and heard.

Stop in at your dealer's and ask for a demonstration of the Ware Neutrodyne Receivers. Their performance will be far more convincing than our description.

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Type TU

Brown mahogany or walnut cabinet, housing Type T circuit. Panel exposed by raising lid. Loud speaker concealed behind grille. Dry cell "A" and "B" batteries enclosed in cabinet. Dimensions: 34 1/2" high, 18 3/4" wide, 18 1/4" deep.

\$150.00 without accessories

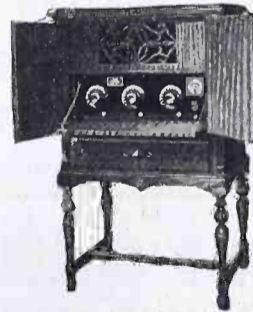


Type XU

(See WU for cabinet open)

Brown mahogany or walnut cabinet, with panel of contrasting shades. Embodies Type X Circuit. Loud Speaker concealed behind grille at top, below which a desk leaf turns down, exposing the panel. Dry cell "A" and "B" batteries enclosed in cabinet. Dimensions: 44" high, 27 3/4" wide, 18 7/8" deep.

\$275.00 without accessories



Type WU

(See XU for cabinet closed)

Brown mahogany or walnut cabinet, with panels of contrasting shades. Embodies Type W circuit. Loud speaker concealed behind grille at top, below which a desk leaf turns down, exposing the panel. Storage and dry cell batteries enclosed in cabinet. Dimensions: 44" high, 27 3/4" wide, 18 7/8" deep.

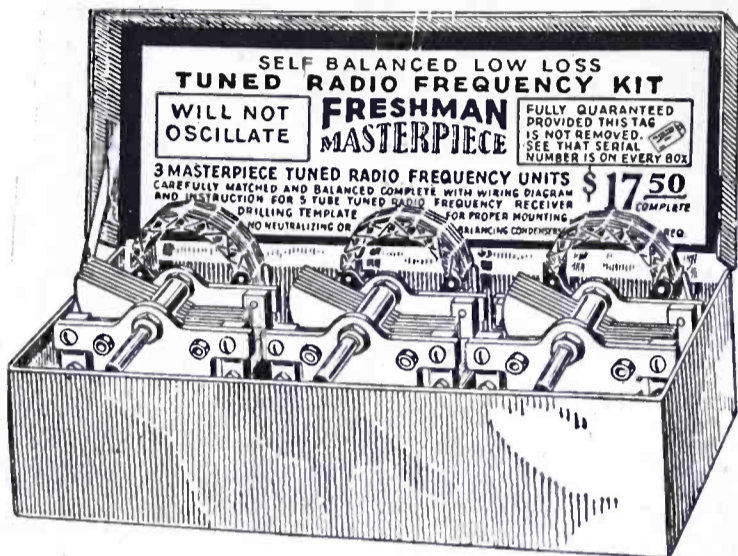
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It's Easy To Build

a five tube radio frequency receiver
when you use the Freshman Masterpiece Kit



NO Neutralizing OR Balancing Condensers Required

when you build with this kit to produce a radio frequency receiver that will bring in even the most distant stations with the volume and clarity of locals. So selective that stations can be brought in day after day at the same dial settings. A set that will be the equal, if not the superior, to any 5 tube receiver on the market, and what's more, it's the easiest set in the world to operate.

Kit consists of 3 Masterpiece Tuned Radio Frequency Units carefully matched and balanced. Complete with wiring diagram and instructions for building any 5 tube tuned radio frequency receiver and also drilling template for proper mounting

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Each and every Freshman Masterpiece Coil bears a serial number and Trademark—our guarantee of electrical and mechanical perfection. Every genuine Freshman Coil is made of specially insulated wire to prevent short-circuiting, so often caused by inferior coils. For your protection demand only the genuine.

At your dealers, otherwise send purchase price and you will be supplied without further charge

CHAS. FRESHMAN CO., Inc.
106 Seventh Ave., New York

Continued from page 62

tiometer should be turned back a ways just beyond this point for best results. The best time to test this outfit out is when one of the local broadcasting stations is in operation, because the final adjustments in balancing the oscillator and the tuning circuit will be easier then.

Turn the condenser knobs slowly from the beginning of the scale. At every five degrees or so move the small coil in the oscillator inductance back and forth until the local station is tuned in. Adjust this coil for best response. It can now be left set. Keep on rotating the condenser dial until a station approximately 200 meters difference is found. Move the small coil again to bring this station up to maximum response. If the coils have been made with care, and are exactly like the ones used in this set, it will not be necessary to move it more than a degree or so. However, a few degrees one way or the other will not produce any serious results. If the coil has to be rotated more than a quarter of rotation, it would be advisable to rebuild the coils, for best results cannot be had when the coils are in this condition. When the best position has been found, it is advisable to solder the shaft of the small coil fast to the nut on the outer coil, so that its position cannot be changed by accident.

The grid condenser on the first detector, as shown in the picture is a .0005-mfd. but has been changed to a .006-mfd. with much better results. Most super-heterodynes use a loop antenna. We believe, however, that such a sensitive circuit as a super-heterodyne should not be restricted to a loop, but may, if desired, be used with an outside or inside antenna so that one may obtain the maximum amplification this sensitive circuit is capable of delivering.

Practically any type of antenna may be used with this set. It will work on one a mile long just as well as one 20 ft. long. Length of aerial will not affect the condition of balance between the oscillator and the tuner. The longer the antenna used, the louder the signal but the broader will the tuning become.

An idea of the sensitivity of this set may be had from the fact that, using the set alone without any ground connection, stations within a thousand miles have been brought in on loud speaker with good volume, so one need not fear about the antenna proposition, as a piece of wire thrown upon the floor or wrapped around the moulding on the wall, and a good ground connection will generally deliver a louder signal than the average small loop is capable of. A loop has many advantages, and, in many cases, is the only thing that can be used; but when an antenna can be put up, why restrict a good set to a loop when ten times the amplification may be had with the larger antenna?

FROST-RADIO

Ask Your Neighbor



THE name **FROST-RADIO** on a piece of apparatus, whether **FROST-FONES**, Plugs, Jacks, Sockets, Rheostats, etc., means highest quality. Your dealer carries complete stocks. See him today.



HERBERT H. FROST, 154 W. Lake St., Chicago

RADIO ^{long-distance sets} COMPLETE

THESE are the finest long distance sets at the lowest prices in history. Wonderful new circuit that brings amazing results. SATISFACTION GUARANTEED. Everything furnished with complete sets. There's a set for every pocket-book.

4 tube set—with 3 dry cells, B Battery, 4 tubes, loud speaker, head phones, antenna	\$57.95
3 tube set—with 3 dry cells, B Battery, 3 tubes, head phones, loud speaker, antenna	\$49.95
2 tube set—with 3 dry cells, B Battery, 2 tubes, head phones, antenna	\$32.95

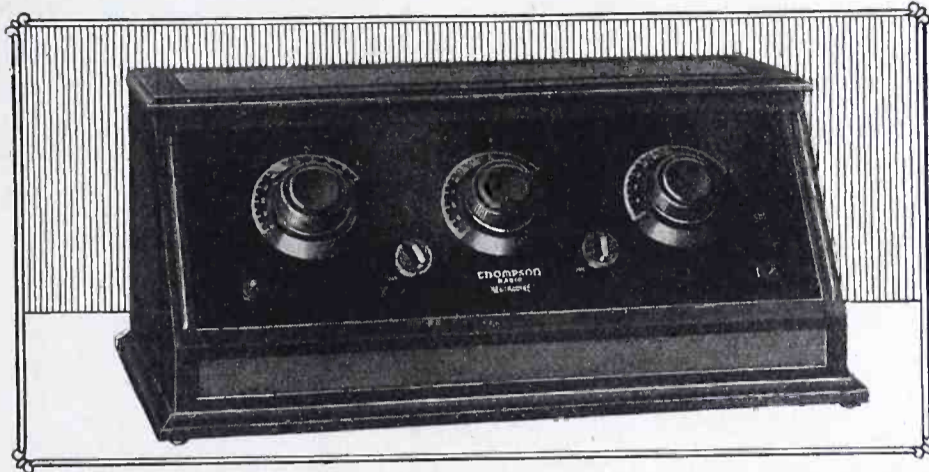
The above 3 sets can also be furnished for use with "A" storage battery instead of dry cells, \$12.00 extra.

1 tube set—with dry cells, B Battery, 1 tube, head phones, antenna	\$19.95
--	---------

Sets also sold without accessories. Also full line of radio accessories, 1 and 2 stage amplifiers and portable sets. Write for FREE catalogue—don't buy until you see it.

THE MELLODYNE RADIO CO., Dept. H CINCINNATI, O.

Write for free catalog today



"Experience is the Vital Factor in Excellence"

THOMPSON RADIO

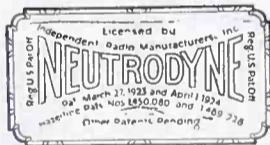
THE THOMPSON COMPANY is the only organization that has been manufacturing radio apparatus *exclusively* for fifteen years. During this time its research laboratories have perfected developments which have contributed largely to the advancement of the radio industry

This wide experience, now available in the Thompson apparatus, means Receiving sets and Speakers that embody the latest and best practice in Radio Engineering.

A critical investigation of each model will disclose outstanding features of genuine excellence—in artistic appearance, naturalness of tone, simplicity of operation.

Radio in the home broadens the scope of human happiness. Every day the broadcast program carries something for every member of the family.

The 5-tube GRANDETTE is \$125. The 5-tube PARLOR GRAND, (shown above) is \$145. The 6-tube CONCERT GRAND is \$180. Prices are without tubes or batteries. The Thompson Speaker, with conical diaphragm and other special features, is now \$28.



Write for attractive literature and name of Thompson dealer near you.

R. E. THOMPSON MANUFACTURING CO.
FACTORY: JERSEY CITY, N. J. 30 CHURCH STREET
NEW YORK, N. Y.



CONCERT GRAND

THOMPSON
SPEAKER

GRANDETTE

The By-Pass Condenser

STATION "GFS"

Continued from page 23

then to deeper crime. "GFS" turned slowly in the big office chair, and placed his piercing eyes on his grandson. He remained silent for a moment and then with a look of sudden determination squared himself for the final words.

"Raymond, all your life I have done your bidding. From childhood you have had every wish. But now you have brought shame on the family name, and I hope never to see your graceless face again. I'll pay up all your debts, but you must take your stolen loot, your belongings and clear out." It hurt Raymond to see the old man's chin quiver as he stared out the window at the line-man hammering on the pole.

"Well, why don't you go?"

Raymond sat in silence some moments, the copy he had prepared and held in his hand advertising the "Shaw Vacuum Tube" was unconsciously crumbled in the tightening fingers. Since finishing college he had been advertising manager for the big corporation which bore his name. His position and promotion now seemed to fade like the mist of the early morn. A remembrance of his grandfather's question brought him again to the grave situation now at hand.

He rose and tiptoed out of the room. "GFS" had a bad temper, better let him cool off a little. He would go back to the office and see if the Christmas gifts and bonuses were being prepared for the employees.

"But isn't it enough," said Mrs. Hubbard tearfully in her relief and also her sorrow, "to know that the good name of my husband is clear. You see, Mr. Shaw, it's different with you. You're young and can go some place where the people don't know you. They won't even put you in jail."

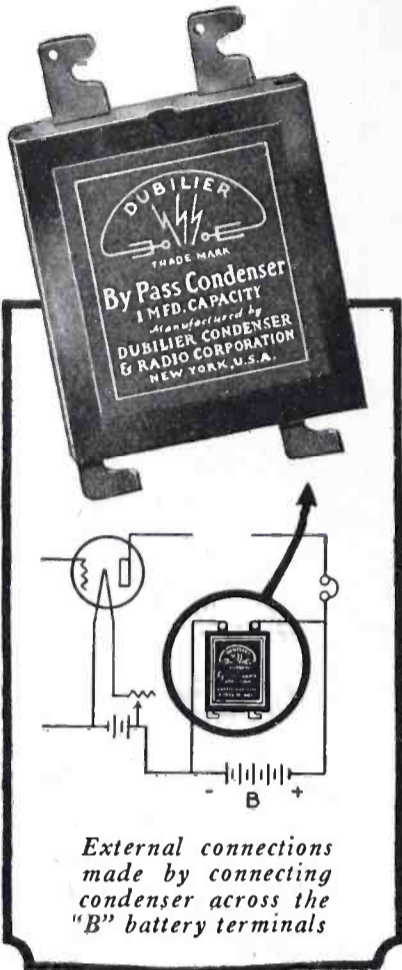
She didn't thank him. Her attitude rather implied that he had done a double wrong in bringing suspicion upon an innocent old man. The daughter seemed to shrink away as though she might be contaminated. His grandfather's secretary quickly picked up her mesh bag and placed it securely in her lap.

Phil Loren, the auditor, whose work took him to every branch of the big corporation, sat with a cynical smile on his face as he watched Raymond come into the office. A feeling of antipathy had sprung up between them months ago. Time had fanned the glowing embers of dislike until now a visible hatred existed between the two. Irritated by all this, Raymond took his hat and went out into the street.

"By George, who would have thought it?" he murmured to himself as he drove home. When he entered his room he found Sam stowing his clothes away in his grips and trunk.

"What are you doing, Sam?" he said sharply.

Continued on page 68



External connections made by connecting condenser across the "B" battery terminals

YOU will get the program clearer if you install a Dubilier large capacity By-Pass Condenser in your radio set. Just locate it as the diagram indicates. The result is that the minute fluctuations of the "B" battery are smoothed out into a steady, even flow of current, devoid of all noises.

The result is astonishing! Signal strength is increased—tones purer—volume smoother. The whole program comes in far truer and pleasanter than ever before.

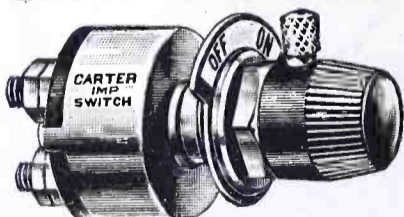
This By-Pass Condenser in quality of material and workmanship measures up to that high standard for which all Dubilier radio devices are famous.

Dubilier

CONDENSER AND RADIO CORPORATION

CARTER

'IMP' The Smallest Made Battery Switch 65c



Actual size—Pat. 1-30-'23
Any dealer can supply. Insist on the original. Write us for catalog.

A quarter turn switch. Compact and enclosed. Complete with knob and pointer and "On-Off" name plate. Again Carter originality in design has produced the switch you have been waiting for.

In Canada—Carter Radio Co., Ltd., Toronto
Coast Distributors:
ATLANTIC PACIFIC AGENCIES CORP.
204 Rialto Bldg. San Francisco, Cal.



BUILD THE "BEST" SUPER-HETERODYNE.
Read January "RADIO." It will feature the new Super in detail. Panel drilling charts in full size will be inserted in the January issue.

A Message FROM MARS

THE possibility of radio communication with Mars is doubtful but the merit of the Rectigon battery charger is a certainty.

Tune up your radio batteries with the Rectigon. Keep the A and B batteries of your set in constant readiness to receive distant stations.

The Rectigon charges radio batteries over-night at less than one-tenth of the price paid for the same service at the battery station.

It charges Automobile batteries, too.

The Rectigon weighs only a few pounds and is no more trouble to install than a light bulb. Send for folders F-4584 and F-4585, they are revelations on battery charging.

Westinghouse Electric & Manufacturing Company
George Cutter Works, South Bend, Indiana
Sales Offices in All Principal Cities of
the United States and Foreign Countries



Westinghouse

"Mistah Shaw done telephoned me to git all yo' contraptions together, suh, said you were going away for good, and for me to—"

"Well, get out of here and cut out this nonsense."

Sam laid a pair of black trousers neatly pressed on the bed, and silently made his exit.

Raymond went down stairs and out to the laboratory where he spent considerable time in experimenting in radio construction. He was preparing a series of radio letters to boys who did not have money enough to purchase one of the expensive sets. From his own observation he had placed radio fans in three classes—the novice who enjoys broadcasting, the amateur who sends and receives code, and the experimenter who gets pleasure from making his own sets. The latter offered a lucrative field in which to do some special advertising.

The keeper of the estate was a little man, a sharp chin import from England. He stood up as Raymond approached, with a copy of the evening paper in his hand. Raymond noted the same expression on his face he had seen the office girl bestow upon him. The story was out. Some inconsiderate reporter had perhaps scored a scoop.

"Peter, would you believe me to be a thief?" Raymond asked impulsively.

"Well, now," evaded the little man, "I wouldn't take it so seriously. Young fellows will be wild at times, and often get in deeper than they expect."

Disgusted at the whole affair, Raymond turned to the house where Sam met him at the door. "Miss Helen's gal done fetched this little box. No message. Miss Helen said just give it to you and you'd understand."

He opened the velvet box which silently told its story.

Trembling and scornful fingers tossed a diamond ring at Sam's feet. "It will make a fine present for your Mandy," he said.

In the center of the room he paused a moment, then called.

"Oh, Sam."

"Yes, suh."

"Go ahead with your packing. "GFS" was right. I'm going away."

TH**E**RE is no loneliness so heavy so difficult to bear as that which falls at Christmas time. The holidays take busy minds from a world of toil and instills within them the love and desire to do things for others. It creates extra hours when memory can race back over a golden past. To have no one interested in you, no fussy packages to open on Christmas morn, no neckties coming by mail from aunt and uncle, no one to extend to you the joyful greetings on Christmas Day is a sad state of affairs, but to have no gree

Continued on page 70



Saws, Drills and Engraves Safely

Manufacturers who desire to build quality into their products and who insist on speed and economy in their plants should write to our nearest office for complete information on Spaulding Bakelite-Duresto.

Factory
Tonawanda, N. Y.
Sales Offices:
Warehouses
484 Broome St., N. Y. C.
659 W. Lake St., Chicago.
310 E. Fourth Street, Los Angeles.
141 N. Fourth Street, Philadelphia.
15 Elkins St., Boston.
171 Second St., San Francisco.
509 First Nat'l Bank Bldg., Milwaukee.

AVOID ruined material, wasted time—use Spaulding Bakelite-Duresto. Unlike hard rubber, it is chip-proof. Besides—due to a special Spaulding process of fabrication, Bakelite-Duresto panels retain a beautiful black, high gloss finish indefinitely; will not warp, shrink not split; highest in dielectric properties and tensile strength.

Insist on Bakelite-Duresto—the best that money can buy. Your dealer can furnish standard sizes from stock, special sizes to order. Look for Spaulding Bakelite-Duresto panels in the set you buy—a sign of quality apparatus.

Write nearest office for descriptive circular.

SPAULDING FIBRE COMPANY, INC., TONAWANDA, N. Y.

Spaulding
BAKELITE-DURESTO
Panels - Sheets - Tubes - Rods

Beat These Wet "B" Batteries If You Can

Rabat Junior (12 cells 24 volts) capacity 800 mil-amps, only \$3.96; Rabat Senior (2800 mil-amps), \$9.60. Prices F.O.B. Cleveland, Ohio. If your dealer cannot supply you, send direct.

The Radio Rabat Company
814 Bangor Bldg. Cleveland, Ohio

See the New! - - - - **MONTROSE LOW LOSS CONDENSER \$2.50**

A new efficient condenser at a new low price. 23 plate, cap. .0005.
UNITED RADIO LABS. of the Montrose Mfg. Co.
1333 Fulton St., Brooklyn, N. Y.

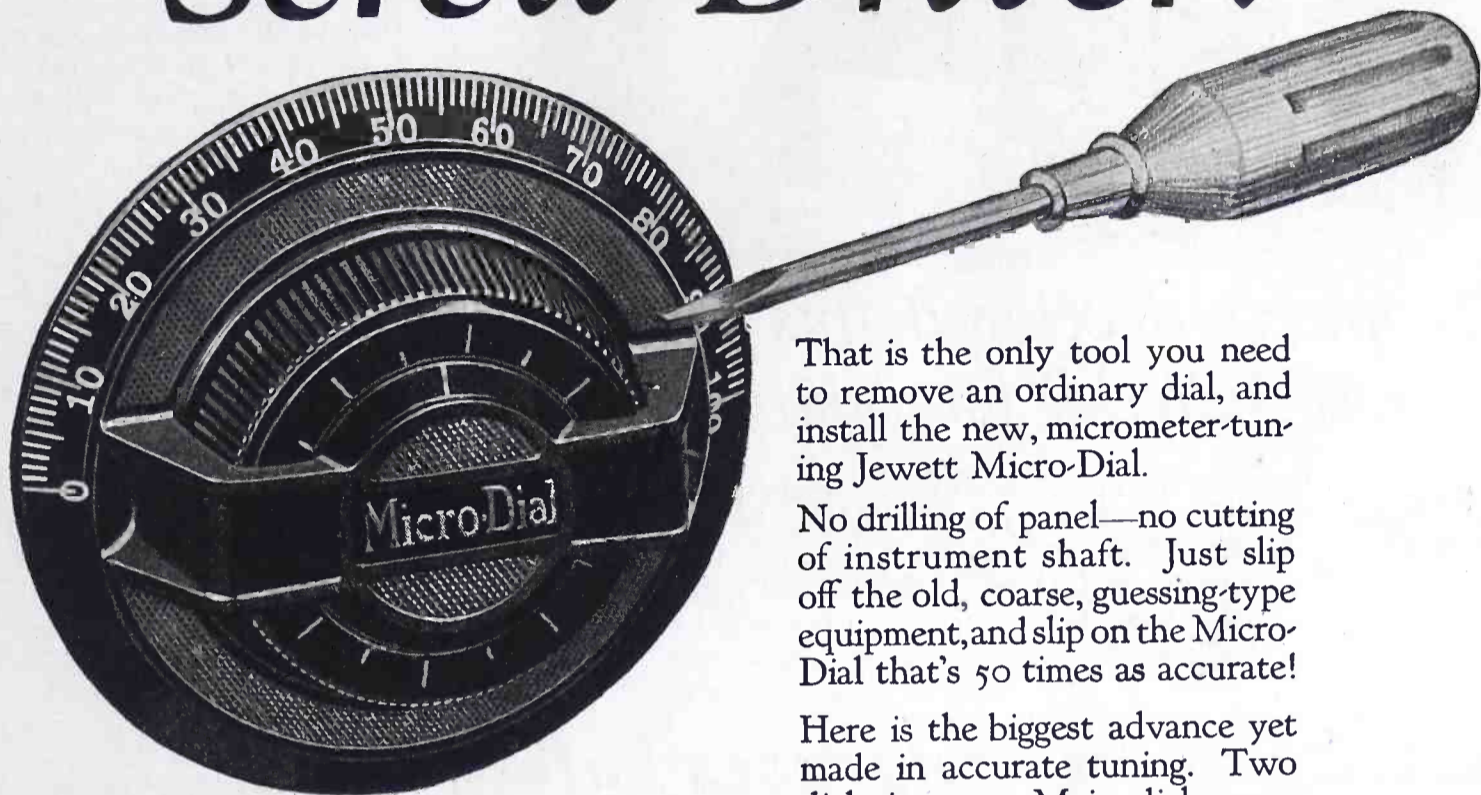
ELECTRIC RADIO SOLDERING IRON **\$1**

Send \$1.00 now for this regular \$2.50 value, postpaid anywhere in U.S.A. Write for Big Free Radio Catalog. Atwood-King, Inc. Dept. G 163 W. Washington St., Chicago 105 POS 1 PAI

ATWOOD KING INC.

The SATURN
Perfect Jack and Automatic Plug.
Your order filled by mail promptly
Every article absolutely guaranteed
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Write for Literature

Have You a Screw Driver?



EXCLUSIVE!

Mounts where any four-inch dial will mount—Absolutely self-contained—Nothing to be attached to panel—Slight eccentricity or angularity of instrument shaft of no consequence; Micro-Dial will not bind—Absolutely noiseless—Knob mounted on double cone bearing, self-adjusting and self-aligning—No metal to tarnish or cause body effects; no rubber to deteriorate—Micrometer and coarse adjustments turn complete circle—Calibrations clockwise or anti-clockwise—Mechanism lubricated for life—Lasts forever—Improves with use.



The Jewett

Micro-Dial

That is the only tool you need to remove an ordinary dial, and install the new, micrometer-tuning Jewett Micro-Dial.

No drilling of panel—no cutting of instrument shaft. Just slip off the old, coarse, guessing-type equipment, and slip on the Micro-Dial that's 50 times as accurate!

Here is the biggest advance yet made in accurate tuning. Two dials in one. Main dial corre-

sponds to your old equipment. Inner dial moves instrument at only one-fiftieth normal speed, permitting accuracy far beyond the former reach of human touch and vision.

More stations—more range—more volume—less interference. Transforms accurate tuning from an accident into a scientific certainty. Especially when coupled with a Jewett Superspeaker ensures the absolute limit of reproductive volume from any set.

Don't confuse the Micro-Dial with any other device for tuning improvement. Its compact neatness, and its complete freedom from wear or deterioration place it in a class all by itself and remember, you need only a screw driver to install.

Rejuvenate your set by Micro-Dial equipment!

JEWETT RADIO &
PHONOGRAPH CO.

5676 Twelfth St., Detroit, Mich.

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DEALERS SUPPLY CO.

323 So. Western Ave., Los Angeles, Cal.

SEND FOR BOOKLET

MAIL coupon below for our catalog and booklet, "Some Insulation Stickers Explained"



Engineers developed this special panel material for radio ONLY

THE radio amateur is to be thanked for the development of "the supreme insulation." When he made known his demands for DX and for volume, it was soon evident that ordinary insulation material wouldn't do.

Panel leakage and capacity effects had to be eliminated. Ordinary insulation good enough for a hundred other uses was not good enough for radio. So we put engineers to work to develop a super panel material that would not only give ample proof of lowest electrical losses, but would also be easy to drill, saw and cut; non-warping, and good-looking to boot.

Radion was the result. There is nothing quite like it for real results. Bureau of Standard tests conclusively prove highest insulation characteristics. In the set you build, it will give you just that extra energy needed to tune in the distant station. When you see Radion in a ready-

built set, it is an evidence of genuine good quality in that set.

You can see the difference between Radion and common panel materials, if you will look at the finish. Radion has a high, polished finish. That keeps out dirt and moisture, which, even in little particles on the surface, cause short circuits and reduce good reception. Look at Radion and other panels under a magnifying glass if you can.

Everyone knows Radion is the easiest panel material to cut and saw. There are eighteen stock sizes, two colors, black and mahogany. Sold universally by dealers who know radio. Better performance will make it worth your while to ask for it by name, and to look for the name on the envelope, and the stamp on the panel.

Radion dials to match, also sockets, binding post panels, insulators, knobs, and the new Radion built-in horn.

Independent Engineers Tests of Radion prove:

1. Lowest Phase Angle Difference.....0.5 to 0.6
2. Lowest Dielectric Constant 3.9
3. Highest Resistivity (Megohms-om.) 1.0 x 10⁸
4. Lowest Power Loss Factor 0.665% to 0.875%
5. Lowest Absorption of Moisture in Air.....0.005% to .02%
6. Lowest Absorption of Moisture in Water.....0.08% to .11%

AMERICAN HARD RUBBER CO.

Dept. RS12, 11 Mercer Street,

New York City

Chicago Office: Conway Building

Pacific Coast Agent: Goodyear Rubber Company

San Francisco

Portland

RADION

The Supreme Insulation

PANELS

Dials, Sockets, Binding Post Panels, Etc.

AMERICAN HARD RUBBER CO.,
Dept. RS-12, 11 Mercer St., New York City:

Please send me your catalog and booklet, "Some Insulation Stickers Explained."

Name.....

Address.....

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

ings, or gifts to send out to those you love is still worse.

In all the world there could have been no one more lonely than Raymond Shaw on the fifth Christmas Eve of his wanderings. The heart of youth does not turn bitter in one hour or three—but five years can work a marvel. He lived in a shadow of loneliness, a shadow cast by his own reserve. In the twelve months he had lived in Ogden he had made no friends. He had secured his position through an application to one of the mid-western branches of his grandfather's huge corporation, and now lived under the name of Harold Wayne. He had been promised a promotion the first of the year. Twelve months of constant application to his work in the advertising department and experimental laboratory had been sufficient to bring his worth to the attention of Mr. Morten, the superintendent.

On Christmas Eve he sat before the grate fire of Mrs. Pierce's empty boarding house, tasting the bitterness of solitude and finding it heavier than usual to bear. The place was empty, as were all the other homes in Ogden. Every one had gone to the big celebration in the radio employees' gymnasium. It had been the custom for years for everyone to attend these annual parties, but this year the interest had been greater than usual. The company was introducing a new feature which had been the talk of the city. De Forest's phonofilm pictures, which reproduce sound simultaneously with the action on the screen, were the added attraction, followed by the usual dancing. Harold had worked most of the day getting the machine in running order and giving instructions to one of the mechanics.

He was really sentimental, at times more so than others. Tonight he dwelt in a land of treasured memories. He held a little knot of dead flowers in his hand. Last spring they had lived, cast a fragrance along with their beauty, then faded and lost their golden color, a life symbolical of his own. His only venture into the social life since coming to Ogden had been when he attended a party given in honor of the superintendent's daughter.

She was a typical American girl, combining health with certain feminine daintiness. No one could have sensed the inner qualities that doubled the fire of her beauty. Harold Wayne called it "soul." Ruth Morten was a lovely girl, what a wonderful woman she would make. At the close of the party her scarf had caught on the chair opposite him. He attempted to loosen it, and then as gently as a caress she had dropped the flowers in his hand, and whispered "Good Night."

The next time he saw her she had given no sign of recognition, and of

Continued on page 72

The "WHY" of



Laboratory Model

Silver Super-Heterodynes

tells the complete story....with FACTS

Mr. George C. Cannon, Delhi, N. Y.

Designer of the first amateur station to be heard in England, reports as follows:

"My Silver Super fully adjusted at last. . . . All reasonable stations received on Loud Speaker. . . . KGO (Oakland) particularly good, while WSAI (Cincinnati) running. . . . Brought in KGO with loud speaker volume on 18" Loop four consecutive nights. . . . Congratulations on such loop reception. . . . Wonderful volume and clear-cut reception. . . ."

SILVER SUPERS

do outperform the best of them. They are the ultimate in Super-Heterodynes. Silver Supers have set records in routine performance that no other set or design has ever achieved—a startling claim, yes, but one founded on facts. The superiority of Silver Supers over every other receiver is not to be denied. They are the last word in Super-Heterodynes.

PARTS for

Portable Model \$57.65 Laboratory Model \$63.60

Shipments Prepaid East of the Rockies.

Get this Book

"The Portable Super-Heterodyne"

It puts into your hands the results of Mr. Silver's experience with hundreds of Supers—dope never before available. Drawings and photographs show how all the "kinks and twists" have been eliminated, and make it easy for any one to build either model Silver Super on the kitchen table. Price 50c

ORDER YOUR COPY TODAY



SILVER SUPER SPECIALS Brings your old super up to the minute. Parts that are thoroughly tested and that are guaranteed to operate with a maximum of efficiency in any circuit. S-M Parts are sold on the Satisfaction-or-Your-Money-Back basis. They are all proven products.

DEALERS—Write for our attractive merchandising plan

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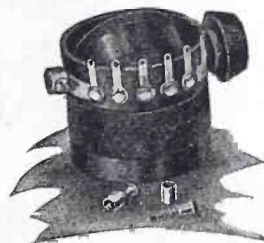
Silver-Marshall, inc.

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CHICAGO

SILVER SUPER SPECIALS

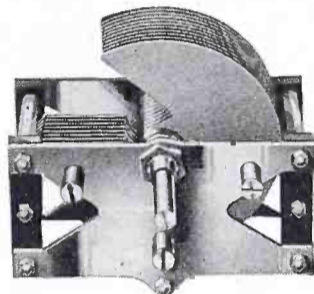


Type 101

Silver Coupling Unit
150 to 600 meters
Small, compact and ultra efficient. Price (with mounting screws)....\$2.50

Type 201

Silver Tuned Output Transformer
30 Kilocycle
The filter that gives your amplifier real selectivity. Price (with mounting screws).....\$3.50



Type 301

Silver Low Loss Condenser
Cap. .000009 to .0005
Loss so low as to be immeasurable. Ideal for any circuit. Price....\$4.50



Type 401

Silver Transformer Unit
50 Kilocycle
Employs two inter-stage and one filter transformer. 1½ to 3½ times more efficient than anything on the market. It is the Original. Price.....\$14.00



Type 501

Silver 5-Gang 199 Socket
For panel and base mounting, with rubber cushions. Price.....\$3.00

Type 601

Silver Tapped Loop
A really efficient collapsible Loop with center tap. Price.....\$6.50

ORDER DIRECT OR FROM YOUR DEALER CIRCULARS UPON REQUEST

FACTS that are proof positive of the startling claims made for Silver Supers, and that explains

The "WHY" of Selectivity that brings WGY

(Schenectady) in on a Silver Super operating within two miles of WGN and WEBH (Chicago - 360 meters), and that separates W T A S and WTAY, 283 and 286 meters (each 20 miles away) with a dead spot between them.

Sensitivity that brings KGO and other West Coast stations into Eastern New York with loud speaker volume on an 18" Loop, and that in Chicago brings in either Coast at will with similar volume.

Logging

Two Condenser Dials may be calibrated for all stations heard, stations always reappearing at the same points.

Volume

Sea to sea with loud speaker volume on an 18" Loop. Either Loop or Antenna may be used.

Quality Comparison

Equal or superior to that of any other receiver known at present. Silver Supers compare with other supers as a regenerative detector compares with a non-regenerative detector.

Tubes

Any standard make of tubes now on the market and a circuit arrangement that makes the 7-Tube Silver Supers outperform other 10-Tube sets.

Assembly

Recommended parts and complete instructions make it possible for you to build either model Super-Heterodyne with a pair of Pliers, Screw Driver and a Soldering Iron.

This is only part of the story. Read it all.

Write for

The "WHY" of Silver Supers

It's Free!

Set building is simple with Dubilier Devices!



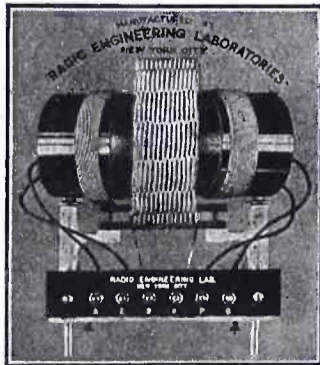
The MICADON: Use this standard fixed condenser when you build. It has permanent capacity. Its extension tabs make it easy to install. 90% of all sets made use Micadons.

The DUCON: Save the expense and labor of erecting antenna. Buy the Ducon—the standard socket plug. Just screw it into your lamp socket and it will pick up programs clearly and distinctly!

The DURATRAN: Build a powerful set by using this radio-frequency transformer. It amplifies with a constant of over twenty on the complete broadcasting band—225 to 550 meters.

Dubilier

CONDENSER AND RADIO CORPORATION



GREATEST RECEPTION RANGE WITH MAXIMUM SELECTIVITY

THE LOPEZ LOW LOSS TUNER

Those Who Know Use the ORIGINAL Because

1. LOWEST Ohmic and Dielectric LOSSES—Heavy solid wire, SECONDARY coil practically SELF-SUPPORTING with the least possible insulating material.
 2. PRIMARY is UNTUNED and COUPLING to secondary is VARIABLE—Negligible receiver radiation. Adaptable to any antenna without circuit changes. Easier to tune. SECONDARY dial may be CALIBRATED.
 3. Increases EFFICIENCY of Super-Hetrodyne and radio frequency circuits.
 4. MECHANICALLY RUGGED—A laboratory product for practical use.
 5. GUARANTEED to give satisfaction. Testimonials upon request.
 6. TWO TYPES—REGULAR AMATEUR 40 to 205 meters (new) and BROADCAST 200 to 600 meters. Price \$10.00 Each at Your Dealer's or Write
- A. C. LOPEZ & CO., 334 Fifth Ave., New York City

Continued from page 70

course he did not presume to notice it. Yet her indifference hurt. Perhaps some one had seen her act and chided her about it. If he spoke to her she might rebuff him, and yet had she not given him ample cause to assume he might do such without being classified as bold. Back in the past which he had chosen to forget he had been said to have a way with women, but he made no attempt to break down the barriers of reserve. The withered flowers he held in his hand, a fond remembrance in an hour of loneliness.

Suddenly Ruth Morten herself came in the room. He scrambled to his feet; the withered flowers fell to the floor.

"R-Ruth," he gasped.

She didn't seem quite real, perhaps it was a dream. There was no lamp in the room, only the glow of the grate made her visible before him.

"When they couldn't get the phonofilm to work dad sent Junior after you. I knew you would be alone, that's why I came along. The boys have been playing Santa Claus, and gathering the kiddies and presents for the party. I've been doing my bit too in my own car. I thought you wouldn't be there tonight, so I brought a gift to you."

"That's very nice of you to remember me," he croaked.

"Don't you like us at all—not any of us," she asked after a moments pause. "You never seem the least bit sociable."

He attempted to answer but words failed him. He pointed abstractly to her flowers on the floor, but she failed to understand his silence and continued.

"Don't you know," Ruth went on earnestly, "I think Christmas Eve is different from all other nights. I don't know what it is that hurts you, but I am sure there is something that makes you unhappy. You know when I was making so many Christmas presents to give all my friends I just couldn't settle down to warm contented gladness and know you were left out. Silly of me wasn't it—so I made you this gift and I hope you'll like it."

She had a small flat package in her hand wrapped in a bit of newspaper. Harold couldn't have spoken for the life of him. A huge knot in his throat kept back any thought of gratitude he might desire to express.

"Please don't spoil it. I know you are not interested in getting presents from me, but I did it for my own peace of mind. I placed a newspaper around the package so it wouldn't get soiled. See, it is all dressed up with ribbon." She tore off the paper and made as if to crumple it.

"Please don't spoil it, I care even for the newspaper."

"You see, there were really several things I came for," she said changing the subject. "Dad wants you to come

Continued on page 74

**Modulation Plus Regeneration
in the New Ultradyne**

To the "Modulation System" of radio reception, R. E. Lacault has successfully applied the use of regeneration in the new Model L-2 ULTRADYNE.

The result is ultra-sensitivity never before thought possible. The use of regeneration produces tremendous amplification which is more noticeable when receiving weak signals.

The Radio Section of the U. S. Bureau of Standards has proven by actual measurement that regeneration becomes more effective as the received signal diminishes in strength.

Regeneration applied to the "Modulation System" allows the ULTRADYNE to respond to an extremely small amount of energy. This energy is further amplified thousands of times by the intermediate frequency amplifier before it is detected and made audible. This amplifier is designed for maximum efficiency without decreasing the tone or quality of music and speech.

The reception of distant stations is only limited by atmospheric conditions and causes beyond the control of Model L-2 ULTRADYNE.

**Loud Speaker Reception
Using Loop Aerial**

Efficient loud speaker reception using a loop aerial is possible with the Model L-2 ULTRADYNE. Ordinarily loop reception is considerably less efficient than an outside aerial. However, the application of regeneration to the "Modulation System" reduces the resistance of the loop circuit, thereby allowing the loop to pick up infinitely weak signals.

The use of a loop also increases selectivity and decreases static and other interference.

**How to Build the New Model
L-2 ULTRADYNE**

This 32-page illustrated book gives latest authentic information on drilling, wiring, assembling and tuning the new Model L-2 Ultradyne. This book explains the "Modulation System" in detail and also deals with the application of regeneration to this new system of radio reception.

It is edited by R. E. Lacault, inventor of the Ultradyne Receiver. Price 50c.



**Model L-2 ULTRADYNE
Kit Is Ready**

This is the new Model L-2 Ultradyne Kit which contains one low loss tuning coil, one low loss Oscillator Coil, one special low loss Coupler, one type "A" Ultra-



former, three type "B" Ultraformers, four matched fixed Condensers.

\$30.00

The Ultraformers are new improved long wave radio frequency transformers, especially designed by R. E. Lacault, inventor of the Ultradyne. As a precaution against substitution, R. E. Lacault's personal monogram seal (R.E.L.) is placed on all genuine Ultraformers. All Ultraformers are guaranteed so long as this seal remains unbroken.—Adv.

Selectivity!
a dominating Ultradyne Feature

AN Ultradyne receiver operating in New York City easily tunes out the powerful broadcasting of WOR, Newark, N. J.—405 meters and brings in WDAR, Philadelphia—395 meters; PWX, Havana, Cuba—400 meters; WDAF, Kansas City—411 meters.

Regardless of close similarity in wave-length, the Ultradyne selects any station within range—brings in broadcasting clearly, distinctly, faithfully.

In addition to this Ultra-selectivity, the Ultradyne is the most sensitive receiver known. It employs the "Modulation System" or radio reception, the achievement of Mr. R. E. Lacault, E.E., A.M.I.R.E., Consulting Engineer of this company and formerly Radio Research Engineer with the French Signal Corps Research Laboratories.

The "Modulation System" responds to weaker signals than the conventional method of detection—because it provides greater rectification. Weakest signals are made to operate the loud speaker.

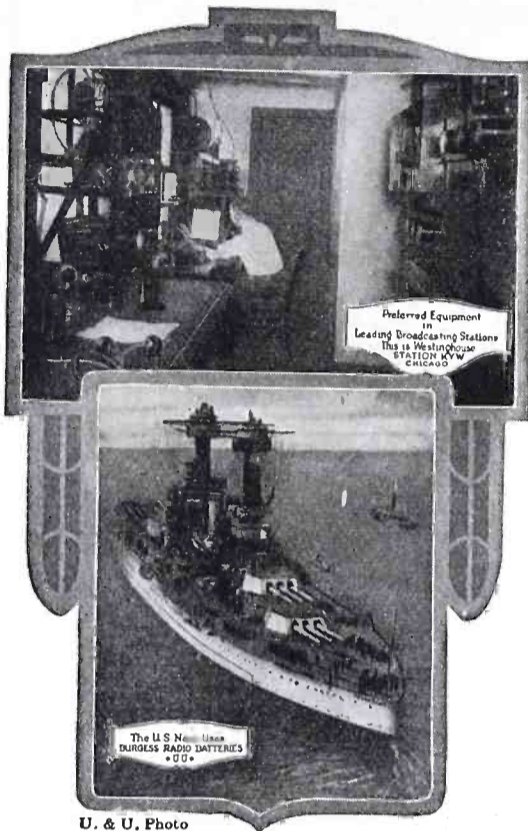
Ultradyne performance is the envy of the radio industry.

Write for descriptive circular
PHENIX RADIO CORPORATION
9 Beekman Street New York

ULTRADYNE
The Improved
SUPER-HETERODYNE
MODEL L-2

Tell them that you saw it in RADIO

More Adventures of **BURGESS** RADIO BATTERIES



U. & U. Photo

The same Burgess Radio 'A', 'B' and 'C' Batteries which are today faithfully serving the nation's armed forces on land and sea and in the air, and used by leading radio broadcasting stations, experienced radio engineers and amateurs, are sold in your own community by your own dealer for your own receiving set.

When you replace your old batteries, ask your dealer for Burgess. Insist upon this brand of laboratory products—you will receive the same measure of satisfactory service that has won the confidence of the radio public.

"Ask Any Radio Engineer"

BURGESS BATTERY COMPANY
Engineers DRY BATTERIES Manufacturers
Flashlight - Radio - Ignition - Telephone
General Sales Office: Harris Trust Bldg., Chicago
Laboratories and Works: Madison, Wisc.

In Canada:
Niagara Falls and
Winnipeg



Continued from page 74

at once and fix the machine, the pictures and sound don't synchronize; then I wanted to bring you the present, and last but not least to ask you if you wouldn't remain for the rest of the program and dance."

"Suppose I would stay for the program," he asked after they were seated in the car, "would you dance with me?"

"As much as you wish, even though Phil is there."

"And who is Phil may I ask."

"One of the men who visits the office frequently from Los Angeles. I met him over a year ago, and since then he has come several times to see me."

Harold hoped the expression of his face portrayed no evidence of his feeling within. "I think after all you may be right about Christmas Eve. It's the hour of miracles, changes, and a time to forget unpleasant things. I'll stay just for tonight."

In the cloak room he laughed again, with a flash of his fine teeth and a mad glint in his eye at the astonishment of the other men. Tonight he would be Raymond Shaw of olden days. He adjusted the phonofilm machine, and after the program went out with the others.

On the floor of the gymnasium he found Ruth surrounded by a cluster of her friends. Easily he slipped into the inner ring.

"May I see your program, Miss Morten?" he asked politely.

Without reply she extended the card which was still blank. She had evidently waited before giving it to the other. He recalled her answer when he had asked her if she would dance with him. "As much as you like," the words were stamped indelibly in his memory. He would take the words for what they said. He crossed out every dance on the program; why should he consider the others? Did they not have her at all other times? This was to be his night. Before he completed marking her program the music started. A murmur of protest followed as he swept Ruth into his arms.

Dance after dance they had together, forgetting those about them. When conscience rapped him because of his actions he threw it off. There would be no gloom-casters tonight.

The evening had glided by as merrily as the dancers on the floor. They had made no attempt to mingle with the others, he was conscious of only one person in all that merry throng. They were dancing the last waltz of the program when the music stopped just as they were opposite the place where the refreshments were being served.

Mr. Morten standing with a group of others drinking punch called to Ruth. "I say can't you two be a little sociable and join us in some refreshments."

Continued on page 76

A-C DAYTON
XL-5

Performance

IF you are going to expect consistently satisfactory performance from your new Receiving Set, you will be delighted with an A-C DAYTON XL-5.

In selectivity, volume, wave-length range, ease and simplicity of operation, the XL-5 is unsurpassed. In CLEARNESS of radio reception, it leads the field of fine Receivers.

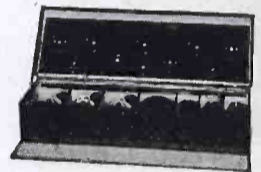
The XL-5 is a five tube Super Receiver that outperforms any set in its price class. It sells on performance—performance that is a pleasant surprise to the most exacting fan—performance that will more than satisfy you.

Ask to see and hear the A-C DAYTON XL-5. Your dealer will gladly demonstrate its wonderful performance and clear reception.

\$115.00

Less tubes and batteries, (\$120 Denver and west.)

Designed for use with either storage battery or dry cells.



A-C DAYTON
Knock-Down Set

The XL-5 is sold in knock-down form, complete with all parts, and directions, for \$72.50 (\$76.50 Denver and west.)

THE A-C ELECTRICAL
MFG. CO.
DAYTON, OHIO

Radio Jobbers and Dealers: We are expanding our distributing organization. Write for complete information.

Makers of Fine Electrical
Equipment for Twenty Years

The A-C DAYTON XL-5—Dark
Mahogany Cabinet.



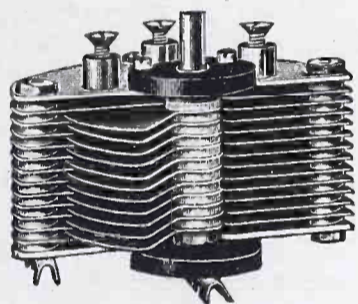
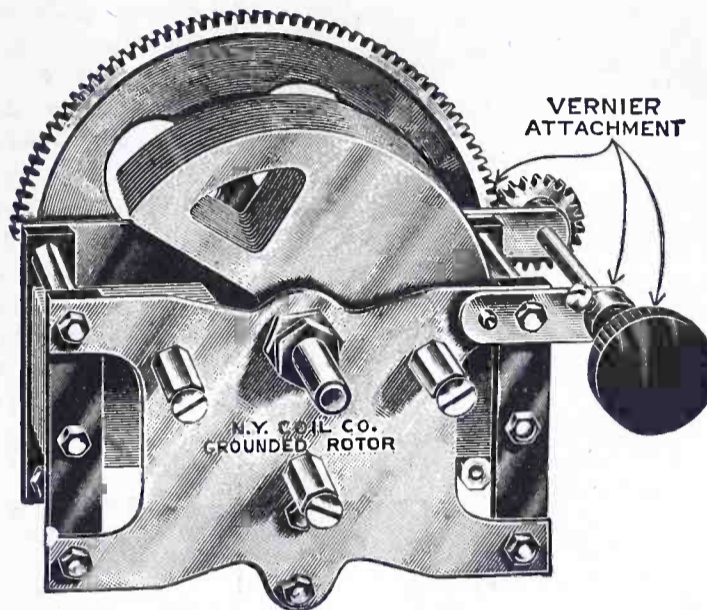
Any Condenser can be called LOW LOSS, but Only It's Performance Qualifies the Name

IN THE NEW YORK GROUNDED ROTOR scientific designing, together with the highest grade of materials and instrument workmanship combine to produce a condenser that is in a class by itself---no other condenser manufactured incorporates so many *actual improvements*.

.005 (23 plate) without Vernier **\$4.50**

Geared Vernier attachment, complete, \$1,50

OUR STANDARD NON-GROUNDED CONDENSERS are made in four sizes with or without vernier — are universally recognized for their efficiency, workmanship and low price—made possible by large production.



Price with Vernier Knob and Dial, 23 Plate, \$3.50. Without Vernier, 17 Plate, \$1.80. 23 Plate, \$2.00. 43 Plate \$3.00



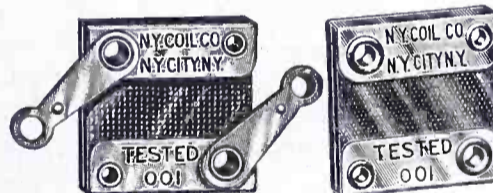
New York Distortionless Audio Amplifying Transformers are the standard by which others are judged. 4 1/4 to 1 ratio correct for all style tubes. Price, \$4.00

Tuned Radio Frequency Transformers, with 17 Plate Condenser attached.....\$4.50

BY PASS CONDENSERS	
.05	\$.90
.01	1.25

NEW YORK PRECISION MICA FIXED CONDENSERS

"More Uniform Capacity"



Type B Type A—No Clips

Adapted by Leading Heterodyne Manufacturers on account of truthful capacity rating. This is the only laboratory precision-built condenser on the market, yet sold at a commercial price. It is standard equipment with some of the largest and most discriminating set manufacturers.

Guaranteed for capacity and against leakage or breakdown.

The following sizes always in stock:

Capacity	Mfd.	Retail Price
.000135
.0001535
.0002535
.000535
.00140
.00240
.00560
.00675
.00025, with Grid Leak Mounting attached, 45c list. Type C		

NEW YORK COIL COMPANY

338 Pearl Street, New York City, N. Y.

Pacific Coast---MARSHANK SALES CO., 1240 S. Main St., Los Angeles, Calif.

GREWOL

The
**PERMANENT
DETECTOR**

\$1.50

Popularity is proof of quality. The tremendous demand for the Grewol detector made possible price reduction—proof of Grewol's quality. The first fixed detector, it still holds the lead because once fixed, it remains so. Can't be equalled for Reflex Circuit and D.X.

Sold by Good Dealers Everywhere or Direct Upon Receipt of Dealer's Name and \$1.50

Patented May 15, 1923.
Serial No. 1454997.

Infringement subject to prosecution

GREWOL 2 in 1 CRYSTAL

Two surfaces instead of one; double life; double value.

50c.
Each

2 IN 1

Jobbers! Write for Exclusive Territory Proposition

GUARANTEED BY

GREWOL MFG. CO.
NEWARK, N.J.

Continued from page 74

Arm in arm they walked slowly towards the group. Harold by chance glanced at Mr. Morten's companions, as he did so his eyes fell upon a face strangely familiar. The gentlemen's piercing look seemed to cast a foreboding of evil. A second look and he recognized Phil Loren, the head auditor from his grandfather's office.

"Mr. Wayne I want you to meet Mr. Loren, who has been over to the Denver office for the past month straightening out a rather tangled mess in the books, and who is here now to see what we are doing."

Harold extended his hand to acknowledge the introduction, but Mr. Loren purposely withheld his. The act was so plainly visible it was noticed by all. Their relation had always been one of enmity. Harold's atrocious actions in monopolizing Ruth's time, which Loren thought rightfully belonged to him, was sufficient cause to ignite the embers of a jealous revenge.

"Mr. Wayne," he added coldly, "or perhaps I should say Mr. Shaw for that is the name by which I have known him before."

"Why, Mr. Loren, what do you mean," demanded Ruth's father quickly.

"I mean simply this," his dark eyes flashing with hatred, "this impudent villain is not Mr. Wayne. He was an employee in our office five years ago and was discharged. Ladies and gentlemen this man is a thief!"

"Mr. Wayne what have you to say for yourself," demanded Morten.

"There is no satisfactory explanation I can make, I bid you good night."

THE Christmas morning sun came shining into Harold Wayne's bedroom. He stirred, groaned over some fragment of a haunting dream and woke. Through his muddled brain came a realization of the night before. On the table by his bed was the gift still on the unfolded paper that protected it. It was part of the Christmas Eve miracle which had brought joy into a lonely life, and now but the shattered remains of a pleasant memory.

There was a knock on the door. "If your up, Mr. Wayne, there is a gentleman here to see you," said the cheery voice of Mrs. Pierce. "It's Mr. Morten."

He dressed hurriedly and found Mr. Morten pacing back and forth in front of the window, his face flushed with anger.

"Well," said Harold with his head back.

Mr. Morten sputtered helplessly for a moment. "I guess you know what I'm here for."

Harold nodded his reply.

"I'll have you know its a promise to my wife and not my years that keeps

Continued on page 78



only **75**
—the gift the whole family will enjoy!

The Marvelous MIRACO Ultra 5

FIVE TUBE OUTFIT IN SOLID MAHOGANY

Unsurpassed selectivity, sensitivity, range, volume and tone combined—

A beautiful sweet toned, five tube "coast to coast" loud speaker set—factory-built, factory-tested and factory guaranteed by one of America's oldest and most reliable manufacturers of quality sets. Composed of finest parts obtainable. Equipped with the latest improvements, refinements and features found on costliest sets. Encased in handsome hand-rubbed SOLID MAHOGANY cabinet. Thoroughly tested and approved by radio's highest authorities. FOR ONLY \$75—A PRICE WHICH HAS ROCK-ED THE INDUSTRY! Unquestionably the most astounding value ever offered radio lovers. Simple to connect and operate. No experience necessary. Even a beginner can cut through the locals get far-off programs loud and clear on the speaker, log all stations and bring them back at will. Non-distorting, non-radiating, non-howling. Works on storage battery or dry cells.

OTHER MIRACO LONG DISTANCE SETS \$14.35

One tube guaranteed long distance outfit, \$14.35. Tube guaranteed long distance loud speaker outfit, \$29.50. Write for latest bulletins, testimony of users proving coast to coast reception. Order direct from this ad or

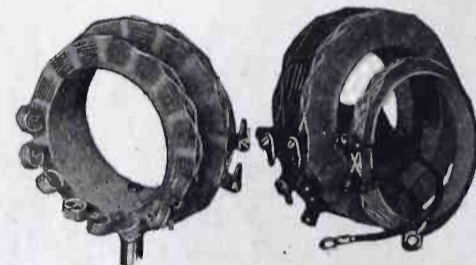
MAIL COUPON BELOW

AGENTS! DEALERS! Send for proposition.

MIDWEST RADIO CORPORATION, Pioneer Builders of Sets
414-E East 8th Street Cincinnati, Ohio

Send free literature and full particulars.
() User () Agent () Dealer

Name _____
Address _____



Price, \$8.00 a Set
Pat. Aug. 21, 1923

for the Roberts Circuit

Two units of remarkable efficiency, built specifically for the immensely popular Roberts Circuit. Primary and Secondary coils in unit No. 1 are mounted on an insulating sleeve, with the primary coil left free to allow for adjustment in coupling.

Unit No. 2 contains primary, secondary, neutralizing coil, and tickler. The tickler is provided with 180-degree dial control. The tickler is also provided with an additional adjustment of coupling to conform to different characteristics of tubes or variations in plate voltage.

Among other popular Sickles products are the Tuned Radio Frequency Coil for self-neutralizing Tuned Radio Frequency Circuits, and the Knockout Reflex Coils. We manufacture coils for all popular Circuits and for special requirements.

Send for Descriptive Catalog

The F. W. Sickles Co.

338 Worthington Street
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SICKLES DIAMOND-WEAVE
COILS

AMERICAN BRAND CONDENSERS

with the

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**Worm Drive Vernier
Finest Condenser Made**

and the
**Greatest Radio Value
Offered the Public**

23 PLATE, only \$5.00 In Canada \$7.00

AMERICAN BRAND CORPORATION
NEWARK, N.J.

Eveready Heavy
Duty "B" Bat-
tery, 45 volts.
Three Fahne-
stock clips.
Length, 8 3/16
inches; width,
4 7/16 inches;
height, 7 3/16
inches; weighs,
13 3/4 pounds.
Price \$4.75.



No. 770
EVEREADY
RADIO
"B" BATTERY
30 CELLS 45 VOLTS
This heavy duty 45 volt
"B" Battery is especially designed
to give longer service under
heavy drain, and is particularly
adapted for use with multi-
tube sets operating at 90 volts
or more.
NATIONAL CARBON CO. INC.
HEADQUARTERS FOR RADIO BATTERY INFORMATION
NEW YORK SAN FRANCISCO
MADE IN U. S. A.

REDUCE Operating Costs

THOUSANDS of people are already cutting their "B" Battery costs one-half, or even two-thirds, by using the new Eveready "B" Battery No. 770 on their heavy drain sets.

This new Eveready Heavy Duty Battery marks a marvelous advance in reducing "B" Battery costs.

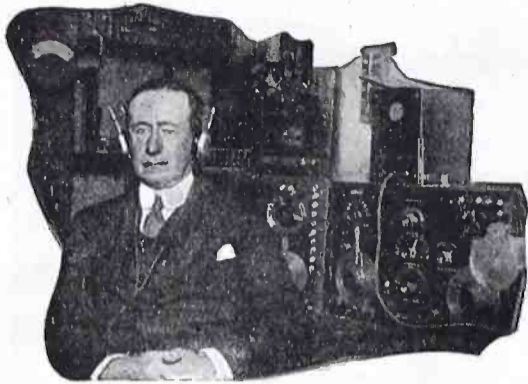
If your "B" Batteries have lasted only two months on a five or six tube receiver, this Eveready Heavy Duty "B" Battery will increase the service two to three times.

Use this Eveready Heavy Duty "B" Battery on any receiving set on which the "B" Batteries last less than four months. When thus used to its full capacity, it is the cheapest as well as the best source of "B" energy ever offered.

Manufactured and guaranteed by
NATIONAL CARBON COMPANY, INC.
Headquarters for Radio Battery Information
New York San Francisco
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EVEREADY
Radio Batteries
-they last longer

*Dry "B" Batteries
are more economical
and more dependable
than any other
source of plate
current!*



Guglielmo Marconi, as he appears today. Signor Marconi is Honorary Chairman of the Radio Institute of America

Train for the big Jobs in Radio

There are big radio jobs waiting. Over 6,000 operators have already graduated from our School. But the radio industry is just in its infancy. There are more demands for operators than there are trained men to meet the demand.

STUDY AT HOME IN SPARE TIME

Take a complete radio course, starting with magnetism and electricity, going straight through code and the practical operation of commercial radio. Take the same course, with the same careful grading and helpful guidance that resident students are getting. A few months' study will fit you for the U. S. Government operator's license. And you may have three weeks Post-Graduate study FREE in our New York Residence School.

GOOD POSITIONS ARE ASSURED

Our School is conducted by the Radio Corporation of America, the world's largest radio organization. This assures you not only finest instruction and closest touch with the most recent radio practice, but also preference for prompt placement in a good position. The pay is excellent from the beginning. The opportunity is unlimited—and entirely in your hands.

Advanced Radio Course

Great popular demand by the advanced student and experienced amateur has led to the opening of an **ADVANCED HOME STUDY RADIO COURSE**, specializing in C. W., I. C. W., telephone and radio measurements. Investigate!

RADIO INSTITUTE OF AMERICA (formerly Marconi Institute)

Established 1909

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Indicate by a cross X the course you are interested in:

Radio Institute of America,
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Please send me full information about radio opportunities today, and your

COMPLETE RADIO COURSE
ADVANCED RADIO COURSE

Name.....

Address.....

Continued from page 76

me from dragging you out and attempting to give you the thrashing you deserve. Why didn't you tell me about this when I hired you?"

"If I had told you the story would you have hired me?"

"Certainly not."

"That is exactly why I didn't tell you; I needed a job."

"Confound your impudence. Does that excuse you from coming here and taking advantage of me?"

"What advantage have I taken?"

"You are dishonest. A thief!"

"Have I been dishonest, or acted like a thief since I have worked for you?"

"N-No, your work has not—"

"My work has been more than the company had hoped for, you told me so last week when you promised me a raise. You emphasized the fact my policy of constant advertising in the national radio magazines had brought about gratifying results. The radio letters sent out to the boys have created an interest in the work that has brought the house thousands of dollars."

"Yes, that is true, but you don't mention the results of advertising the 'Super Condenser,' that was a flat failure."

"True, and I told you in the beginning it would be so; no amount of advertising will sell a poor article twice. Advertising places a commodity before the public, but it is the service that article gives which will cause it to repeat. You can't put cheap material in something and expect advertising to keep it on the market."

"Perhaps you are right in that, however, I am not here to argue."

"You have accused me of being dishonest, but you yourself have never found me so; my work you criticise now because you are angry. I resent your accusation as to my integrity, or criticism of my work. I am willing to listen to what you want."

"If I had my way," he fumed, "I'd—but after all this is Christmas. Look here! You understand of course you are fired from the company. If you get out today I'll not take the matter up with the head office, if not we shall see what they can do for you."

It passed through Raymond's mind there could be no greater power of vengeance than accusing one of dishonesty, taking from him his means of sustenance. He assured Mr. Morten he would leave that afternoon, whereupon Mr. Morten left the house.

Raymond dropped heavily into a chair beside the window. The busy crowd on the street showed evidence of the holiday spirit. It was the spirit of good will when others forget themselves and give more thought to the joy of loved ones about them. The memory of Ruth was an oasis in a desert of loneliness. She had brought to him a

Continued on page 80

ELECTRASOTE TRADE MARK PANELS



Clear reception and selectivity are what every radio fan wants. To obtain these advantages, every part should be chosen wisely—beginning with the panel.

Electrasote Panels are unaffected by climatic conditions; they will not warp or change color. Due to their electrical qualities they reduce surface leakage to a minimum. And yet they cost less than other standard panels.

Electrasote is one of the famous "sote" products introduced by

The Pantasote Company, Inc.

On sale at good Radio Dealers



M. M. FLERON & SON
Inc.

Sole Sales Agents

Trenton,

New Jersey

MAR-CO CONDENSERS

RADIO
PRODUCTS



The name
"MAR-CO" on the
 carton—and one
 good look at the
 construction—is
 enough for those
 who know a good
 condenser when
 they see it!

**MAR-CO
CONDENSERS**

43 plate \$6.50
 23 " 5.50
 17 " 5.00
 11 " 4.50

without dials.

*Choose the safe—
and leak-proof way!*

**Specify MAR-CO whenever
you buy radio instruments.**

**MARTIN-COPELAND COMPANY
Providence, R. I.**

The Last Word In Radio

McCALL COMPENSATED CIRCUIT

The latest, tried and tested triumph of radio engineering---the new McCall Compensated Circuit now manufactured by the pioneer radio concern---Kilbourne & Clark Mfg. Co.

HERE ARE THE POINTS OF SUPERIORITY:

1. Unusual Selectivity.
2. Quality of Reproduction.
3. Great Volume.
4. Logs Accurately.



AIR ROAMER PRICE \$140

WITHOUT ACCESSORIES

Here's a McCall Compensated Circuit set of advanced design, electrically and mechanically perfect. Being non-regenerative, it does not re-radiate.

Ask your dealer to show you this set---listen to its wonderful tone and notice how simple it is to get a pleasing, clear volume of sound and how accurately it brings in the desired station.



NEW K. & C. LOUD SPEAKER

A perfected loud speaker with moulded Bakelite base—phone tip jacks, instead of binding posts—cellular rubber horn—gives those pleasing accurate tones so desired.

Price \$28.00

Send to the nearest office for full details.

KILBOURNE & CLARK MFG. CO.

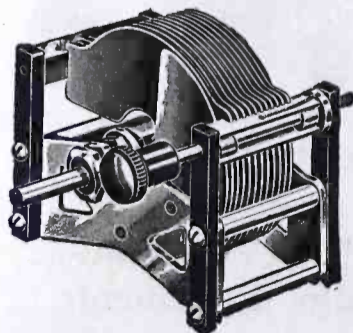
SEATTLE

Branches: 1103 W. 10th St., Los Angeles; 171 Second St., San Francisco; 1241 Montana St., Portland, Ore. Australian Distributors, Pacific Electric Co., Sydney

HICO

The New Sexton Condenser

For Neutrodyne or any other circuit, the HICO is a real worker. Four capacities. Beautifully made. Live Heat, Electric Soldering Iron. Light, Durable, guaranteed element. Price, \$2.50.



At all dealers or sent on receipt of price.

HARTFORD INSTRUMENT CO.

309 Pearl Street

Hartford, Conn.

Continued from page 78

new life, a world that might be made a wonderful place in which to live, but it had changed as quickly as it had appeared. This little storm would pass, he would go to some unknown place and start again. Her life would go on beautifully and serenely to its appointed goal.

Two hours later he took his suit case from the closet and placed it on the bed. While he was making a mental inventory it was natural for him to think of his two greatest treasures. He gathered them together, a withered bunch of flowers and the Christmas present she had brought.

Going to the table he raised the box carefully. A softening of his emotions came as his eyes rested on the gift. Then he gave a sudden start. Folded outside on the piece of newspaper was a head line beginning, "Long Beach, California, December 18."

In the bitterness of renunciation Harold had put the past away from him, he had severed every tie, having no faith in the endurance of friendship, or paternal love. Something stirred him to unfold the paper and read that scrap of correspondence. It was the first real news he had heard from his home town in five years. As he read a wonderful light flamed into his eyes. He finished reading with a mad shout that contained all the pent up tension of the years. He glanced at the top of the sheet. It had been printed in the Long Beach Press. How had it come to be way out here, and how had she chanced to use it on the gift she brought him? What a difference it would make in the world. It turned time back five years and wiped out the black hours. He would be able to forget everything. No, not everything, there were some things which he did not care to forget, even through those dark lonely hours. It was the bitterness of the past which brought her into his life. She came the most beautiful way a woman can come, giving and not seeking.

A rap on the door woke him from his dream. "Come in," he shouted expecting to see Mrs. Pierce. The door opened and Junior Morten entered.

"Sis sent me up to ask you if you wouldn't come down to the car for a moment Mr. Wayne."

He followed Junior down stairs and met Ruth, who was sitting in her coupe. She opened the door and motioned for him to be seated beside her.

"I know you are frightfully shocked," she said going back to her mask of lightness. "I wouldn't have dared to do this but I just had to see you and say good-bye."

"It was divine a thing for you to do" said Harold in his deep sentimental way. Then he asked an apparently irrelevant question.

Continued on page 82

Earn \$5⁰⁰ to \$20⁰⁰ a Day in RADIO

You can! Hundreds of ambitious men are already earning thousands of dollars in this wonderful new industry—you, too, can get your share. Mail coupon below for Free Book which describes fully the amazing money-making opportunities in Radio and tells you how YOU can earn from \$5,000 to over \$10,000 a year.

The astounding growth of Radio has created thousands of big money opportunities. Millions of dollars were spent during the past year on Radio, and thousands of young men are needed right now to meet the ever-increasing demand of work.

Men are needed to build, sell and install Radio sets—to design, test, repair—as radio engineers and executives—as operators at land stations and on ships traveling the world over—as operators at the hundreds of broadcasting stations. And these are just a few of the wonderful opportunities.

Easy to Learn Radio at Home in Spare Time

No matter if you know nothing about Radio now, you can quickly become a radio expert, by our marvelous new method of practical instruction—instruction which

includes all the material for building the latest up-to-date radio apparatus.

Scores of young men who have taken our course are already earning from \$75 to \$200 a week. Merle Wetzel of Chicago Heights, Ill., advanced from lineman to Radio Engineer, increasing his salary 100%, *even while taking our course!* Emmett Welch, right after finishing his training, started earning \$300 a month and expenses. Another graduate is now an operator of a broadcasting station—PWX of Havana, Cuba—and earns \$250 a month. Still another graduate, only 16 years old, is averaging \$70 a week in a radio store.

Wonderful Opportunities

Hardly a week goes by without our receiving urgent calls for our graduates. "We need the services of a competent Radio Engineer." "We want men with executive ability in addition to radio knowledge to become our local managers." "We require the services of several resident demonstrators"—these are just a few small indications of the great variety of opportunities open to our graduates.

Take advantage of our practical training and the unusual conditions in Radio to step into a big paying position in this wonderful new field. Radio offers you more money than you probably ever dreamed possible—fascinating, easy work—a chance to travel and see the world if you care to, or to take any one of the many radio positions all around you at home. And Radio offers you a glorious future!

The National Radio Institute is America's Pioneer Radio School—established in 1914. Our course is the absolutely complete one now being offered which qualifies for a government first-class commercial license. It gets you *bigger* paying jobs in Radio.

Send for **FREE RADIO BOOK**

Learn more about this tremen-



dous new field and its remarkable opportunities. Learn how you can quickly become a radio expert and make big money in Radio.

We have just prepared a new 32-page booklet which gives a thorough outline of the field of Radio—and describes our amazing practical training in detail. This Free Book, "Rich Rewards in Radio," will be sent to you without the slightest obligation. Mail coupon for it *now!*

For a short time we are offering a reduced rate to those who enroll at once. Act promptly and save money.

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NATIONAL RADIO INSTITUTE
Dept. 10 MA Washington, D. C.

Please send me without the slightest obligation your Free Book, "Rich Rewards in Radio," and full details of your special Free Employment Service. Please write plainly.

Name.....Age.....
Address.....
City..... State.....

Pay Increases Over \$100 a Month

I am averaging anywhere from \$75 to \$150 a month more than I was making before enrolling with you. I would not consider \$10,000 too much for the course.

(Signed) A. N. LONG,
120 N. Main St.,
Greensburg, Pa.

Doubles Salary

I can very easily make double the amount of money now than before I enrolled with you. Your course has benefited me approximately \$3,000 over and above what I would have earned had I not taken it.

T. WINDER,
731 Belford Av.,
Grand Junction, Colo.

From \$15 to \$80 a Week

Before I enrolled with you I was making \$15 a week on a farm. Now I earn from \$2,080 to \$4,420 a year, and the work is a hundred times easier than before. Since graduating a little over a year ago, I have earned almost \$4000, and I believe the course will be worth at least \$100,000 to me.

(Signed)
GEO. A. ADAMS,
Route 1, Box 10,
Tamaqua, Pa.

Continued from page 80

"Where did you get that piece of paper you had wrapped around my Christmas gift?"

"Was it a piece of the Long Beach paper?"

"Yes."

"A chum of mine sent it to me telling me about a radio party, they had at the Virginia Club. She thought I might try something like that here. Why do you ask about the paper?"

"Did you read the page you sent me?"

"No, I didn't read anything except about the party."

"I want you to read something."

"What in the world," wondered Ruth, but she took the paper he held in his hand without further questioning.

LINE MAN CONFESSES BURGLARY

LONG BEACH, Calif., Dec. 18.—Arthur Hickman confessed to his doctor in the City Hospital today that he had stolen the money of L. M. Shaw, president of the Shaw Radio Manufacturing, Inc., five years ago. Hickman fell from a pole yesterday as a result of coming in contact with a live wire. The money was taken during the absence of Mr. Shaw from the office. The lineman working outside saw the open safe and noticed Mr. Shaw leave the office, followed a few moments later by Raymond Shaw, his grandson. Mr. Hickman stepped through the window snatched a packet of bills and was back on the pole when Hubbard, the janitor came in to do some plumbing.

At the time suspicion fell upon Hubbard, because he was the only one besides young Shaw to enter the room during Mr. Shaw's absence. The grandson confessed to the crime in time to save the old janitor from trial and imprisonment.

Young Shaw disappeared immediately after his confession, and has not been heard of since. Detectives will institute a search for him.

That evening Raymond sat smoking a cigar and visiting with the Morten family, when Junior called from the other room. "Come in here you folks and listen to my new set. Its one of those you told me how to build in your letters Mr. Shaw. I made it myself." With boyish pride he turned the dials until a clear voice spoke.

"KFI, Los Angeles, Calif. As a personal favor to L. M. Shaw, president of the Shaw Radio Corporation we wish to make the following announcement before starting the Christmas program. Anyone knowing the whereabouts of Raymond Shaw, his grandson, please wire him at once."

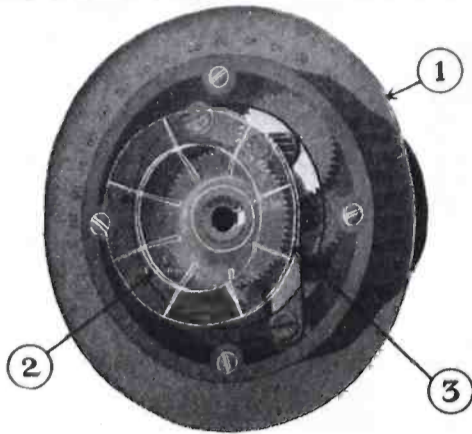
During the pause which followed Junior asked. "What do you think of my set, Mr. Shaw?"

"I think it is the most wonderful set I have ever heard."

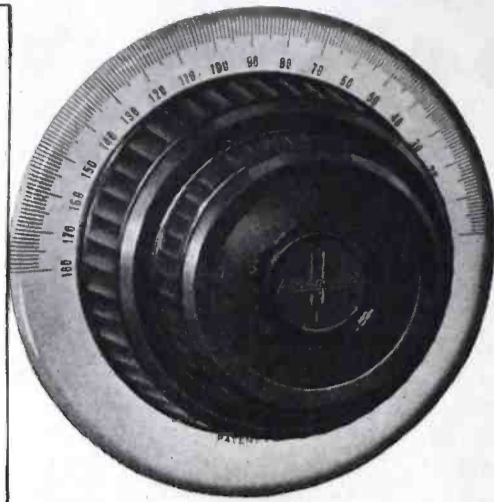
Late that night, after several delightful hours with Ruth, a message hummed over the wires of the Western Union. It brought joy and gladness to an old man's broken heart, for it announced that on the morrow two visitors would be on their way to spend the holidays with him.

ACCURATUNE

MICROMETER CONTROLS



for close tuning



Geared 80-1

Improved NO BACK LASH

No ordinary standards of tuning efficiency can be applied to the new improved Accurate Micrometer Control.

Special construction of this new model offers these superior advantages:

Eliminates all back lash—Gears and gear operation designed upon scientific engineering principles, producing quiet operation, eliminating all lost motion and back lash. The greatest advance in tuning devices. Increases the tuning efficiency over that of any known tuning device.

Fits all standard Condenser Shafts—Accurate Micrometer Controls fit all standard shafts and mount to always operate parallel with panel.

Flush Panel Mounting—Take all standard condenser shaft lengths and fit flush with panel. Eliminates the necessity of cutting off shafts before mounting dial.

Geared 80-1 Ratio—Permits infinitely close tuning with perfect ease. A practical ratio—not too low or too high.

Accurate Micrometer Controls log station after station you never tuned in before. Indispensable on all Super-Heterodynes. Price, \$3.50. At your dealers, otherwise send purchase price and you will be supplied, postpaid.

1. Beautiful silvered etched metal disks, making a pleasing contrast between bakelite panel and dial, with finer graduations for finer tuning.

2. A new principle takes up all the lost motion and back lash, and produces a very smooth operating instrument.

3. Friction shoe steadies condenser and dial operation.

Canadian Representative:

**RADIO Ltd.,
Montreal**

ACCURATUNE

80-1

MICROMETER CONTROLS

THE MYDAR RADIO CO.

9-G Campbell St., Newark, N. J.



TRADE MARK

A CHRISTMAS GIFT THAT WILL THRILL, SATISFY AND SERVE

Give the finest of all Radio Receivers for Xmas—the one every one knows as the peer of them all—BESTONE V-60.

Gives a new meaning to the word Radio.

There is prestige in Owning a Bestone V-60.

There is philosophy in buying the best.

A piece of furniture worthy of the machine it contains.

The Bestone V-60 five-tube receiver in beautiful, distinctive antique polychrome cabinet, with built-in high-grade loud-speaker and battery compartment.

List, \$165.00. West of the Rockies \$175.00.

Bestone V-60 five-tube receiver, Imperial Model, in beautiful polished mahogany cabinet.

List, \$115.00. West of the Rockies \$125.00.

Manufactured, Guaranteed and Distributed by

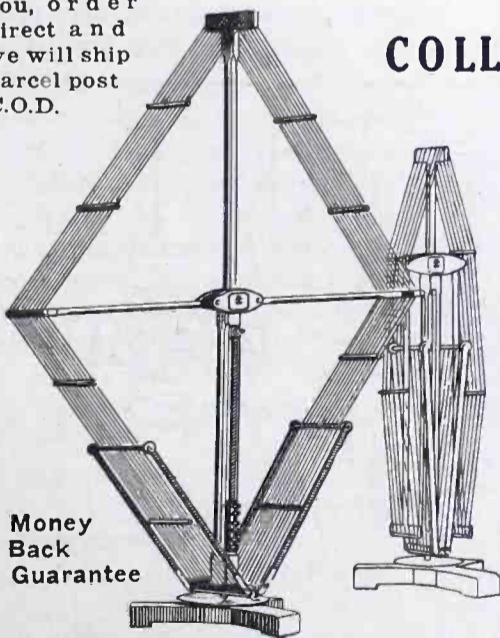
Henry Hyman & Co., Inc. 476 Broadway, NEW YORK
212 W. Austin Ave., CHICAGO



THE SENSATION OF EVERY RADIO SHOW



If your dealer cannot supply you, order direct and we will ship parcel post C.O.D.



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\$25.00

Formerly \$35.00

West of Chicago \$1.50 Additional

The New 1925 D. T. W. COLLAPSIBLE IMPORTED GERMAN LOOP \$25.00

Formerly \$35.00

The one piece of Radio Apparatus acknowledged universally by Radio manufacturers to be superior. There is no secret about its selectivity, due to:

1. Its plan of construction.
2. Superior quality of materials.
3. Careful attention to every detail of construction.

The inductance consists of 14 turns of Real Litzendraht, made up of sixty strands of Number 38 gauge enamelled copper wire woven into three cables of 20 strands, which in turn are wound into one strand with double silk insulation. The wire is connected into plots or sections to a series of binding posts located on the upright arm, giving a wave-length range of 100-400, 200-600, and 250-800 meters. Our method of not tapping, but cutting the inductance prevents dead end losses. A table graduated into the degrees of an arc is placed at the base of the loop so that the angle of reception can be accurately determined. The loop is a distinctive instrument of truly scientific nature and uncommon beauty, which will add a thrill to the performance of your set and bring in stations you never heard before.

From the Boston Traveler: "Masterpiece in construction—having no equal made in this country."

From S. Kruse, Technical Editor Q. S. T.: "Appearance and construction excellent. Certainly is a wonderful job."

John Schantz, American Institute of Electrical Engineers: "Nothing more can be, nothing more need be said about it. The results are beyond my expectations."

Manufactured by the Deutsche Telephonwerke und Kabelindustrie of Berlin, Germany, makers of telephone and scientific apparatus since 1867 and now employing over 6,000 skilled mechanics.

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Shipped in a permanent, cylindrical container.

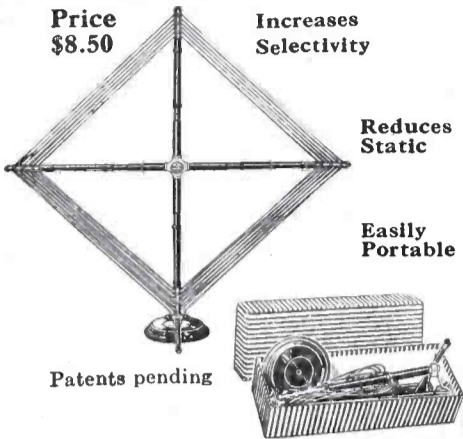
Duo-Spiral Folding Loop

Price \$8.50

Increases Selectivity

Reduces Static

Easily Portable



Patents pending

The favorite loop aerial because of its great convenience, handsome appearance and superior performance. Brings in the distant stations with remarkable volume. Fine for permanent installations or portable sets.

Rotates on base which has silvered dial graduated for calibration. Handle permits adjustment without body capacity effects. Standard loop for superheterodyne. Adopted by leading manufacturers of complete sets. Handsomely finished in silver and mahogany.

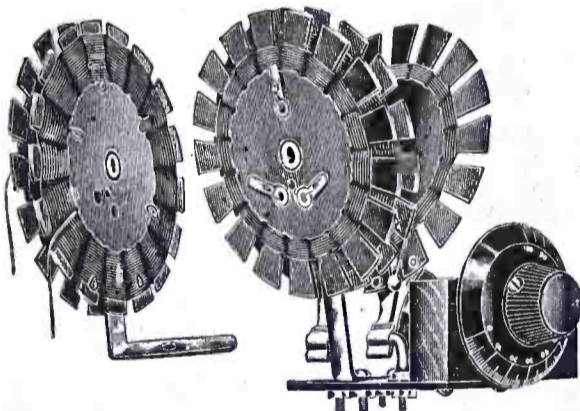
Duo-Spiral is made by the manufacturers of Tiny-Turn, the superior vernier control which makes perfect tuning easy. If your dealer is unable to supply either of these standard products, write us direct.

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Maywood, Ill.

Perkins Electric, Ltd., Montreal



ROBERTS UNITS

(Trade Mark)

THE WONDER CIRCUIT OF THE YEAR

Combining Neutralization—Regeneration—Reflex Developed by Walter Van B. Roberts, E.E., Ph. D. Editorially Endorsed by Radio Broadcast, as Without Doubt The Best We Have Ever Seen.

California Actually Heard at Princeton University On The Loud Speaker, WITH TWO TUBES.

ROBERTS UNITS consist of Five Coils in Two Mountings Ready for Installation. Packed complete with all instructions, Hook-up, Schematic Print. Cut of Complete Set, etc.

BUILD A ROBERTS

AND REACH THE COAST

Coils Mfg. under Zig-Zig

Pat. Aug. 21, 1923.

\$8.00

ROBERTS KIT

(Trade Mark)

Complete Kit of High-Grade Parts for the

ROBERTS TWO TUBE KNOCKOUT SET

Genuine Bakelite Panel, completely drilled. General Radio Condensers, F. M. C. Transformer, Sockets, Condensers, Genuine Roberts Units, Baseboard, Dials, Knobs, Busbar, Spagetti—Everything, except Tubes, Batteries, Cabinet.

\$60

with Portena Folding (Loop for Local Use)

\$53

Without Loop

J. NAZELEY COMPANY, Dept. B
571 Hudson St. (Sole Mfgs.) New York

Western Representatives

BAKER SMITH CO.

741 Call Building

San Francisco

THINGS EQUAL TO THE SAME THING

Continued on page 21

placing the tickler coil close to PS or L_2 . Or, if the desire to create a more novel circuit with another control to monkey with, seizes the experimenter, he can make L in two parts and have a sort of double feed-back, shown in Fig. 4. The

a detector and then carrying audio-frequency as well, through the same tubes. The more common position in which to look for the secondary of the audio transformer in the reflexed part is in the set-wire leading from the coil PS to the filament. This wire is called the "grid return." As previously, a variometer may be used to pass forward

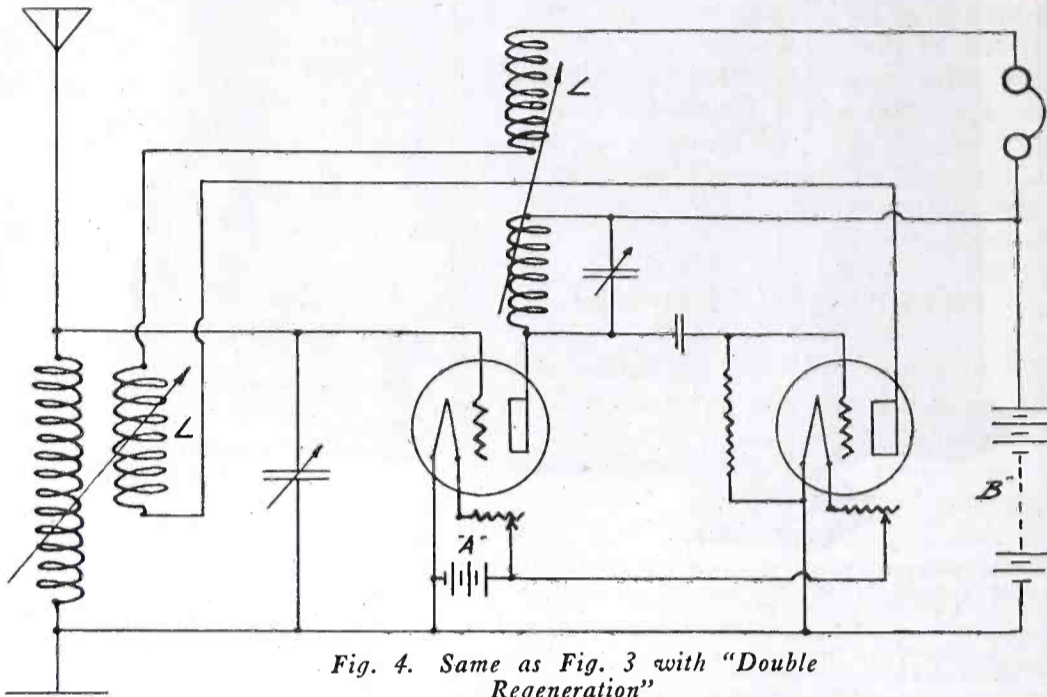


Fig. 4. Same as Fig. 3 with "Double Regeneration"

Crosley Triridyne and certain other manufacturers' sets succeed in using regeneration with radio-frequency (and reflexing), in a compact and simple way, but the combination is not always successful.

Reflexing consists in making one or more tubes do double duty, by first carrying radio-frequency through them into

the radio-frequency impulses as shown (Var. in Fig. 5), or a coil shunted by a variable condenser, or the usual iron core r. f. transformer, or tuned air core transformer of the Neutrodyne type.

Of course it will be noted that Fig. 5 shows a crystal detector CD instead of the possible vacuum tube. The vacuum tube gives a signal strength of from three to eight times that of the crystal; but the clearness, stability and lack of tube noise or hiss, has made the crystal generally preferred for reflex circuits.

If one searches the new "Wonderful-dyne" or whatever it may be called, it will pretty generally resolve itself into

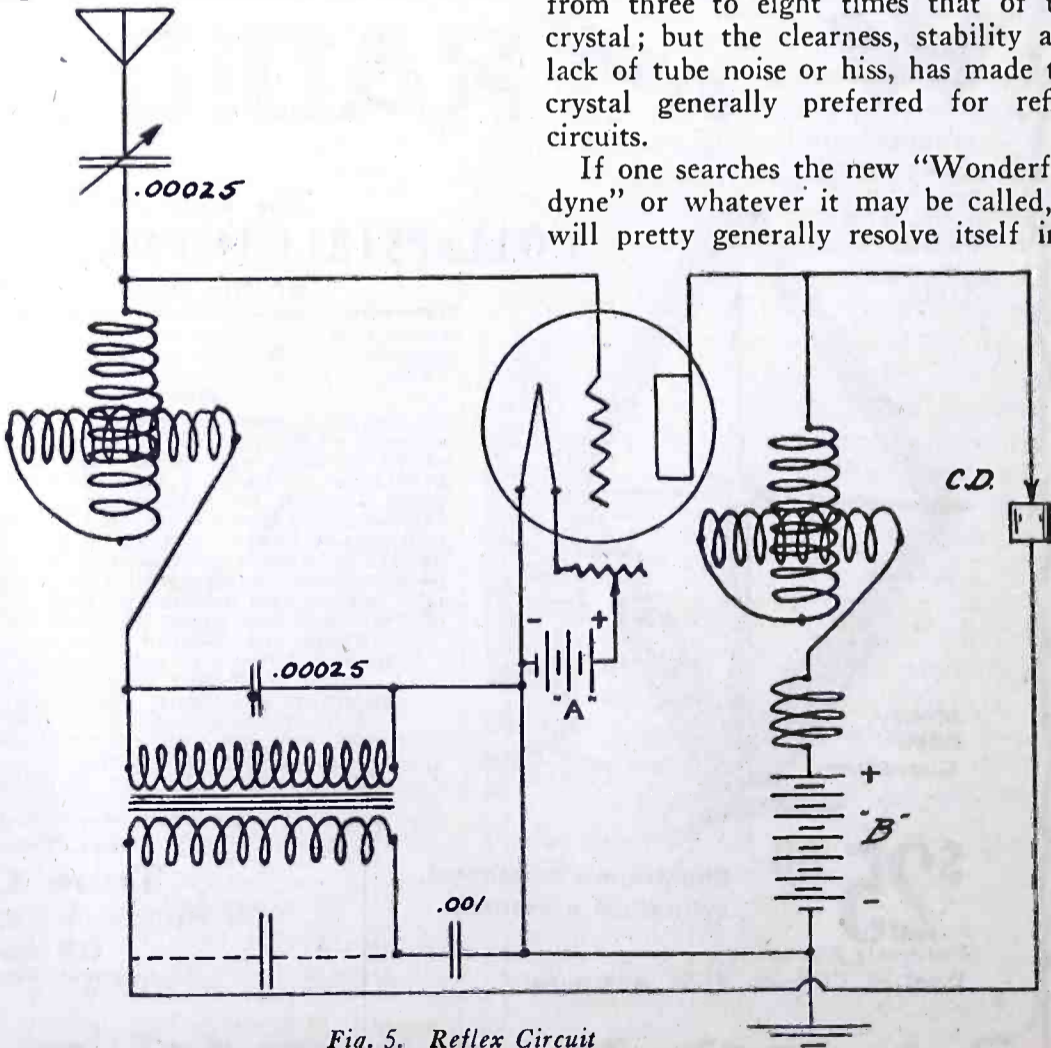


Fig. 5. Reflex Circuit

a substitution of single or double circuit one for the other, the use of regeneration in some less familiar form, substitution of a different type of tuning device for the more usual, or, most often, a combination of well-known and established circuits and tuning devices.

Count them up—the regenerative, including ultra audion, tickler feed-back, tuned plate and Reinartz as the better known types; the super-regenerative; the radio-frequency amplifier, including the somewhat hybrid Neutrodyne, super-heterodyne and reflex—one can pull apart most of the present day crop of high sounding titles and resolve them into these.

REFLEX NEUTRODYNE

Continued from page 25

the condensers entirely out and makes an untuned antenna system. Fig. 3 shows this.

Preliminary tuning is done with the antenna untuned and the neutralizing condenser at the center. The set can not now oscillate and cause interference.

Tuning is done on the primary and secondary condensers. When the desired station is reached the antenna circuit is tuned, and the neutro is shifted either way to get the desired selectivity and volume.

The last rheostat on the right and the binding posts, controls the current to the Magnavox field. This is a real battery saver.

The loud speaker jack is filament control and is connected to the two last tubes. An extra jack is shown above the detector jack. This is connected to the primary of the first stage audio-frequency transformer and permits the output from any other set to be amplified.

In wiring up this set extreme care was used as to position of wire with relation to other parts. All wires were cut to exact lengths and copper terminals soldered on. Particular attention was paid to all jacks and each one was tested for leakage. All condenser shafts were drilled at the rear ends and brass pins soldered in. To these pins, pig-tails of generous size were soldered. Steel springs were added to all sockets and it takes a real push to insert a tube.

== BIG NEWS! ==

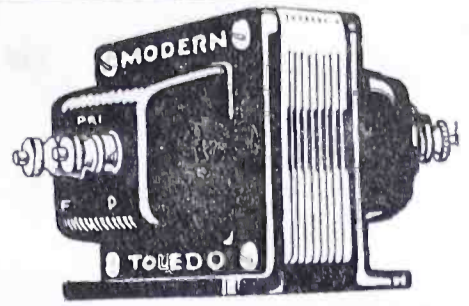
The new improved Best Super-Heterodyne will be the feature of January "RADIO"—out on Dec. 21st, in San Francisco.

Send \$1.00 today for a special six months' trial subscription

"RADIO"

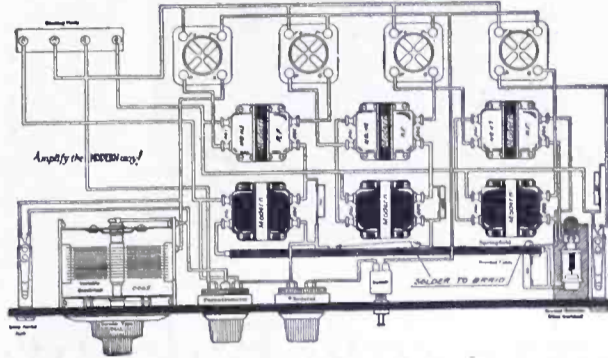
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MODERN "Push Pull" Transformers



Recommended by the leading radio authorities everywhere for all circuits.

Not only was the MODERN "Push-Pull" the first transformer of this type to be offered the radio public, but it is also first in the matter of Quality Amplification



MODERN Super-Six "Reflex"

This Circuit Is Easy to Build

Full-size wiring diagram and complete constructional bulletin of above circuit mailed on receipt of 4c in stamps. Write for it today.

Modern Transformers make any set better. Insist on genuine Modern Transformers.

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Jobbers and Dealers write for attractive prices and discounts.

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Bakelite Mouldings, Dies, Custom Work



What Happens Behind the Panel?

A good looking panel—beautiful dials, knobs and switches—but what happens behind the panel? Does every nerve in the brain of your set function to give you the best possible results. Do you get distance, volume and quality? That's what counts! When it comes to condensers, you don't have to experiment to get a good reliable unit. The Proudfoot is a condenser that controls both group and vernier plates with one knob. Stator plates are mounted on two rods instead of three. Three positive wiping contacts do away with that easily broken pigtail. Minimum bulk and simplicity of mounting are other important Proudfoot features. Before you buy condensers, get acquainted with the

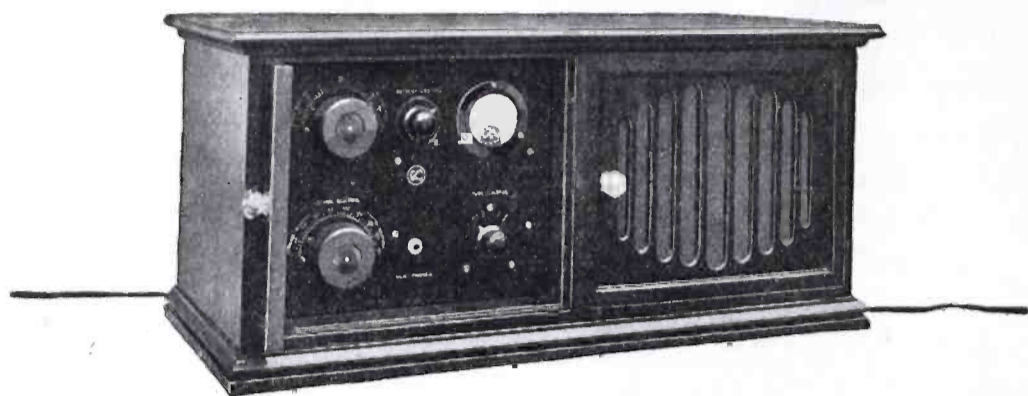
PROUDFOOT ONE-KNOB VERNIER CONDENSER

The Proudfoot isn't expensive—13 plate (M. F. C.—.00025) \$3.75, 25 plate (M. F. C.—.0005) \$4.50, 43 plate (M. F. C.—.001) \$5.75. Try one on your set and check your results! If your dealer cannot supply you, write us, sending us his name.

JOBBERS and DEALERS—Write us for the facts.
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K. & C. DeLuxe and Bakelite

For clear radio reception, reliable insulation is essential. That is why the Kilbourne & Clark Mfg. Co. uses Bakelite—radio's premier insulation—for this De Luxe receiving set. Manufacturers who use Bake-

lite insulation guarantee good results from their radio sets. Amateurs will do well to profit by the experience of these radio experts and use Bakelite when building their own sets. Write for our Booklet "S"

Send for our Radio Map

The Bakelite Radio Map lists the call letters, wave length and location of every broadcasting station in the world. Enclose 10 cents to cover the cost and we will send you this map. Address Map Department.



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was designed especially for the non-technical set owner who can replace in an instant the fixed grid leak with this new, efficient cartridge type Variable Grid Leak: without requiring the change of a single wire.

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WITH RESISTANCE
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It will be well worth your while to use the identical parts specified by Mr. Cockaday without changes or substitution of any kind. Complete parts, including drilled panel and set of three full-sized blue prints.

COMPLETE KIT, \$54.75

WHOLESALE RADIO SERVICE CO.

Dept. R., -9 Church Street, N. Y. C.

TONE QUALITY

Continued from page 26

The tubes will not, if they are good ones, introduce any distortion unless they are overloaded. There is no danger of overloading any one but the last tube in the set. For moderate signals tubes of the type of UV-201A, UV-201, C-301 and C-301A are very good in the last stage. The dry cell family of tubes UV-199, WD 11-12, and so on, are not so good here and it is recommended that UV-201A's or the like be used in the last audio stage, even though all the other tubes in the set are of the dry cell type. This will introduce an additional drain on the dry cells, but will repay itself in quality. For loud signals it is best to use power tubes in the last stage such as VT-2, UV-202 and 216A.

The loud speaker is the next possible source of distortion. For relatively weak signals many speakers are made and sold at prices of ten dollars and less. They are intended, it should be remembered, for weak signals such as would normally result from a single audio stage. If an attempt is made to overload these speakers very bad distortion results, making them almost ludicrous to hear. It is not recommended that economy be considered foremost in the selection of a loud speaker. It is best to purchase one made by a reliable manufacturer and above all to listen critically and intently before buying, in conjunction with a standard receiving outfit.

The loud speaker should be purchased on approval, because no single item of the radio set is so important, and one should know all its characteristics before buying. Some speakers are resonant at a certain note; they will resound violently whenever this note is reached. Others will not properly handle even moderate power. In judging the value of any loud speaker it is well to listen to its rendition of many kinds of voices and instruments. Very often a single instrument like the violin will sound good even on a poor speaker, whereas the full orchestra will reveal its defects. The very best test is the quality of speech. If all types of speaking voices sound reasonably clear and natural then one may be certain that the loud speaker is a good one and music will sound relatively even better.

The remaining possible source of distortion in the audio circuit is the amplifying transformer. This is probably the most frequent. An audio frequency amplifying transformer is not expensive and the difference in price between a good one and a poor one is slight. Yet there are thousands of transformers which are good only for amplifying radio telegraph signals where quality is no factor. The audio frequency transformer is surely the vital part of the radio—it is one of those elements whose quality alone must be the guide to choice.

Continued on page 88

KIC-O "B" Battery and Charger

---the Ideal Christmas Gift

Nothing gives more pleasure or lasting satisfaction to the radio fan than this outfit of KIC-O "B" Battery and Charger. Battery is of the nickle-zinc alkaline type, giving constant current and long life. Heavy glass jars are completely enclosed in a highly finished cabinet. Nothing but new 2500 M. A. H. elements used.

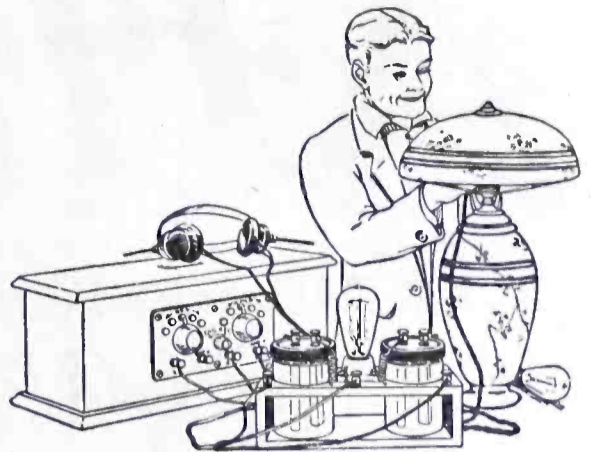
KIC-O Multi-Polar Double Potential Chargers recharge storage "B" Batteries quickly and economically. They use both halves of the A. C. cycle and operate from the ordinary electric light circuit. Fully guaranteed.

Further information sent upon request

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2661 Main St.

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P. Z. indicates panel type with switches. CZ is plain type without switches.

Type	Voltage	Price
PZ	140	\$33.00
CZ	140	30.00
PZ	100	25.00
CZ	100	22.00
PZD super	100 double capacity	40.00
PZ	70	20.00
CZ	70	17.00
CZ	45	13.50
CZ	22½	7.00
CZD super	100 double capacity	37.00

KIC-O CHARGERS

Type K-1 single mounted.....\$1.50
 Type K-2 single mounted..... 3.50
 Type K-3 Multi-polar, mounted 5.00

KIC-O Special Charger Chemicals 75c

GUARANTEE

Your money back on any KIC-O Battery if not satisfied within 30 days' trial. Write for full information on "B" Batteries.

NEXT MONTH!

GERALD M. BEST'S new improved Super-Heterodyne, together with two full size templates for panel layout, will be the big feature of the January issue of "RADIO." This new set is the last word in radio. Order your copy now. The demand will be greater than the supply.

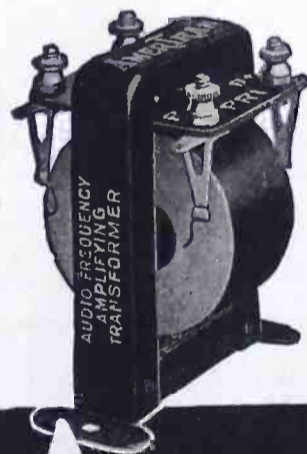
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San Francisco

Standard of Excellence for audio amplification



Made in two types:

AmerTran AF-6 (Turn ratio 5) for use in the first stage.

AmerTran AF-7 (Turn ratio 3½) the companion transformer for use in further stages of amplification where AF-6 is used in the first stage.

AMERTRAN

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Improve your set with an AmerTran

Price, either type, \$7 at your dealer's

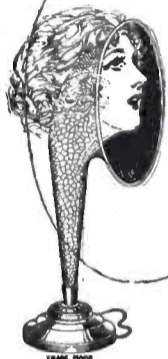
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Designers and builders of radio transformers for over 23 years
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Atlas

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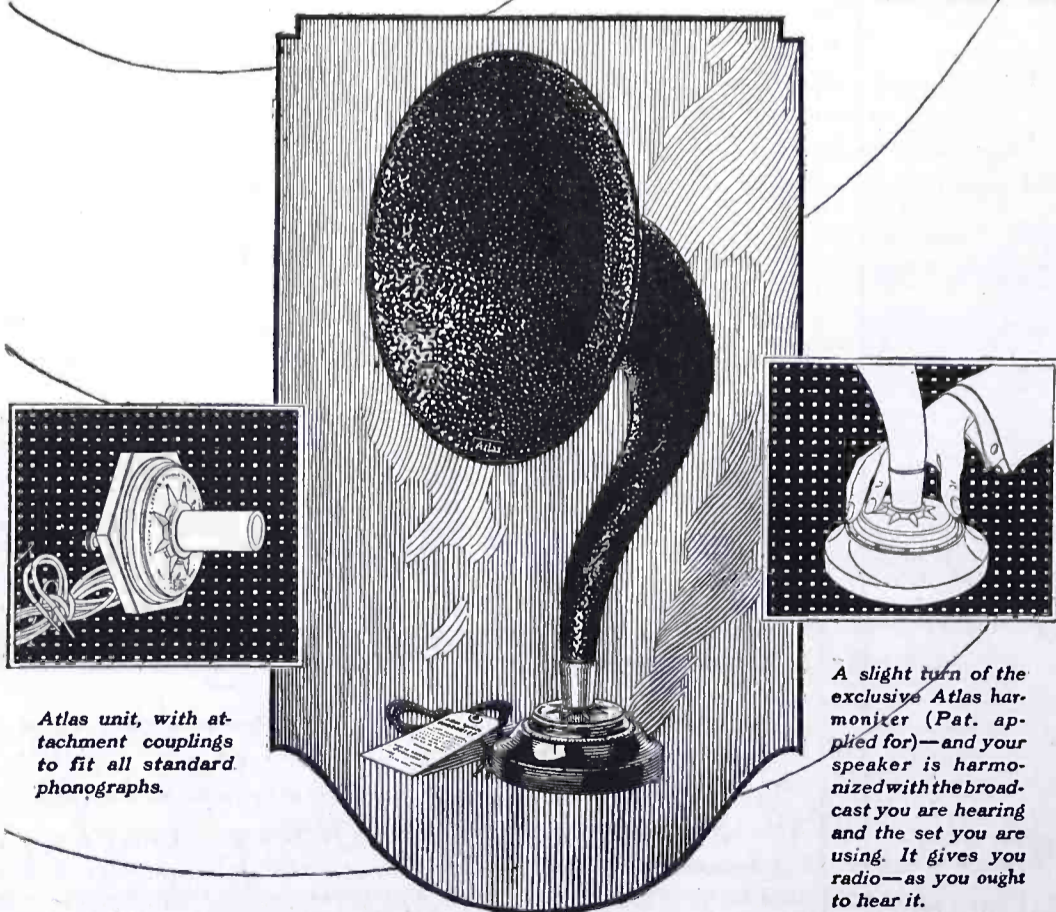


ATLAS floods the room with the best that's in your set. Write for the interesting booklet you ought to read before buying *any* speaker.

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Atlas unit, with attachment couplings to fit all standard phonographs.

A slight turn of the exclusive Atlas harmonizer (Pat. applied for)—and your speaker is harmonized with the broadcast you are hearing and the set you are using. It gives you radio—as you ought to hear it.

New type Atlas with the strikingly beautiful bronze-brown ripple-finish goose-neck horn.

Continued from page 86

One binding post is as good as another, one panel and one cabinet, one rheostat and one socket is as good as another, provided they function at all without mechanically falling to pieces. After all, we do not purchase radio equipment to decorate the home. We might go further and add that one variable condenser is little better than another, because greater efficiency means only a little greater distance or a little more volume.

But emphatically audio transformers are not alike and interchangeable. They are built not for appearance, convenience or mechanical strength—they are built primarily to preserve all the frequencies which have been handed over from the detector circuit and to pass them on to the loud speaker.

The reason that audio transformers are not alike in quality is that they do not amplify the different frequencies presenting the voice to the same degree. Thus a poor transformer will leave out entirely the low frequencies. It will specialize on the higher frequencies and it will sometimes pick out one resonant frequency to favor particularly, so that this frequency will come out of the loud speaker very much exaggerated in strength while low and medium frequencies are absent altogether. The effects are lamentable. Tenors suddenly become falsetto sopranos, orchestras become flute and violin quartets, speakers develop nasal catarrhs and other apparent troubles.

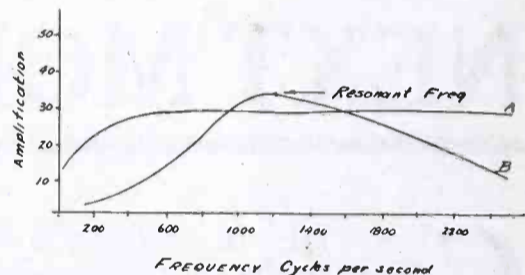


Fig. 1. Amplification Curves of Good Audio Transformer

In Fig. 1 is given the amplification curve of a good audio transformer. Vertically is plotted amplification and horizontally is plotted frequency. Inspection shows that between a range of 600 to 40,000 cycles the amplification is substantially equal and the curve is flat. This covers the ordinary soprano range as well as that of many instruments. From 100 to 600 the amplification is not even, discriminating against low frequencies. Yet this is an extremely good curve compared with that of a poor transformer superimposed in Fig. 1. Instead of a flat characteristic the poor transformer will give a peaked one so that some definite frequency will show very large amplification, whereas the frequencies below 1,000 cycles pass on with very little amplification and are consequently inaudible.

This discussion should convince anyone that even the very best audio transformer is none too good for a radio set.

Continued on page 89

Practice shows that the use of a good make of transformer will make the tone quality nearly all that can be desired—full rich tones, natural and worth listening to by a musically critical ear. In purchasing an audio transformer therefore price is no factor. There are a few standard makes of manufacturers with years of experience and national reputation. In general, here as elsewhere, one gets what one pays for, but more so than anywhere else, false economy does not pay.

When the three elements, the tube, transformer and loud speaker, are properly chosen, the quality obtainable is all that can ordinarily be desired. The full orchestra comes through completely from the piccolo down to the bass drum, and the result is such that even a musical critic may listen to with pleasure. It certainly is a revelation to those who have listened merely to a "radio set" and condemned it as a mechanical curiosity. If this article has succeeded in conveying the idea to the constructor and purchaser as to where to give up the *economy* idea and what to look for in *quality* it will have accomplished its purpose.

CALLS HEARD

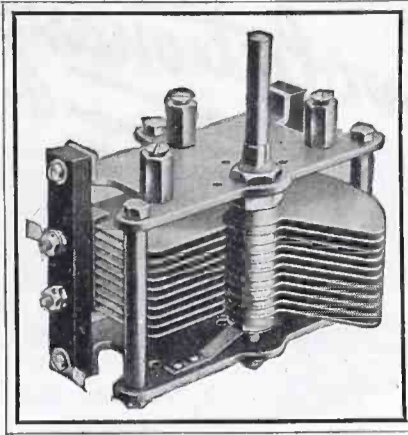
Continued from page 50

2pd, 2ru, 2xai, 2xna, 2xbf, 3ab, 3adp, 3apv, 3bay, 3bdo, 3bnu, 3bof, 3bva, 3cdg, 3chg, 3cia, 3ckj, 3fb, 3ga, 3js, 3ma, 3tf, 3xg, 3zn, 3zo, 4ag, 4ai, 4bq, 4cu, 4dx, 4eq, 4fg, 4fs, 4gw, 4io, 4kk, 4kt, 4ku, 4ld, 4nj, 4oa, 4pb, 4pl, 4pv, 4rr, 4ru, 4rz, 4sa, 4sh, 4si, 4un, 4ta, 4tj, 4xe, 4xx, 4zd, 6aak, 6aad, 6abc, 6adx, 6aja, 6aju, 6aji, 6aol, 6apw, 6ase, 6asf, 6avm, 6avv, 6bgl, 6bfi, 6bfw, 6bku, 6bcp, 6ccn, 6cgc, 6cgo, 6cgw, 6cgs, 6che, 6cqs, 6csm, 6cmu, 6crx, 6cz, 6gg, 6gi, 6ja, 6oo, 6oh, 6rf, 6rk, 6rr, 6ti, 6vo, 6xcd, 6zh, 7aac, 7abb, 7acf, 7ads, 7adt, 7ael, 7agv, 7ahv, 8ajt, 8bj, 7ef, 7co, 7de, 7dv, 7ez, 7fd, 7gk, 7gp, 7gr, 7gv, 7iw, 7ks, 7lh, 7lw, 7mf, 7ot, 7qc, 7id, 7ya, 7sf, 7tt, 7vn, 7ws, 7zn.
 Can. C. W.—3aa, 3gg, 3ni, 4di, 4ea, 5go, 9av.
 Mex. C. W.—ij, gx.
 English C. W.—2kf.
 Cuba—2by, 6kw.

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1aac, 1aap, 1aea, 1ams, 1al, 1all, 1apk, (1are), 1atj, 1att, 1awe, 1axa, 1AOU, 1ayq, 1bc, 1bie, 1bib, 1bgq, 1boa, 1bkr, 1bqi, 1bsd, 1cmp, (1coj), 1da, 1dd, 1ei, 1er, 1fd, 1gv, 1kc, 1ml, 1my, 1nf, (1nt), 1nu, 1qv, 1rp, 1sf, 1sw, 1te, (1ts), 1tu, (1vc), 1xap, 1xaw, 1xu, 1xw, 1xam, 1zab, 1ow, 1vj, 1cwj, 1tt, 1tb, (1abp), 2abr, (2ach), 2abg, 2acs, (2agq), 2agw, (2aoy), 2axc, 2bco, 2bg, 2bgb, 2bqu, 2bqw, 2brb, 2bse, 2buy, 2byp, 2bgc, 2ce, (2cee), 2ceg, 2cgl, 2chs, (2chz), 2crp, 2ctn, 2cxy, 2cyx, 2cyq, 2cyw, (2czr), 2bqb, 2gk, 2kd, 2ku, 2nm, 2oq, (2pd), 2py, (2qs), 2rk, (2sy), 2wc, 2wz, (2kx), (2ate), 3acf, 3acy, 3adp, 3ajd, 3aix, 3adb, 3arp, 3leo, 3asz, 3bz, 3cbl, (3che), (3cdn), (3cdk), 3cg, 3chg, (3ckl), 3cog, 3cyw, 3ii, 3fv, 3hq, 3kq, 3oq, 3en, 3wv, 3zs, 4bq, 4bz, 4dv, 4dx, 4eq, 4ft, (4fz), 4hw, 4fn, 4kq, 4li, 4mi, 4mz, 4io, 4oa, (4pd), 4qf, 4qk, 4rg, 4ro, 4rr, (4si), 4tn, 4vn, 4xe, 4xx, 4hr, 4yn, 6aao, 6ab, 6ac, 6adt, 6afh, 6age, 6ahk, 6alw, 6aot, (6ahp), 6apw, 6avj, 6asv, 6aik, (6ano), 6arb, 6awt, 6bft, 6bfw, 6bgo, 6big, 6bis, 6bqa, 6blw, 6bnu, 6bpt, 6bqc, 6brq, 6bra, 6bsg, 6bua, 6buh, (6cae), 6cax, 6cby, 6ccl, 6ckw, 6cmu, 6cnk, 6cgw, 6crx, 6csw, 6ctd, 6cto, (6bdt), 6dj, 6fy, 6gg, 6gt, (6ln), (6ji), (6jp), 6pl, 6pq, 6pz, (6rn), 6rv, (6tl), (6uf), 6yo (6wt), 6xn, 6yb, (6cog), (7akk), 7av, 7bb, 7fa, 7fd, 7gk, 7gr, (7gv), 7ij, 7io, (7mf), 7mp, 7no, 7ob, 7ok, (7pj), 7qp, 7rn, 7st, 7un, 7oy, 7ajt, (7df), 7iu. Can.—lar, 1dd, 2az, 2bg, 2fo, 3aa, 3co, 3gv, 3hh, 3ly, 3ms, 3ni, 3mv, 3xi, (3yv), 3tb, (4aa), (4au), (4cb), 4cr, 4dq, (4fv), (4gh), (4gt), (4hh), 4io, (5as), 5ba, 5bf, (5bz), 5gf, (5hs), (5go). Can.—3afn, (ncg), nfv, nkf, nse.
 Foreign—cb, bx, 1b, 1ie, 1e. W1 ans all crds repting my sigs.

Continued on page 90



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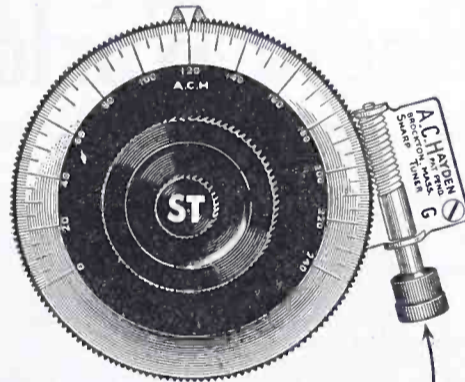
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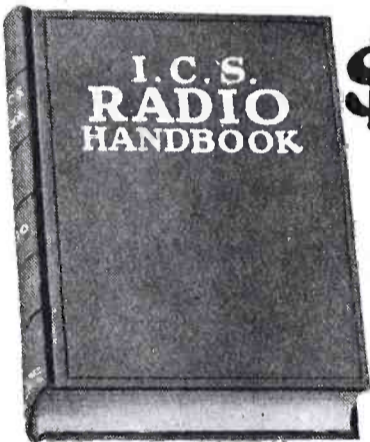
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3bhv, 3bz, 3chg, 3hh, 4fg, 4io, 4oa, 4tj, 4xe,
5aac, 5aal, 5aaq, 5acl, 5adv, 5agl, 5ajh,
5ame, 5aww, 5be, 5dw, 5jf, 5ka, 5rh, 5uk,
5adk, 5atp, 5bpl, 5bvj, 5cel, 5clc, 5dhw,
5fm, 5pl, 5ve, 5yx, 5zy, 9aau, 9abf, 9aol,
9awm, 9bcd, 9bfg, 9bio, 9cbf, 9cdv, 9cek,
9cjc, 9ctr, 9ded, 9eam, 9eht, 9ela, 9em, 9ny,
9qw, 9zb, 9zd, 9zt, nkf, nfv, wgh. Mex.—
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7gr, 7no, 7nw, 7sf, 7un, 8axn, 8doo, 8tt,
9ado, 9aks, 9amx, 9avy, 8bqi, 9bqu, 9caa,
9clq, 9eam, 9xbb. Can.—5gg.

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5aam, (5aek), (5agv), 5air, (5aly), 5akn,
5akq, 5akw, (5alj), (5alz), 5amh, 5ap,
(5apc), 5apj, 5aqw, 5aqy, 5cn, (5ge), 5jf,
(5ka), 5lr, 5nl, 5oq, (5qh), 5to, 5uk, 5wi,
6abe, 6arb, 6avj, 6bcl, 6blw, 6bq, 6bl,
6bur, 6cae, 6cek, 6cgw, 6chl, 6lv, 6ry, 6ur,
7agf, 7akt, 7bj, 7gb, 7pj, 7qc, 7sf, 7tq,
(9aad), 9aal, 9aau, (9ach), 9acq, (9agl),
9agz, 9alb, 9amb, (9amx), (9aog), (9asa),
9ato, (9atn), 9aus, 9ayv, (9azi), 9azz, 9baz,
9bcb, (9bcf), (9bdu), (9biq), (9blg),
(9bmk), (9bmy), 9bnu, (9bob), (9bph),
9bpt, (9bsz), (9btv), (9buk), (9bvn), 9bwf,
(9bwx), 9caa, (9ccf), (9ccj), 9cco, 9ccs,
9ccw, 9cdo, (9cdv), 9cee, 9cfi, (9cgr), 9cho,
9cip, (9clz), 9co, 9cro, 9csa, 9ctr, 9czm,
(9dap), 9dct, 9del, (9dfq), 9dga, (9djd),
9dlh, (9dlc), 9dlw, (9dng), (9duj), (9dww),
9dxn, 9dxr, (9dxy), 9dym, 9dyt, (9dzz),
(9ebh), 9ebv, 9ejl, 9elb, 9eli, (9ell), 9gs,
9ny, 9pq, 9uc, (9vm), (9xbe), (9ze), (9zy).
Can.—(1ei), (2bg), (2be), 2cg, (3ad),
(3bi), (3jb), (3ly), (3nf), 3ni, 3oh, (3wg),
(3wv), 4cr, 4hh, 5go, vdm.
Reports on my 5-watter greatly appre-
ciated.

By Bryce Sells, 810 "E" St., Oxnard, Calif.

C. W.—1kx, 2bye, 4hr, 4iz, 5acf, 5adv,
5aex, 5afx, 5ajj, 5apm, 5aqa, qra?, 5aqy,
5cc, 5ct, 5ej, 5ew, 5gu, 5ll, 5lm, 5ox, 5pm,
5qw, 5se, 5vv, 5wk, 5xa, 6's, 7ahs, 7ald,
7ar, 7va, 7ob, 8afz, 8api, 8apu, 8axf, 8bjt,
8cal, 8dal, 8del, 8dzd, qra?, 8rj, 9aen, 9bdq,
9bdw 9beb, 9bec, 9bjf, 9bji, 9bxx, 9ble,
9boj, 9cec, 9cer, 9cro, 9dbf, 9ded, 9dhw,
9djn, 9dlj, 9dlq, 9dnn, 9eam, 9ejn, qra?,
9fj.

Fone—5mf, 6cif.

I. C. W.—ndf, 9ds1.

Spark—nlv, njx, har.

All crds answered.

By D. Cason Mast, Bizbee, Ariz.

4io, 5ak, 5ew, 5fc, 5lh, 5pn, 5qh, 5ajj,
5apm, 5ada, 5ih, 6ja, 6rn, 6ti, 6aak, 6afh,
6aja, 6ajh, 6aji, 6ano, 6aqa, 6avj, 6bev,
6bbq, 6bfi, 6bkb, 6brf, 6bsg, 6btp, 6bts,
6cek, 6cgv, 6cig, 6cnf, 6crx, 6css, 6ctl, 6cto,
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9cee.

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4oa, 4qf, (4rr), 4sa, 4si, 4tj, 4xe, 4xx, 5ap,
5aw, (5ce), 5ez, 5ek, 5fs, 5ka, 5kg, 5ll, 5lp,
5mz, 5nj, 5oq, 5qh, 5qi, 5ru, 5uk, 5yd, 5xa,
5aaq, 5aef, 5afs, 5ags, (5agv), 5ame, 5apy,
5are, 6gt, 6ji, 6hs, 6pl, 6of, 6rn, 6ry, 6wt,
6adt, 6ahp, 6alu, 6avj, 6awt, 6atr, 6atr, 6bbq,
6bkd, 6blw, 6bmv, 6buh, 6buy, 6bwl, 6cae,
6cef, 6cgw, 6cqe, 6crx, 6xad, 7gr, 7ij, 7qc,
7sf, 9es, 9fj, 9mq, 9ny, 9rc, 9wo, 9zd, (9ze),
9zk, (9aad), 9abc, 9age, 9agz, 9ahy, 9aio,
9aks, 9att, 9ayi, 9bbj, 9beg, 9bdu, 9biu,
9bjr, 8bmc, 9bsz, 9bxg, 9caj, 9cap, 9cbc,
9cbi, (9cca), 9cgr, 9cdv, 9cfl, (9chc), 9cnb,
9ckm, 9ctg, 9dac, 9dau, 9dlc, 9dno, 9dmj,
9dpc, 9dpx, 9dsu, 9dzz, 9duo, 9eac, 9eas,
9ebq, 9eev, 9efy, (9elb), 9ell.
Can.—lar, 1dd, 2be, 2mv, 3dz, 3ly, 3om,
3vh, 4cr, 4dy, 4io, 4hh, 5cn, 5go.

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nkf, poz, uft, zm, 52a.

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1bfl, 1bfq, 1bgt, 1bhm, (1bip), (1blz), 1bgq,
1bqk, 1bvb, 1bv1, 1ccx, (1cdn), 1cfj, (1cl), 1cln,
(1ckp), 1cpn, 1cpv, 1dd, 1gv, (1mo), (1my),
(1sf), 1te, 1vu, 1wl, 1xau, (1xw), (1xz),
1yb, (3aak), (3adp), 3adt, (3aek), (3agf),
(3ahp), (3ahr), (3ais), (3ari), 3avk, 3bay,
(3bde), (3bfe), 3blu, (3bef), (3bpb), (3bsb),
3bta, (3btu), 3bva, 3bvu, 3cee, (3chg),
3chs, 3du, 3fc, (3fs), (3hs), 3ig, (3lr),
(3oq), 3qv, 3rs, 3wl, 4af, (4ai), 4cl, 4dl,
(4fg), (4fs), 4fq, 4hi, (4io), 4js, 4ku, 4ls.

4my, (4oa), 4oq, (4pi), 4pv, (4rr), 4sa, (4tj), 4vl, 4xe, 4xt, (4zd), 5ads, 5aek, (5agv), 5aic, 5air, 5aiy, (5ajh), 5ame, 5amh, 5amv, 5apc, 5be, 5fv, (5in), (5jf), 5ka, 5kq, (5li), 5ph, (5qh), (5rh), 5vv, (5wy), (5zai), (6aao), (6anb), (6apw), (6aup), 6bfw, (6bra), 6bur, (6cgo), (6cgw), (6gg), (6lv), 6pl, (6vc), (6wt), 6xad, 6xbn, 7bj, (7fd), 7fr, (7gk), (7ij), 8ada, 8aeb, 8ajm, (8aub), 8avx, 8baf, 8bhc, 8bic, (8bkh), (8bnh), 8bos, 8bp, 8bpl, 8ccq, 8ccr, (8chb), (8clc), 8con, (8cql), 8cwf, (8cww), (8cyi), 8dfi, 8dhw, 8dme, (8fm), (8gz), (8jq), (8nb), (8pl), 8px, 8rh, 8up, (8ve), 8xaq, 8zah, 8zg, 9aau, 9abf, 9ada, (9aei), 9akz, (9aeg), 9ap, 9arj, 9atn, (9avg), (9awm), 9axz, (9ayx), 9azj, 9azx, 9beb, 9bcc, 9hed, (9bcx), (9bdu), 9bex, 9bhf, (9biq), 9bly, 9bm, 9bmk, (9bmx), 9bqf, (9bqy), (9brx), (9buk), 9bvn, (9caj), (9cbf), 9ccf, 9ccx, 9cdv, (9cii), 9cjc, (9clq), 9cnw, 9cro, 9csi, 9ctd, 9ctr, (9cvi), (9cvs), (9dap), 9dbf, 9dbw, (9ddp), 9dqa, 9dxn, 9dxr, (9dxy), (9dyn), (9dyt), 9dza, (9eas), (9ebh), 9ekf, 9eky, (9elb), (9eld), 9em, 9es, (9hw), (9ny), 9sy, 9vd, 9vm, (9xbb), 9za, (9zb), 9zt.
 Can.—2be, (2cg), (3bp), 3co, 3fc, 3gg, 3gk, 3kq, (3mv), (4cr), 9lc, mz, qra?, muu, ncg, qra?, (nfv), (nkf), (iht).
 Mex.—(1b), (52a), qra?

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 1aac, 1abf, 1aid, 1ajp, 1arf, 1bbo, (1bcu), 1bdx, (1bjo), 1bie, 1brx, 1bwj, (1cab), 1ccz, 1cmp, 1cmx, 1ei, 1gv, 1pl, 1my, 1x, 1sf, 1vc, 1xae, 1xam, 1xw, 2acs, 2agb, 2azy, (2bck), 2bgi, (2bir), (2boo), (2bqw), 2brb, 2bse, (2buy), 2byw, 2by, 2cee, 2cel, 2cg, 2enk, (2coa), 2cqz, (2cty), 2cvj, (2cvu), (2cyw), (2czr), 2ev, (2fo), (2kf), 2iu, 2mu, (2qs), (2rk), (2ry), 2wr, 2wz, (2xbf), 2xi, (3ach), 3adb, 3adp, (3aen), 3apv, (3auv), 3bco, 3bg, 3bj, (3bmn), (3bmo), 3bnu, 3bta, (3btq), 3btu, 3buy, 3bvl, 3ccu, 3cel, 3chc, 3chg, 3cjn, 3ckl, 3hg, 3hs, 3kg, 3lg, 3lr, 3mb, 3mf, 3mo, 3oe, 3og, (3qt), (3tf), (3wx), 3zo, 5aac, (5aaj), (5abf), (5acm), (5aeq), 5alr, 5aiy, (5ajn), (5ajt), (5akp), (5amh), (5alz), 5aom, (5app), (5arb), (5be), (5ck), 5cn, (5ek), (5er), 5es, 5ez, (5fv), (5gi), (5in), (5jf), (5ka), 5kc, 5mb, (5ml), 5nj, (5nt), 5ox, 5qh, 5qz, (5pk), (5ru), (5se), (5sh), 5tq, 5tx, 5uj, 5uk, 5ux, (5vv), (5xa), (5zas), 6acm, (6adt), 6afz, 6age, 6agk, (6ahp), 6aid, 6amg, 6and, 6aol, 6aos, 6apw, 6ase, 6avv, 6awt, 6bbc, 6bbh, 6bcg, 6beh, 6bfw, 6blw, 6brf, 6bt, 6bwl, 6cfz, 6cgw (most consistent), 6chl.
 Continued on page 100

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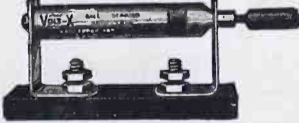
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ELECTRIC FILTERS

Continued from page 28

pass filter, and its action may be analyzed in the same way as that of the low. It is seen that the series and the shunt elements are the reverse of the low pass filter. The series section is a capacity which has very low reactance at high frequencies and very high reactance at low frequencies. Hence it lets through the high frequencies and tends to suppress the low frequencies. The opposite behavior of the shunt inductance L assists this filtering action. The shunt inductance L offers very low reactance to the low frequencies, hence it short circuits the low frequencies, thereby preventing them from passing to the load. On the other hand, due to its high reactance at high frequencies, it does not accept the high, which must therefore pass on to the load. Here again the exact frequency at which the high frequencies begin to be admitted depends upon the value of L and C , and by properly proportioning them the filter may be made to pass currents from any assigned frequencies up to infinity.

Two of the very simplest types of filter circuits which form the basis of the band pass and exclusion band filters are the series resonant circuit and the parallel resonant circuit, both very well known to the radio amateur and broadcast listener. The series circuit of Fig. 11(a), used as the tuned circuits of almost every type of receiving set, has a resonance curve or transmission characteristic as shown in Fig. 11(b). From this curve it will be seen that maximum transmission occurs at the frequency f_0 , to which the circuit is tuned, and that only a limited range of frequencies between f_1 and f_2 are transmitted. In other words, the series resonant circuit behaves like a simple band pass filter.

The more sharply it is tuned the narrower the band of frequencies which it passes and the limit is reached when it passes only the frequency to which it is tuned, which is the condition aimed for in the tuning of radio sets.

The parallel resonant circuit of Fig. 12(a), on the other hand, performs in an inverse fashion. Its transmission characteristic may be drawn as in Fig.

12(b), from which it is seen that it transmits least at the frequency to which it is tuned, and transmits very little within a narrow band of frequencies between f_1 and f_2 . Outside of these limits it passes all frequencies very well. Thus a parallel resonant circuit may be regarded as a simple exclusion band filter. The more sharply it is tuned the narrower the band of frequencies which it excludes. The reader may now recognize that the parallel wave trap used to reduce interference does so by virtue of the fact that it functions as an exclusion band filter, and excludes those frequencies which create the interference.

In the foregoing we have considered qualitatively the behavior of some of the simpler types of filter circuits. The performance of these filters may also be derived graphically from a consideration of the reactance characteristics of the series and shunt elements making up the filter. In the following we will denote the reactance of the shunt section of the filter by X_1 , and the reactance of the series section by X_2 .

The performance of a filter depends upon the values of the series and shunt reactances. These values determine the so-called "cut-off points"; that is, they determine the frequency at which the filter begins to pass currents and exclude currents. These cut-off points are really

the boundaries of the band of frequencies which the filter passes. Thus, take the case of the low pass filter whose characteristic is shown in Fig. 1. The range of frequencies which is admitted by the filter is bounded by the frequency zero and f_1 . These two frequencies are the cut-off points of this filter, and these cut-off frequencies are determined by the reactance values of the shunt and series elements of the filter. Likewise in the case of the band pass filter whose characteristic is shown in Fig. 3, the cut off frequencies are f_1 and f_2 , since these frequencies bound the band which is admitted by the filter.

Out of the complex mathematics involved in the study of filters we may take two very simple formulas which tell us what the cut-off frequencies of any particular filter are. A filter will have one cut-off point at that frequency f_1 which makes the series reactance X_2 equal to zero. It will have another cut-off point at that frequency which makes

$\frac{X_1}{X_2}$ equal to -4 . These two conditions

may be set down thus: If

$$X_2 = 0 \text{ at a frequency } f_1, \text{ and}$$

$$\frac{X_2}{X_1} = -4 \text{ at a frequency } f_2$$

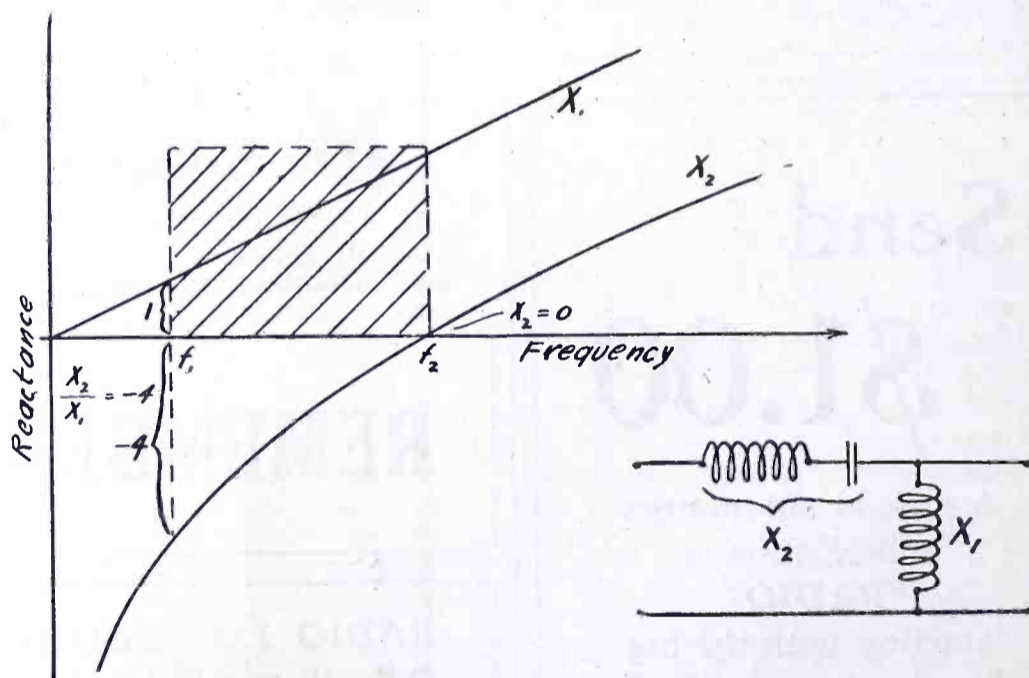


Fig. 15. Band Pass Filter

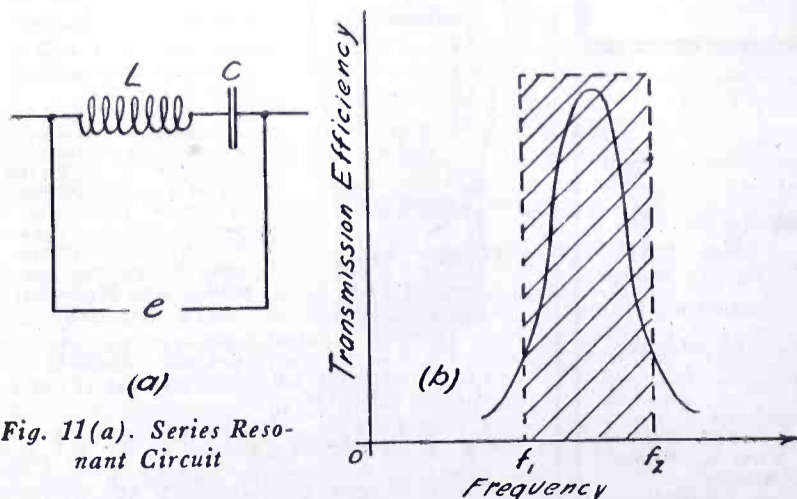


Fig. 11(a). Series Resonant Circuit

Fig. 11(b). Transmission Characteristic

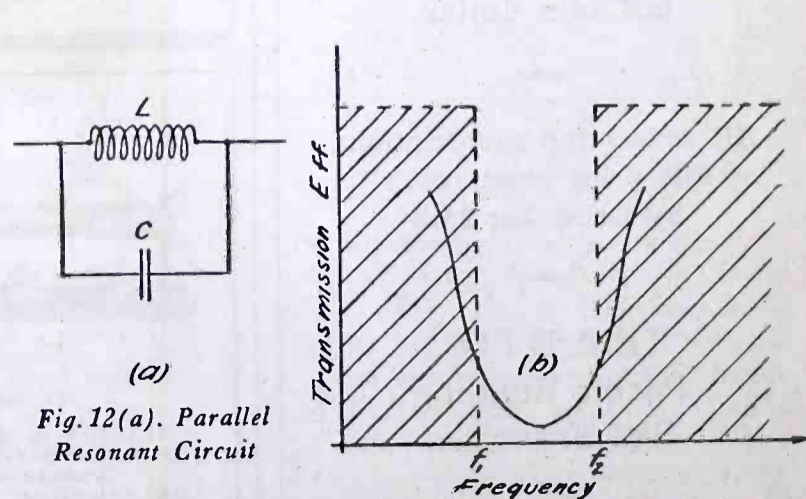


Fig. 12(a). Parallel Resonant Circuit

Fig. 12(b). Range of Frequency Excluded

then the filter will pass all currents having frequencies between f_1 and f_2 , and will exclude those currents outside this range.

Knowing these two conditions we can determine graphically what any filter will do from the reactance curves of the series and shunt elements of the filter. Let us take the filter circuit of Fig. 9 as our first example. If we draw the reactance curves of the series and shunt elements on the same plotting paper and scale they will appear as in Fig. 13,

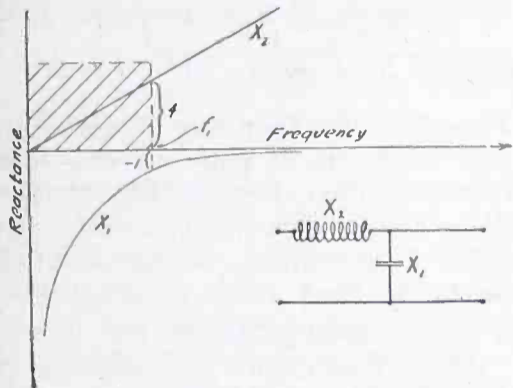


Fig. 13. Low Pass Filter

where the straight line X_2 represents the series inductance, and the curved line X_1 represents the shunt condenser. From the curve we see that X_2 equals zero at zero frequency. Hence, according to the conditions given above, zero frequency is one cut-off point of this particular filter. At point f_1 it will be seen that X_2 is equal to $-4X_1$, or $\frac{X_2}{X_1}$ equals -4 . Hence f must be the other cut-off point of this filter. Therefore the filter of the type shown in Fig. 9 will pass all currents from zero frequency to f_1 , and will exclude all frequencies above it. In other words, it is a low pass filter, passing all the frequencies below f_1 .

Suppose now that we consider another type of filter, as in Fig. 10, where a condenser is a series element and an inductance is a shunt element. Here, too, we can determine what this filter will do by a simple consideration of its reactance characteristics. In Fig. 14 we

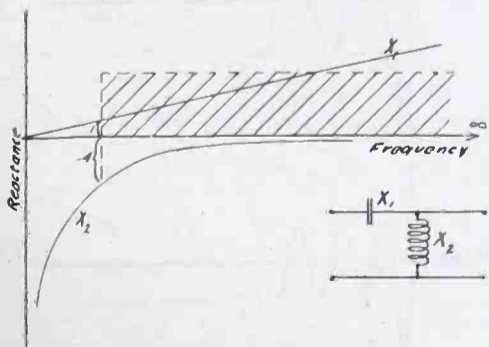
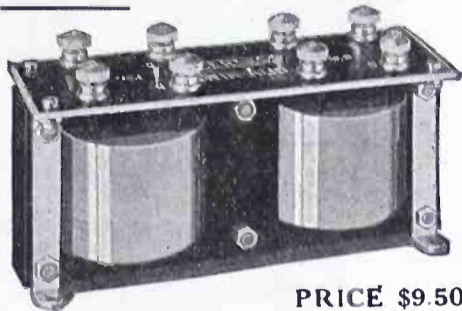


Fig. 14. High Pass Filter

have drawn the reactance curve of the shunt inductance, X_1 and that of the series condenser X_2 . From this curve we see that the reactance of the series condenser X_2 is zero at infinite frequency. Therefore infinite frequency must be one cut-off point of this filter, according to the conditions outlined above. Also at point f_1 the value of X_2 is $-4X_1$, or

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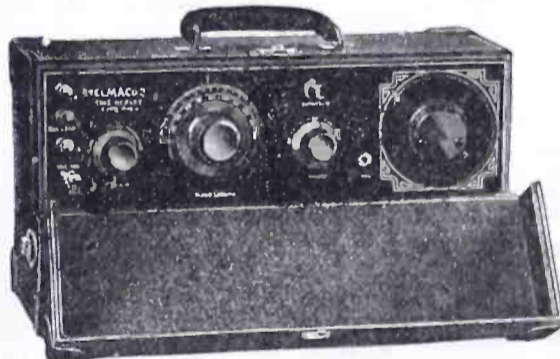
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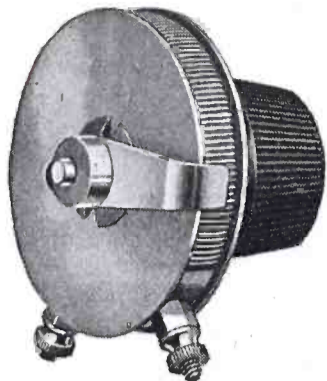
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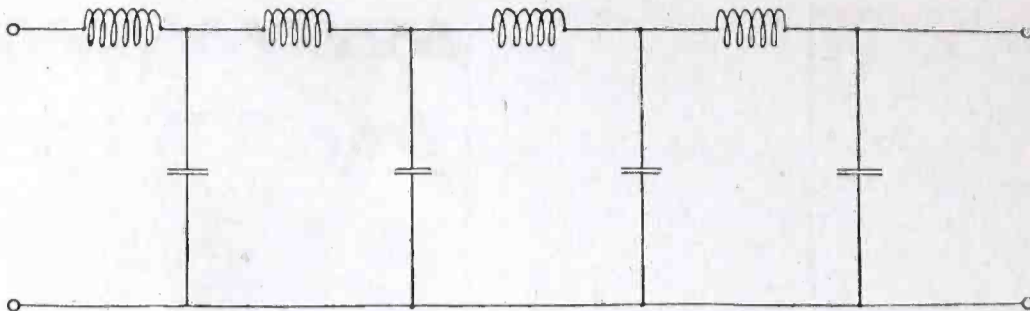


Fig. 16. Low Pass Filter of Four Sections

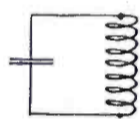
$\frac{X_2}{X_1}$ equals -4 . Hence this point f_1 must be another cut-off point of this particular filter. That is, the filter shown in Fig. 10 will pass all currents having frequencies above f_1 , and will not pass any below f_1 . Thus it must be a high pass filter.

Let us consider a more complicated filter such as that shown in Fig. 15, in which the shunt element is an inductance, but the series element consists of a coil and condenser in series. The reactance of the shunt inductance is a straight line as before, and is so shown in Fig. 15. The reactance of the series element (coil and condenser in series) is the sum of the two curves shown in Fig. 13, and appears as X_2 in Fig. 15. From this figure we see that the series element X_2

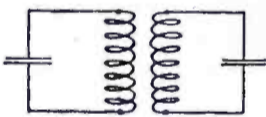
becomes equal to zero at a frequency f_2 . Therefore this must be a cut-off point of this filter. Also at frequency f_1 the value of X_2 is $-4X_1$, or $\frac{X_2}{X_1}$ equals -4 .

Therefore this frequency f_1 must likewise be a cut-off point of this filter. Hence the filter shown in Fig. 15 passes all currents within the band of frequencies between f_1 and f_2 , but excludes those outside the band. Hence the filter shown in Fig. 15 must be a band pass filter.

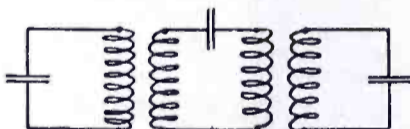
These illustrations are sufficient to show how the performance of a filter may be qualitatively understood from a consideration of the reactance characteristics of the filter circuit. In our discussion we have considered each filter to be made up of only one section, that is,



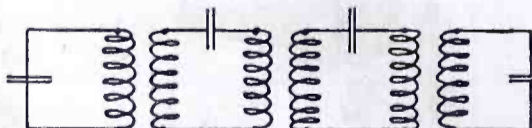
1 Section



2 Sections



3 Sections



4 Sections

Infinite Sections

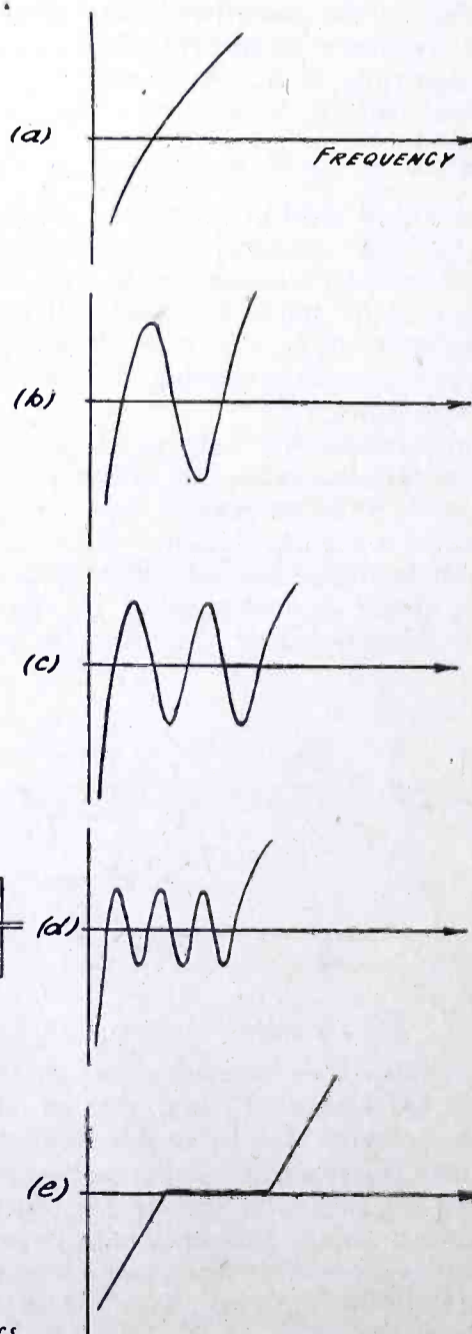


Fig. 17. Reactance Characteristics

one series element and one shunt element. However, the filtering action improves as the number of sections is increased. Thus in Fig. 16 we have a low pass filter of four sections. In the first section the high frequencies are shunted by the condenser and are not permitted to pass through the inductance on account of its high reactance at high frequencies. Thus only the low frequencies are passed. However, owing to the imperfections of existing coils and condensers some of the high frequencies will pass by the first section. If another section is added the second shunt condenser will shunt most of the high frequencies which managed to get through the first section, and the second inductance will tend to stop any high frequencies flowing through it. Thus there will be still less of the high frequencies at the end of the second section. In the same way succeeding sections continue to weed out more and more of the high frequencies, at the same time letting through the low frequencies. Thus the more sections added the better.

This may likewise be shown graphically by considering the reactance curve again. A single tuned circuit is a filter. Its reactance at the resonant frequency

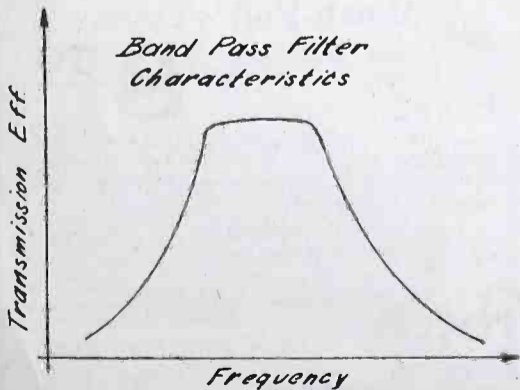
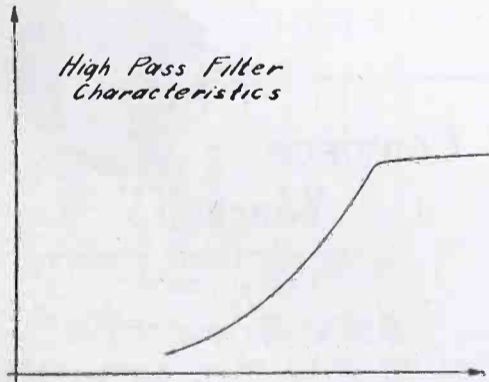
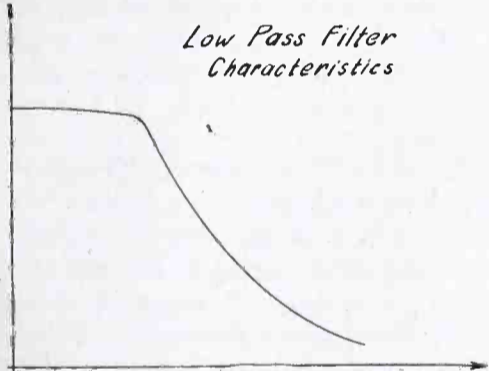
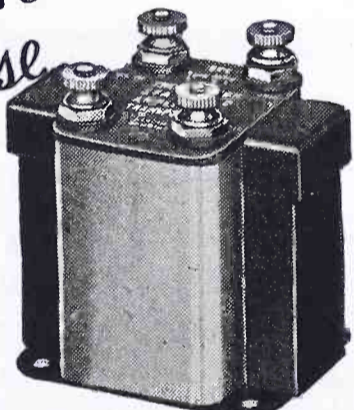


Fig. 18. Characteristics of Low Pass, High Pass, and Band Pass Filters

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is zero, and its reactance curve is shown in Fig. 17(a). If we couple to it another tuned circuit the reactance curve of the combination is as shown in Fig. 17(b), which shows three zero reactance points. If still another coupled circuit is added the reactance curve becomes that of Fig. 17(c) with a couple more zero reactance points. This continues as the number of sections is increased, and when an infinite number of sections is used the reactance curve becomes that of Fig. 17(e), which shows zero reactance over the band of frequencies, which is transmitted.

In conclusion it should be stated that actual filters do not give such sharp cut-off points as shown in these curves. These sharp cut-offs are given by ideal filters. Actual filters give cut-offs more like those shown in Fig. 18, which are rounded due to the resistance of the coils and condensers which make up the filter.

A sand screen or sieve permits sand particles below certain size—this depending upon the mesh of the screen—to pass through but exclude all particles above this size. The sand screen may be called a sand filter similar to the water filter. It is seen that the idea of a filter presupposes two separate actions: one of exclusion, and one of admittance.

The electric filter behaves in a similar manner, namely, it excludes certain currents and admits others. In the case of the mechanical filters the basis of discrimination is the physical dimensions of the objects admitted or excluded. Thus sand above a certain size is excluded by a certain mesh sieve. In the case of electrical currents we take as the basis of discrimination the frequency of the current.

BUILD-UP

MICA CONDENSER

Patent Pending

insure high efficiency and the Build-Up feature enables the operator to obtain any definite capacity from .00025 to .006 by simply adding extra plates of copper and mica to the Build-Up base.

Each alternate copper and mica plate has a capacity of approximately .0002 Mfd.

Build-Up Mica Condensers of the following capacities, each assembled complete in carton, at the following prices:

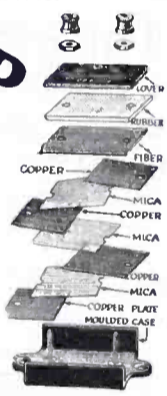
Capacity	List price
.00025 Mfd.	50c
.0005	55c
.001	60c
.002	65c
.0025	70c
.005	75c

Extra envelope containing 20 copper and mica plates, or sufficient to build up a condenser from .00025 to .006, list price 25c.

Table showing required number of plates needed for any capacity is furnished with each condenser.

Ask your dealer—or order direct
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1402 W. Delaware Ave., Toledo, Ohio

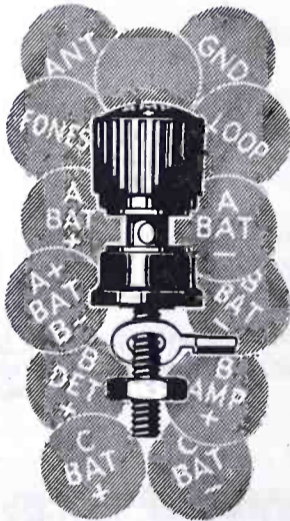


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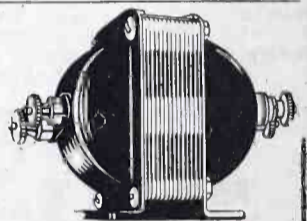
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Crescent Transformers

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NOTICE!

Full Size Panel Layout of Improved "Best" Super Will Appear in January "RADIO." Don't Miss It!

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U. S. Patent
1,495,582



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The Balkite Battery Charger is today universally accepted as one of the most efficient and trouble-free methods of charging radio batteries.

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Charges the 6-volt "A" battery at 3 amperes, from 110-120 AC, 60 cycle current. Special model for 50 cycle. Will also charge "B" batteries of the lead type. If your dealer cannot supply you, sent direct prepaid on receipt of price.

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FANSTEEL East of Rockies \$19.50
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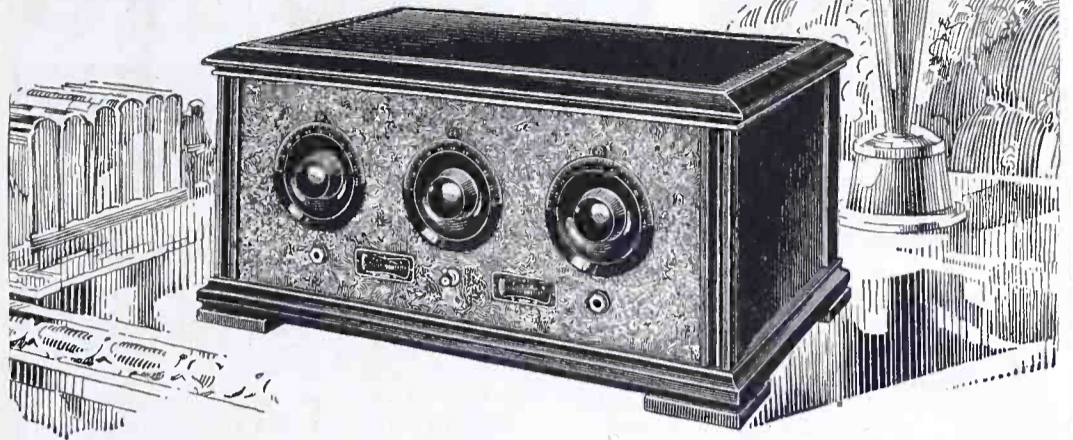
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EISEMANN

ELECTRICAL EQUIPMENT



Type 6-D Broadcast Receiver

Non-oscillating — Non-radiating

SPECIFICATIONS

Circuit: Two stages of tuned radio frequency amplification, detector and two stages of audio frequency amplification. Non-oscillating. Non-radiating. Astatic transformers used to minimize mutual induction.

Tubes: Five in all. Jacks provided for either five or four tube operation.

Batteries: Either storage or dry-cells.

Cables: Complete set supplied for "A" and "B" batteries.

Wavelengths: 200 to 600 meters, with uniform efficiency of reception.

Aerial: 75 to 125 feet, single wire.

Panel: Aluminum, with attractive crystal black finish. A perfect body capacity shield.

Dials: Sunken design. Shaped to fit the hand and permit a natural position in tuning.

Rheostats: Adequate resistance for all standard base commercial tubes.

Condensers: Single bearing, low leakage losses.

Sockets: Suspended on cushion springs which absorb vibrations.

Cabinet: Mahogany, with distinctive lines and high finish. Ample space provided for "B" batteries.

EISEMANN

THE real, intrinsic value of the 6-D Receiver can be fully appreciated only by making direct, side-by-side tests with other makes.

Such comparisons need not be confined to sets in the same price-class. The 6-D is the equal, in every detail, of many receivers priced \$25, \$50 and even \$75 higher.

Performance of the highest order strikingly attractive appearance and moderate price—all these elements of true worth are found in the 6-D

You will note its clarity and the full, generous volume. You will also observe the unusual sharpness of tuning. And the finely carved, high finish mahogany cabinet will make a strong appeal.

Price \$125.00 without accessories. For sale by reliable dealers.

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General Offices: 165 Broadway, New York

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CHICAGO

3 BIG THINGS that this WINDING

does to improve Reception

All transformers are alike except SAMSON'S. For SAMSON'S are the only transformers with Helical Wound Coils—with the wire wound in discs which are laid at right angles to the coil. No paper insulation is needed or used. Helical Winding gives SAMSON Transformers three big advantages:

[1] Maximum Amplification: SAMSON transformers have, by scientific tests, an amplifying efficiency of 51, which is reached at lower frequency than in any other transformer.

[2] Minimum Distortion: The Helical Winding practically eliminates distortion throughout entire audio range.

[3] Minimum Distributed Capacity Effect: Adjacent turns of wire in SAMSON Helical Windings are but 80 turns apart instead of 800 to 1200 or more as in others. This reduces distributed capacity, or electrical resistance, to an absolute minimum.

Samson Helical Wound Transformers

Examine SAMSON Helical Wound Transformers at your radio dealer. Test them. Use them in the set you are building; or replace transformers in the set you now have.

SAMSON HW-R1 Transformers for Super-Heterodyne circuits are perfectly matched.

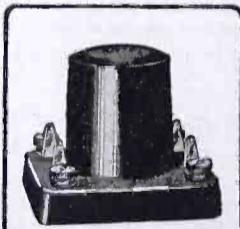
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AT RIGHT: Samson HW-R1 Transformer

NOW
\$5.00
Two Ratios
3 to 1
6 to 1



H.W.
stands for
HELICAL
WINDING

HAMS I HAVE VISITED

Continued from page 40

pocket, so he brought a barrel, and yours truly has got some dandys himself Hi. He had some trouble with the Radio Inspector and therefore will not be on the air until this fall, and in the meantime he is rebuilding and expects to give 'em all a run for their money. He is installing a 250-watt tube and will have 3 ops always on the job.

Leaving Parkersburg, I thought I would like to visit a few 5's, so went down to Bristol, Tenn., and expected to see 5AGO, but was told he was out of town and therefore had to get out, as he was the only one in that town.

Got into Knoxville and called on 5WO, the city manager, and he showed me his outfit, which consisted of a four 5-watt combination in a Hartley circuit which has done some wonderful Dx for this shack. Working the coast with only 30-watt input was the feature act of this station also being reported by a ship op. 300 miles off the Pacific Ocean. After working a few stations on his transmitter, we went visiting and called on 5JV, 5UV, 5ACK, 5AKW, and 5LF, who was busy looking for power leaks, as the poor boy was getting blamed for everything that was going on the air. The majority of these hams are non-active in the summer time and are more interested in the "YL" than the old side swiper, but 5WO makes up for all of them by taking care of the traffic report and handling most of the messages.

After riding around in 5RE's flivver (they all happen to be flivvers Hi) I left for Nashville, where I thought I would strike some better luck, but it seemed that the first ham I called on, 5AAM, had a call but no station, so went over to 5FV, who is using an "E" tube as a master oscillator for a 50-watt tube. His motor generator delivers 1,000 volts which feed the hungry plate and sticks 4 amps into the old hot wire meter. His receiver is the berries, tuning as low as 40 meters pulling in foreign stations with ease. His best DX for the winter month was working all districts in one evening, as well as being heard by WNP.

Left Nashville and started for Jackson, Tenn., but couldn't find anyone interested in the transmitting end of it, so beat it right out and got into Memphis, which is supposed to be a ham's paradise. Visited most of the gang, who tried to persuade me to stay over for their big convention, but couldn't very well do it as my funds were getting low, so started for home but stopped in to see 3TX in Corinth, Miss., who is doing some good Dx on three 5-watters. He is about the only ham in that town who really handles traffic and as he is a dentist he has his hands full between pulling teeth and pounding brass. He is shortly leaving for a month's vacation and will take along a portable transmitter and receiver with him.

Leaving Corinth I arrived at Savannah, where I intended to see some hams but couldn't get the chance, as I had passage on the *S. S. Birmingham* bound for New York and my time was limited. But as soon as I boarded the ship I went up to the radio shack and found an old timer pounding away at the old familiar Marconies 2 KW spark. His call is 2CPX when at home and he sure did chew the fat for a long time. Letting me listen to the static about 100 miles out convinced me there's no place like home and stick to my little shack in the north and not do any complaining after this.

Well, to sum up the entire trip, it was not half as bad as I thought it would be, as the hams treated me nicely and I want to take this opportunity to thank them again for all courtesies extended. Will take another trip shortly (as soon as I rob some bank Hi), this time through the 6th and 7th districts and will let the boys know all about it.—3 BVA, York, Pa. Transmitted at 8 BFE.

Special Announcement

Gerald M. Best's new revised and improved Super-Heterodyne will be the big feature of January "RADIO." This issue will be the best number of "RADIO" yet published. The demand for copies will be greater than the supply. Send 25c now for a copy. We will mail it to you on December 21st.



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 Better-Costs Less
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THINK of the boundless delight of that dear old mother, confined to the house by the rigors of winter or the infirmities of age, when she listens in for the first time on a Crosley Radio. Imagine the joy of the kiddies, when they awaken you Christmas morning with the glad tidings that "Santa has brought us a Crosley Radio." Then decide to make this a Crosley Christmas.

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It is a delight to operate a Crosley. The immediate response to the turn of the dials; the clearness of reception from far distant points; the real ease with which local stations may be tuned out; all help to make Crosley reception distinctive and exceptionally pleasurable. The very low cost at which this really remarkable radio performance can be obtained places Crosley Sets within the reach of all—the ideal Christmas gift.

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 \$3.75*



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 With tube and Crosley Phones \$22.25



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A Perfect Radio Christmas Gift

You, of course, desire to give the best you can afford and if any Mozart product comes within your price limit you will always have the satisfaction of knowing you gave the best. You will enter into a little of what we enjoy from day to day, as we continue to receive entirely unsolicited appreciations like the following:

"Baby Grand received, and, saying that I was surprised is putting it very mild. Due to low B battery voltage, a \$25.00 speaker would not work, so hooked up the Mozart on a one tube Auto-Plex, and secured KDKA, WBZ, WGY and several others with volume enough to fill the room. I then hooked it up to a two tube Crosley, securing more volume with very satisfactory results.

"This is not a fair trial, as none of the B batteries registered over 16 volts, and to be exact, they were as follows: 16-16-15-14. Will say the tone was exceptional, very little distortion, if any, volume wonderful, and, will simply say that none of your claims are exaggerated, but are very modest and conservative.

"You have a product worthy of consideration, and the best all round speaker I have tried out and I feel you are due this letter of appreciation, which you may use as the quality of your product deserves it."

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Continued from page 91

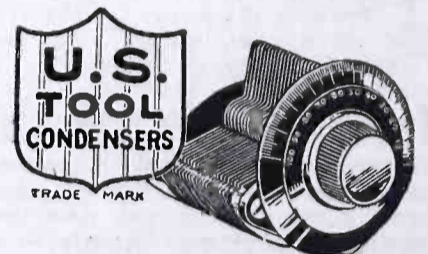
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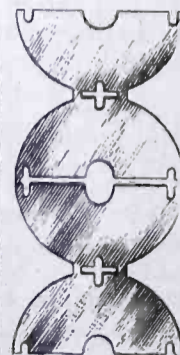
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Continued on page 102



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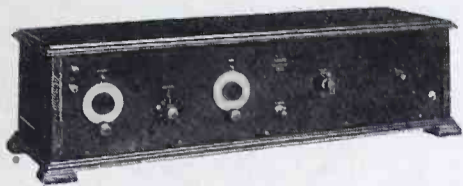
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This set is designed with one step of tuned radio frequency applied to the standard Acme Reflex circuit (rights fully protected). Three stages of untuned radio frequency amplification and three stages of audio frequency amplification give you eight-tube efficiency in performance with a five-tube set. Crystal detector insures purest tone and eliminates detector tube adjustment.

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If you want a set with selectivity and range, but easy to tune and free from distortion, get the facts on the Terlee-Acme Reflex Receiving Set. Ask your dealer. If he cannot give you complete information, write us sending us his name.

JOBBERs—Write us for the details and prices.

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Distant Stations with Volume

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A highly selective, triple circuit, single tuning control,
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Plenty of volume on both local and distant stations to operate a loud speaker and fill your living room with entertainment for the entire family.



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PACIFIC RADIO PUB. CO., Pacific Building, San Francisco

Continued from page 100

5mi, 5nn, 5nt, 5oq, 5ox, 5ph, 5qh, 5se, (5aaq), 5acm, 5agv, 5air, 5aiy, 5ajh, 5akd, 5alj, 5amh, 5aqy, (5zas), 6lv, 6pl, 6tl, 6aao, (6adt), 6ahp, 6aja, 6ajn, 6alv, 6arb, 6ase, 6avj, 6awt, 6bao, 6bel, 6bkb, 6blw, 6bql, 6bui, 6cba, 6cgw, 6chl, 6cqe, 6crx, 6xad, 7gk, 7akk, 8ab, 8ah, 8ay, 8bf, 8bn, (8bp), 8bw, (8dc), 8ef, 8es, (8fm), 8fn, (8hb), (8ir), 8jq, (8jw), 8ku, (8lo), 8mc, 8nb, 8nl, (8qv), (8rj), 8rv, 8ry, (8sf), 8tt, (8tw) 8ut, 8vq, (8wz), 8zg, 8zz, 8aam, 8abm, 8ada, (8ade), 8aeb, 8aer, 8agw, 8alg, (8ali), 8alf, (8ali), (8anb), 8aol, (8apn), (8apo), (8apt), (8ase), 8atc, (8atd), (8atz), 8aub, 8avj, 8aws, 8axf, (8axn), 8bbf, 8ben, 8bgn, (8bhj), (8bah), 8blp, (8bmi), 8boa, (8boe), (8boq), 8bow, (8bpl), 8bpu, 8bpv, (8bqn), (8brb), 8brc, (8brj), 8bsq, (8bsu), (8btf), (8bvr), (8byf), (8bzd), 8bzf, (8cab), 8ccb, 8cbp, 8cci, 8cct, 8cdc, (8ced), (8cej), 8cgf, 8chy, (8cix), 8cmh, 8cmt, (8cni), (8cnw), 8coi, 8coj, (8con), 8ctu, 8cur, 8cwm, (8cyt), 8dae, (8dbo), (8dea), (8dfm), 8dga, (8dgb), (8dgo), (8dgp), (8dhs), (8dhw), (8dle), (8dif), (8diz), (8dki), (8dln), 8dmx, 8dnf, (8dny), 8dol, (8dok), 8dpj, (8dpk), 8dsa, (8dsn), (8zab), 9ei, 9fj, 9gp, 9la, 9my, (9nl), 9nu, 9ny, (9oa), 9pb, 9ry, 9vc, 9vm, 9zd, 9aad, 9aaf, 9aaw, 9abb, (9ach), (9ado), (9adk), 9adq, 9afi, (9agz), 9ahe, 9ahz, 9aig, 9aio, (9amb), 9amp, 9amx, 9ana, (9aog), (9aoo), (9apd), (9asa), 9atn, 9awp, (9ayd), (9azr), 9bbj, (9bdb), 9bdn, (9bdu), 9bew, 9bfb, 9bbh, (9bhf), 9bis, (9biq), 9bjl, (9bjz), 9bk, (9bkr), 9bmk, (9bmx), (9bna), (9bre), 9bsz, (9bvn), 9bxg, 9bzi, 9caa, 9ccj, (9cck), (9crp), (9scb), 9ctj, 9ctr, (9csg), (9cur), 9cdv, (9cee), (9cfs), 9cgr, 9cii, 9cjb, (9cjc), 9cjh, 9ckb, 9cln, 9clz, 9cnb, (9cov), 9cro, 9czb, (9dap), (9dat), (9dcw), (9dek), 9del, 9dfz, 9dge, 9gds, 9dix, 9djd, 9dkv, 9dcl, 9dlk, 9dlw, 9dmi, (9dng), (9drx), 9dut, 9dyt, 9dyy, 9afz, (9eht), (9eib), (9eji), (9eir), (9ra?), 9eky, 9ell, 9elz, 9xbb, I. C. W.—1cl, (1fb), (1ra), (1so), (1aav), (1adb), 1ckp, 3zo, (3btq), 3xan, (4bx), (4dx), 5aw, (5nl), 8eb, 8rv, 8aro, (9rc), (9dwx), NRG, VDM, WNP. Fone.—(1ij), (8apn), (8boq), 8brc. Spark.—1azt, 1btf, (3qw), 4fg, 9aaw. Canada.—1bq, 1dd, (1ef), (1ei), 2ax, 2fj, 3bq, 3co, 3gg, 3gk, 3he, 3kg, (3kq), 3vh, 3wg, 3wv, (3afp), 5cn. Please report on 2WZ signals. Will qst to all who ask.


Anti-capacity JACKS


Anti-capacity SWITCHES


Lower-Loss Vernier VARIABLE CONDENSERS


Lower-Loss PHONE PLUGS


Lower-Loss RHEOSTATS


Lower-Loss SOCKETS


Lower-Loss VARIO-COUPPLERS

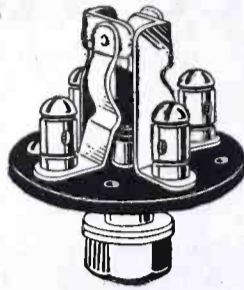

Lower-Loss GRID LEAKS


Lower-Loss INDUCTANCE SWITCHES


Lower-Loss POTENTIOMETERS

NO SOLDERING LESS DRILLING
SCIENTIFICALLY BUILT

-and then hear the difference!



JOS. W. JONES Double Circuit Jack—\$1

Anti-capacity JACKS—5 Types



JOS. W. JONES "A" Battery Switch—\$1

Anti-capacity Switches—5 Types

You know what you want from that set—longer DX, clearer tone, no interference. Get what you want by building with Jos. W. Jones parts. Aside from better results, it is twice as easy to work with Jos. W. Jones parts.

Jos. W. Jones Jacks and Switches kill capacity effects. The long parallel leads of old-style jacks and switches act as condensers. Jos. W. Jones Jacks and Switches pass the "juice" through without loss. Ask for the switches with the little red button.

For Better Results Build with Jos. W. Jones

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| Jacks | Rheostats |
| Switches | Vario-couplers |
| Sockets | Potentiometers |
| Grid Leaks | Induction |
| Variable Condensers | Switches |
| | Phone Plugs |

Always ask for the switches with the little red button

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TRADE MARK
"IMPROVED"

radio parts

JOS. W. JONES RADIO MFG. CO., INC.
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FROST-RADIO

A New Development

FROST-RADIO offers a brand new development in jack design and construction. Pan-Tab Jacks support panel for panel-hung assembly. Heavy triple nickel plated frame; extra wide springs. All types at your dealers.

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SUPERTRAN SHIELDED!



The Supertran Audio Transformer is now shielded—absolute protection against damage while mounting. For distance, volume and clarity of tone the Supertran is unrivalled. It is the perfect transformer.

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Manufactured by
FORD MICA CO., Inc.
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Write for interesting literature

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Here is a Crystal that is worth its weight in gold to any radio owner. It is sold on the very broadest guarantee to SATISFY THE PURCHASER, and thousands of letters of grateful appreciation testify to the merits of B-METAL LOUD TALKING CRYSTALS. Get them from your dealer but remember that there is no substitute for B-METAL CRYSTALS.
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Four Way Company
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QUALITY LOOP

The only folding loop on which wires stay taut when opening and closing. Wires CAN'T get tangled!

**Simplest, Most Positive
Single Radio Plug**



The Spring Terminal used in the Single Plug and the Four Way Plug (shown below) is without doubt the surest and best connection, as the tips are gripped all around, insuring a perfect connection with no lost energy.

No tools are needed. Just insert tips by pressing and turning to the right. Fits all standard Jacks; takes all types of tips.

Price 50c.

**The New Four Way
Switch Plug**

Is a multiple plug used to connect the head phones and loud speaker to the radio set.

The dial at the base of the plug stem revolves with stops in four positions.

No tools needed. No set screws to get lost. Fits all standard Jacks. Takes all types of tips.



The Extension

**Cord
Jack**



is manufactured to enable those who want to use the loud speaker or phones in other parts of the house without moving set.

No tools or soldering iron needed to make connection.

Price \$1.00

Takes any standard plug.

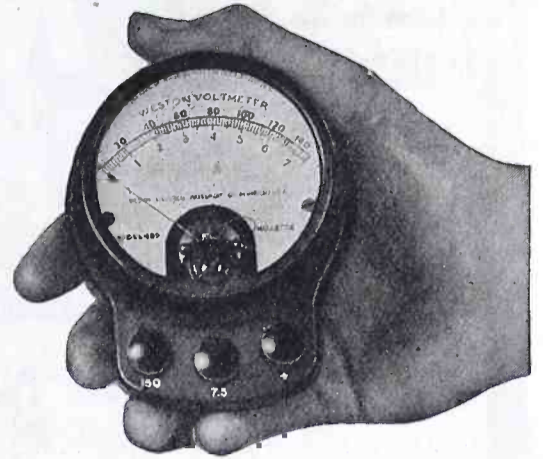
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**Weston---A Table Voltmeter that
Insures the Evening's Pleasure**

Locates trouble immediately, and will show you which cells need replacing, if your batteries are not just right. Will accelerate exact tuning and eliminate noise. Close regulation with the aid of a dependable voltmeter will prolong the useful life of a tube enormously. Model 489 is a high resistance, double range, portable instrument for accurately measuring filament and plate voltages, for testing A and B batteries and for locating trouble and making continuity tests. Ranges 0-150, 0-75 volts.

Write for complete information. If your dealer cannot supply you, we shall fill your order direct.



Weston Electrical Instrument Co.,
156 Weston Ave. Newark, N. J.
Branch Offices in All Principal Cities

Electrical Indicating Instrument Authorities Since 1888

WESTON

STANDARD - The World Over

T. M. R.

U. S. P. O.



"Bruno"

3 in 1

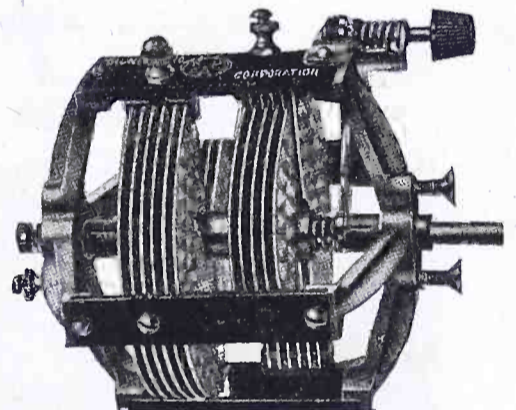
Ultra-Vario Condenser

A balanced precision instrument; scientifically designed, with three capacities:

.000125 — .00025 — .0005

The equivalent series resistance at 1,000 cycles (of the BRUNO CONDENSER) was SO LOW that it could not be accurately measured on our capacity bridge. Both plain and vernier types were submitted by the Bruno Radio Corporation.

—Radio News, October, 1924.



Lowest Losses
Grounded Rotor
Milled Spacing
Long Bearings
Aluminum Plates
Aluminum Casting
Friction Vernier

Simple Mounting
Split Bearings
7/8" Wiping Contacts

Variable Capacities
Tune Several Stages
Multiple Tuning

11 Plate .00025.....\$4.00
22 Plate .0005.....\$5.50
44 Plate .001.....\$7.50

Vernier \$1.00 Extra

BRUNO RADIO CORPORATION — New York City

Pacific Coast Representative:

A. S. LINDSTROM, 111 New Montgomery St., San Francisco, Cal.

REDUCE STATIC

Pat. Pending 690459

by using our super-sensitive
Omni-Directional Aerial

Collapsible, Ornamental,
Mechanically Perfect



Can be used either as a loop or antennae inside or outside.

A wonderful value featured at a price within the range of all.

Ask your dealer or send order direct

\$10.00

Prepaid in U. S.

The Portable Globe Aerial Co.
1602 Locust Dept. 45 St. Louis

Build the New Best Super
See January "RADIO"



**Build a Super-Heterodyne
with the Improved
"Airkore" Transformer**

Points of Construction

1. Each transformer is shielded with a NON-MAGNETIC SHIELD, which prevents interaction between the radio frequency stages and does away with using bulky shields, thus simplifying the construction of a Super-Heterodyne. A binding post is furnished on each shield for connection to Neg. A. Battery.

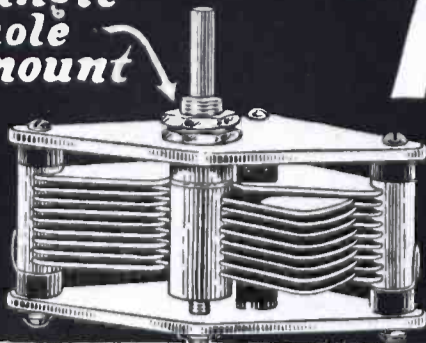
2. Accurately matched in sets of four.

3. Moulded of genuine Bakelite.

4. Kit includes 3 matched intermediate transformers, 1 matched input transformer. Complete Blue Prints giving every detail for the making of an eight tube set.

PRICE \$20.00
THE RADIOPHONE EQUIPMENT CO.
Write for Booklet. 1409 W. York St., Philadelphia, Pa.

Single
hole
mount



“NOL-LOS”

Variable
Condenser

\$4.00

Capacity.0005 M.F.

Minimum Capacity
.000012

Where “Nol-los” Excels

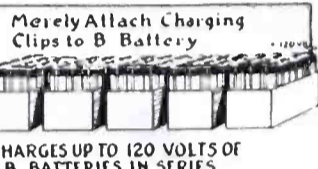
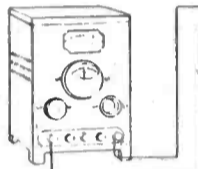
A single mount condenser! Only one hole needed in panel. No screws. Mechanically rugged. Built almost entirely of aluminum, insuring rigidity as well as lightness. The “Nol-los” condenser has been tested in one of the most important technical laboratories in the world (name on request), and proved to be exactly equal in resistance in ohms to the standard condenser used by that laboratory, namely 1.0 ohms.

Simple and Accurate Tuning

The “Nol-los” condenser is so perfectly constructed that tuning is remarkably sharp, losses practically eliminated and reception made clearer. Rotor plates are grounded to both front and rear end plates, thereby reducing the rotor plates to ground potential, and eliminating body capacity.

When buying a condenser ask your dealer for “Nol-los.” If your dealer cannot supply you, send direct to

B. GROSSER & SONS CO., INC., Manufacturers
51-55 Sudbury Street Boston, Mass.
Dealers and Jobbers Write for Terms.



CHARGES UP TO 120 VOLTS OF
B BATTERIES IN SERIES

Simple - No Trouble - Quick - Convenient

THE FRANCE WAY
of Charging “B”
Batteries



THE SILENT
FRANCE
MULTI-DUTY
SUPER-CHARGER

Charges Up to 120 Volts of “B”
Battery IN SERIES

Two, Four, Six and Eight volt Radio “A” or Auto batteries can also be charged at a 5 to 7 ampere rate.

The France Super Charger is truly the highest attainment in battery charges. No bulbs or acids, no noise, no sticking or sparking contacts—it embodies every desirable feature.

Price West of Rockies, \$23.00

Dealers and Jobbers—Now is the time to tie up with France and increase your profits. Write us today for discounts and details. No troublesome wire changing—just leave your batteries wired in series, attach clips, insert ordinary lamp to regulate charging rate and turn on current. Simple—Quick and Convenient.

THE FRANCE MFG. CO.

10321-35 BEREA ROAD
CLEVELAND, OHIO

U. S. A.

The
Quiet NILES



Battery Charger

Solves Another Radio Problem

A safe, dependable, efficient charger for home use. Easy to operate. Light to handle. Puts 72% of the current into the battery. Handsome crystallized black finish. An attractive addition to your radio equipment. No liquids. No fumes. No bulbs. For radio and auto batteries. Model A for 6-volt batteries \$19.00; Model AB for 6-volt and 24-volt batteries \$21.00.

Sold by Dealers
Write for literature

Niles Mfg. Co., Dept. 70Ypsilanti, Mich.



Puts the Joy
In Radio

After all, what is sweeter to your ears than the music from some DX Station coming in on the loud speaker, clear and undistorted? To insure amplification without distortion use the “HEGEHOG.” This marvelous little audio transformer, half the size of any other made, is different in design—the most efficient construction known—for transformers. It has an exclusive self-shielding feature that shuts out foreign noises. Unsurpassed for volume and tone quality. Saves space, mounts anywhere, and easy to connect. Ideal for portables.

Ratios 1 to 3, 1 to 4 and 1 to 5... \$3.50
Ratio 1 to 10..... 4.50

Write for Free Bulletin No. 94, showing complete line of Premier Quality Radio parts. Ask your dealer for Premier Free Hook Ups. If he does not have them send his name and receive a set free.

Premier Electric Company
3813 Ravenswood Ave., CHICAGO
Maker of

PREMIER
Quality Radio Parts

RADIO CATALOG
Full of Information

100 Live Pages

Contains interesting explanation of marvelous benefits of Radio which you may enjoy told in language anyone can understand. You should get it before buying!

FREE

Earnings in Sets, Parts and Accessories—

Everything you may need to build or equip any set. Satisfaction or your money back. **Don't Delay!**

Send for it TODAY!

(And will you be so kind as to add the name of one or more friends you believe will soon want radio goods? Thank you!)
Liberty M.O. House, Dept. 6747 106 Liberty St. N.Y.

De Forest
License



HONEYCOMB COILS

The Universal all-wave inductance. Back and front panel mountings. Send 25c for Super Het., R. F. and Honeycomb Coil Circuits and Complete Catalog.

Chas. A. Branston, Inc.
815 MAIN ST. BUFFALO, N. Y.
DEPT. 12

TURNABOUT PEDESTALS FOR Radiola Super-Heterodyne

and other directional receiving sets. Permits your set to revolve freely upon a mahogany-finished base.

Send postpaid upon receipt of \$1 Special quantity prices to dealers.

LEVISON RADIO LABORATORIES
58 Collins Street, San Francisco, Calif.

See Bargains on Page III

Tell them that you saw it in RADIO

Why It Is Better

"MASTER of Every Note in the Orchestral Range" is the **PROVEN** claim of the Federal No. 65 Audio Frequency Transformer! Volume without distortion is the basis for the beauty of Federal Tone.

From its oversize locking nuts to its heavy brass mounting feet, the Federal No. 65 Transformer incorporates the same engineering skill that has made Federal the recognized leader in electrical communication apparatus since 1890.

Insist upon Federal parts for your "pet" hook-up. There are over 130 standard parts bearing the Federal iron-clad performance guarantee.

FEDERAL TELEPHONE & TELEGRAPH CO.

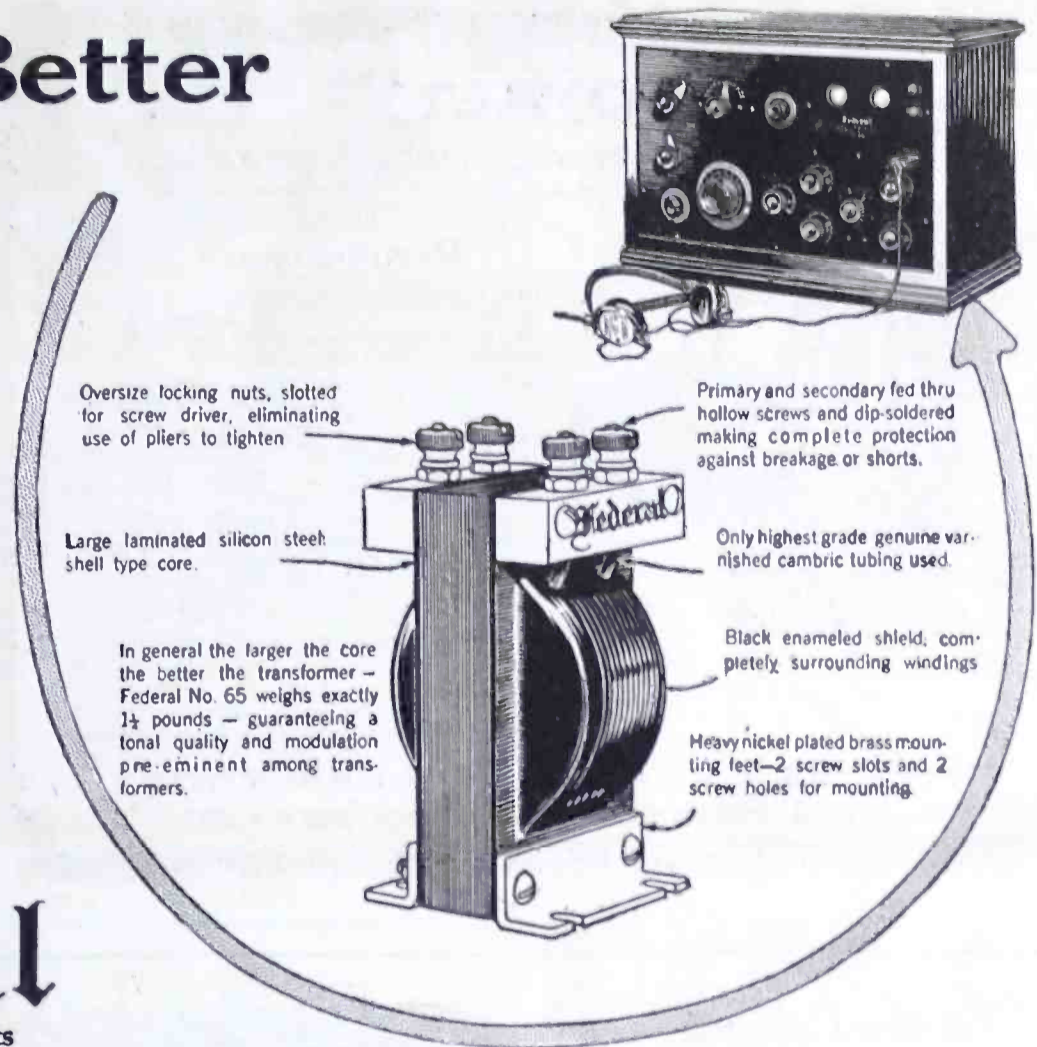
Buffalo, N. Y.

Boston New York Philadelphia
Chicago Pittsburgh San Francisco
Bridgeburg, Canada



Federal

Standard **RADIO** Products



Oversize locking nuts, slotted for screw driver, eliminating use of pliers to tighten

Large laminated silicon steel shell type core.

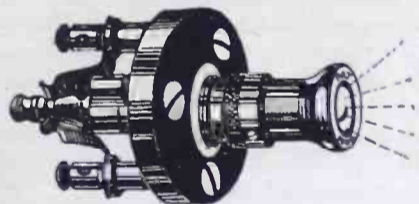
In general the larger the core the better the transformer - Federal No. 65 weighs exactly 1 1/2 pounds - guaranteeing a tonal quality and modulation pre-eminent among transformers.

Primary and secondary fed thru hollow screws and dip-soldered making complete protection against breakage or shorts.

Only highest grade genuine varnished cambric tubing used.

Black enameled shield, completely surrounding windings

Heavy nickel plated brass mounting feet—2 screw slots and 2 screw holes for mounting.



Push-Pull "A" Battery Switch Style

THE Kant-Blo signal is easily installed. Simply takes the place of either the ordinary push-pull "A" Battery Switch or one "B" Battery Binding Post now on set. Kant-Blo Signals — both Binding Post Style and Switch Style—are at all the best radio stores. If your dealer is out of stock send us \$2 for a Kant-Blo Binding Post Style, or \$3 for the Switch Style, and we will ship any number of KANT-BLOS direct to you, charges prepaid.

Manufactured by

GANIO-KRAMER CO., Inc.,
New York

Sole Distributors

APEX RADIO COMPANY
503 Fifth Avenue New York, N. Y.
Write to Dept. H

"The Kant-Blo Switch on our Super-Heterodyne does all that you claim for it. If we had installed this signal long ago it would have paid for itself hundreds of times."

(Copy of letter on request)

YOUR MONEY BACK

IF YOU BLOW A TUBE

When Your Radio Set Is Equipped With a

Kant-Blo

SWITCH **SIGNAL** BINDING POST

"Lights on any Short Circuit"

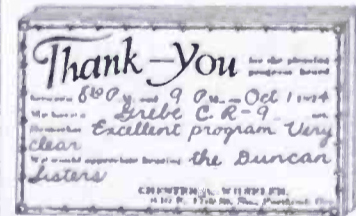
Only one Kant-Blo needed to protect any number or any kind of radio tube.

Send No Money Hear what YOU Like

Stations are glad to put on numbers at your request. We print special "Thank You" cards that get ATTENTION. See the name CHESTER A. WHEELER on illustration. That is where YOUR name will be. Your INDIVIDUAL cards show more than ordinary interest and stations appreciate them and consider your request.

Thank YOUR Favorite Stations

Speakers and musicians deserve and appreciate applause for radio programs just the same as from the stage. Their entertainment makes your radio possible. Encourage them and help bring the best talent to radio. Send them YOUR "Thank You" card of appreciation.



SAMPLE CARD FREE

All the Rage. Be up-to-date. Enjoy these popular "Thank You" cards. Get this additional pleasure from your radio. Save letter postage. Cards require only 1c stamp.

FREE No Charge for Printing Your Name and Address

Good quality cards. High grade printing. Attractive special radio design. The kind that gets results. 100 only \$1.45; 200—\$2.25; 300—\$2.95, plus few cents postage. Don't send one cent. Just pay postman after cards arrive. If you prefer to send money order or check with order, we prepay postage. We GUARANTEE Satisfaction.

Money Returned If Not DELIGHTED
Send order today—NOW. A postcard will do.
RADIO PRINTERS, DEPT. 50, MENDOTA, ILL

RADIO SET

Complete with everything all ready to listen in on Local Broadcasting

BINFORD 5-95
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Approved Leads
Insulation
Wires
Ground
Clamp
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SEND FOR FREE BOOKLET

Why not subscribe to "RADIO" for 6 months?
Price, \$1.00.



Ask Your Dealer For a MONTROSE VERNIER CONDENSER

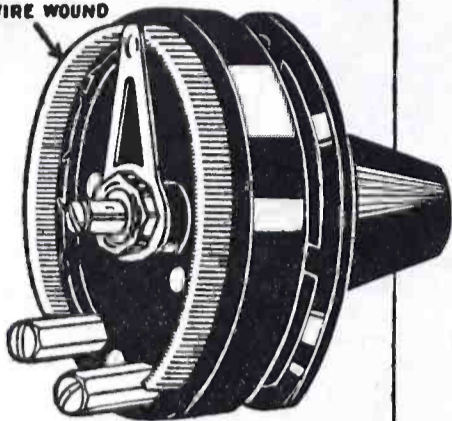
The condenser with genuine bakelite end pieces. Has positive contact between the vernier plate and main shaft. Will get the results where others fail, guaranteed to give entire satisfaction.

MONTROSE MFG. CO.
1333 Fulton St. Brooklyn, N. Y.

ROYALTY

VARIABLE HIGH RESISTANCES--VARIABLE GRID LEAKS

WIRE WOUND



Revolutionary

ROYALTY Variable High Resistances and the ROYALTY Variable Grid Leaks represent the greatest improvements ever made in this field. They are wirewound!

This wire winding eliminates at one stroke all the common grid leak and resistance troubles. The lever arm cannot scrape away the resistance element. The grid leak and the high resistance are noiseless and positively non-inductive. The resistance value is retained indefinitely.

Your dealer has the ROYALTY Variable High Resistance (Type B, 1,500 to 100,000 ohms;—Type C, 500 to 50,000 ohms) and ROYALTY Variable Grid Leak (Type A, 100,000 to 7,000,000 ohms) **\$1.50** any type.....

FREE—Write for the ROYALTY Hook-Up Booklet

WIRELESS PRODUCTS CORPORATION
136 Prince Street, New York City

The New Cabinet Model

For those who admire the full, round, musical voice of the Audiophone, but prefer a cabinet design, we have brought out this splendid model.

The case is real mahogany. The design is in keeping with the best furnishings. The size, 17 x 10 x 10 $\frac{1}{4}$, is just right for the top of your phonograph or your receiving set. The voice of the Audiophone is

NOT A "PHONE UNIT"

It is a highly developed, electro-magnetic tone mechanism, which reproduces with natural



Model "C" Cabinet Type \$30.00

quality in most powerful tones, yet has a sensitiveness equal to any loud speaker developed. The Bristol line includes five Audiophones priced from \$12.50 to \$30.00. If not at your dealer's, write for Bulletin No. 3022-R.

THE BRISTOL COMPANY, Waterbury, Conn.

Bristol AUDIOPHONE LOUD SPEAKER

A Dozen Thrilling Yarns

Read the Story of the Life of a Sea-going Radio Operator—
"THE RADIOBUSTER"

SENT POSTPAID ANYWHERE

PACIFIC RADIO PUB. CO.
Pacific Bldg., San Francisco, Cal.

\$1.00
Per
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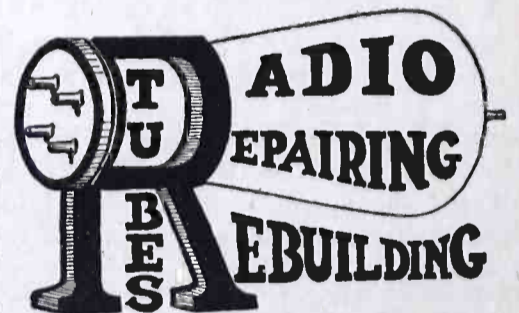
\$1.00
Per
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SIXTH DISTRICT AMATEUR CONVENTION

The fifth annual convention of sixth district amateurs, which was also the first A. R. R. L. convention, was held at Modesto, Calif., on Nov. 7th and 8th, under the auspices of the Modesto Radio Club, and was most ably managed and directed by Frank Flowers, 6ST, and L. J. Wrenn, 6BDS. Friday afternoon was devoted to the traffic meeting and in the evening, under the direction of A. H. Babcock, addresses were given by K. B. Warner, Secretary of the A. R. R. L.; Mr. Herbert, the Treasurer, M. E. McCreery, Pacific Division manager, and D. B. McGown, U. S. Radio Inspector. Members of the Modesto Radio Club presented a very clever song and dance act, singing original radio songs to popular airs, with the whole Modesto Club as chorus.

A spirited sending and receiving test for two handsome silver cups was held the morning of the 8th, 6CMD winning the sending contest and 6DL receiving. The silver cups were donated by a member of the Southern California Radio Association. At the technical meeting on Saturday afternoon K. B. Warner described the transmitter used by F. H. Schnell, 1MO, at Hartford. He was followed by D. B. McGown, U. S. Radio Inspector, who presented some novel ideas, and considerable information on transmitting coupling systems and on master-oscillator power-amplifying systems. He was followed by G. M. Best, who described a super-heterodyne for use on the new low amateur wave bands. Gaston B. Ashe presented a most complete paper on the theory and practice of antenna construction. The banquet in the evening was addressed by noted amateurs and others present. Santa Barbara was selected for the next meeting place. A "speed" receiving contest of code and cipher matter was held after this meeting, and a Magnavox awarded to the winner, H. W. Dickow, who copied the matter with a perfect score.

An exemplification of the work of the Royal Order of Wouff-Hong was presented
Continued on page 108



SAVE ON TUBES!
Buy Direct From Manufacturers!

All Tubes Repaired
(Detectors or Amplifiers) **\$2.25**
Guaranteed Like New
New Amplifon Tubes **\$2.50**
Regular \$4 Quality
Introductory price.....

1 Amp. 6 Volt Tubes Changed to $\frac{1}{4}$ Amp. Tubes. Send for Circular on New and Refilled Tubes.

AMERICAN RADIO TUBE WORKS

23 Central Ave. Newark, N. J.

Big Money for Agents Everywhere

The biggest little thing in radio

What Makes Metallic DURHAM Fixed or Variable Grid Leaks Noiseless?

CIRCUIT noises are caused by uncontrolled resistance changes—unavoidable in the old style leaks. Carbon, graphite, india ink, pencil marks—all vary greatly with temperature and atmospheric changes. Metals alone remain constant.

DURHAM Fixed Metallic Grid Leaks are the only truly noiseless. A rare metal deposited on glass has its resistance value fixed for all time. Noise is impossible.



DURHAM Variable Metallic Grid Leaks—in 3 ranges—have a permanent range of the values marked. Continuous variation is by smooth sliding plunger. For any particular setting, operation is as noiseless as the DURHAM fixed type.

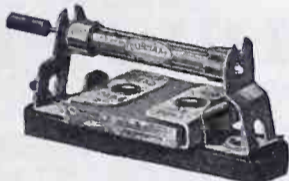
DURHAM Metallic Grid Leaks will fit your present holders. But for new sets, the new DURHAM bases are more convenient—plain, condenser clip, or double for resistance amplifiers.

Prices:—

Fixed, 28 sizes
50c - 75c

Variable
3 ranges, 75c

Mounts
30c - 40c



All about Resistance Amplifiers—25c

Build a distortionless amplifier. Parts for two stages cost less than one good transformer. Complete detailed instruction booklet, 25c. At your dealer's or postpaid.

Satisfaction Guaranteed

DURHAM & CO., Inc.
1930 Market St., Philadelphia



Don't Miss a Program Get a Valley Battery Charger

Sometime, haven't you wanted to hear a certain radio program . . . but could not because your storage battery was down?

Don't let it happen again. Add a Valley Battery Charger to your radio set, and you can always be ready to listen in. With the Valley Charger you can completely recharge any radio battery at home overnight.

Quiet in operation.
Full 6-ampere charging rate.
No liquids. No bulbs.

The Valley Battery Charger recharges 2-volt peanut tube cells, 6-volt A batteries, and from one to four 24-volt B batteries. Takes about a dime's worth of current for a full charge.

Plugs into the ordinary light socket like a fan or other household necessity, and is just as easy to operate. It has a grained and engraved Bakelite panel which harmonizes with any radio set. Clear glass top shows the simple, patented working parts at all times.

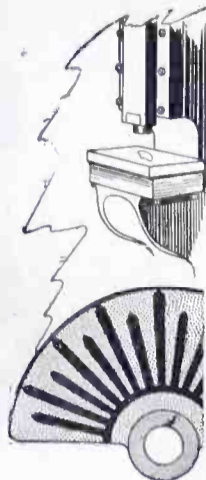
At radio dealers everywhere.

VALLEY ELECTRIC COMPANY
Rialto Bldg., San Francisco

HEATH

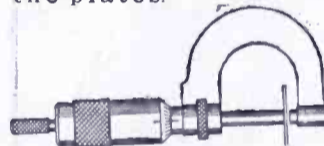
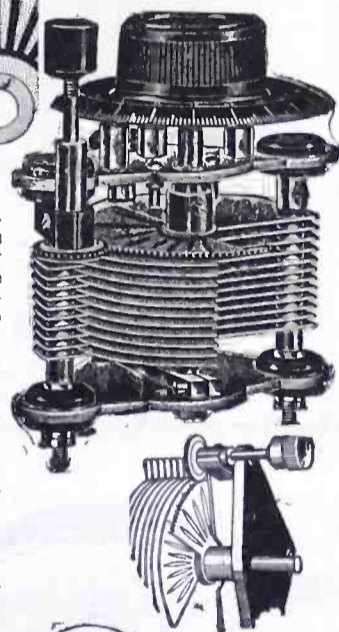
Permanently FLAT PLATES

The well known Heath process of stamping rotor plates to lasting flatness, makes the new Heath a permanently satisfactory instrument.



Micrometer Geared Vernier

Ordinary adjustments reduced by separate geared adjustment to hairbreadth distinction. We guarantee the Heath Vernier Condenser to be more highly selective than any condenser employing a vernier which actuates ALL of the plates.



RADIANT-- Non-Dielectric Condensers

A new type of end plate which banishes leakage and capacity effects, added to the popular Heath features of permanently FLAT Plates and the most perfect type of vernier. These advantages of Heath condensers are the best guarantee of lasting satisfaction.

PRICES FOR VERNIER CONDENSERS

	With Dial	Without Dial
No. 12AV—12 Plate	\$5.00	\$4.35
No. 24AV—24 Plate	5.50	4.85
No. 44AV—44 Plate	6.50	5.85

Plain types in all sizes

Heath Bakelite Dials in Three Sizes

HEATH Sockets

With the Exclusive Shock Absorber Feature

Bakelite base into which re-enforced phosphor bronze self-cleaning contacts are securely embedded. Binding posts are slotted hexagon nuts. HEATH Standards of material and workmanship. Price 75c.

Heath Radio & Electric Mfg. Co.

208 FIRST ST. NEWARK, N. J.

Canadian Distributors
Marconi Wireless Telegraph Co.
of Canada, Ltd.

Distributors for Northern California

ELECTRIC APPLIANCE CO.
807 Mission St., San Francisco, Calif.

Distributors for Southern California

FREDERIC L. TOMLINSON CO.
443 So. San Pedro St.,
Los Angeles, Cal.

443 Pacific Bldg., San Francisco
1512 Boylson Ave., Seattle, Wash.

EASIER-BETTER TUNING WITH B-T PARTS

That's just what you get. Stronger signals, greater distance, surpassing selectivity with little or no effort. It's being done by hundreds of others. Why not you?

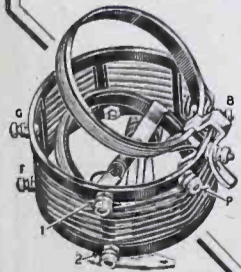
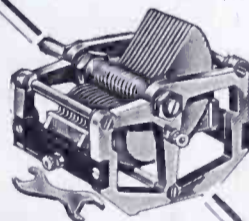
The sixth edition of our 40-page book, "Better Tuning," tells you why and shows you how. Hook-ups, construction, tuning and general information on crystal to five tube R. F. circuits. Sent postpaid for 10c.

See the B-T parts at your dealers, or write for detailed information today.

BREMER-TULLY MFG. CO.

532 SO. CANAL ST., CHICAGO, ILLINOIS

B-T Type	Lifetime Plates	Condenser M.M.F.	Price
7-L	7	125	\$4.25
11-L	13	250	4.50
23-L	23	500	5.00
35-L	35	750	6.50



B-T LOW LOSS TUNER

Made for Broadcast or Short Wave

Type B, 200 to 565	\$5.00
Type SW, 50 to 150	5.00

"INSULATE"
(Molded Composition)

Articles of any Shape
or
Molded to Order

"HI-HEET"
(Bakelite)



100

Knobs, Dials,
Binding Posts,
Head Caps,
Insulators, etc.

STYLE in stock for prompt shipment



Insist on "Hi-Heet" or "Insulate" from your dealer.

GENERAL INSULATE CO.

999 Atlantic Ave., Brooklyn, N. Y.

by the degree team of the Southern California Radio Association, and some hundred-odd members admitted to the secrets of the order. A complete low wave length 250 watt transmitter and a low loss tuner were presented to Lester Picker, 6ZH, of San Ysidro, Calif., by the Modesto Radio Club. After the initiation the convention closed at midnight, with a total attendance of about 150, who voted the entire affair most successful and a credit to the Modesto Club and the officers thereof.



Bracket mounting type, complete \$4.50.

One Pull on the Jones MULTI-PLUG instantly disconnects antenna, ground, A and B batteries from your set. One push reconnects. And it can't be plugged in wrong! Eight foot cable permits placing batteries out of way—in basement, closet or elsewhere. Makes your set portable. All leads plainly coded.

Jones MULTI-PLUG
THE STANDARD SET CONNECTOR

Nothing else like it. Enables anyone to connect your set with safety. Prevents burning out tubes or shorting batteries. 100 per cent foolproof. Standard on Zenith, Workrite and many other leading sets. Ask your dealer to put one on the set you buy, if it isn't already equipped. Carried by all jobbers. Any dealer can supply you. May be ordered direct by stating dealer's name. Folder mailed free



Patent Applied For

Binding Post Type complete with seven coded leads for attaching to binding posts of any set and 8 foot coded cable \$5.00

Lombard J. Smith,
324 North San Pedro St.,
Los Angeles, California
Mr. A. S. Lindstrom,
111 New Montgomery St.,
San Francisco, California

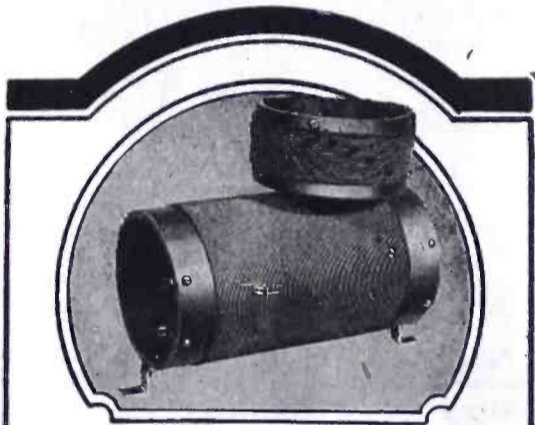
Mr. H. A. Killam,
146 1/2 North Tenth St.,
Portland, Oregon
Mr. G. H. Maire,
95 Connecticut St.,
Seattle, Washington

HOWARD B. JONES, 614 S. Cana Street, Chicago

New LeFAX RADIO HANDBOOK—\$2.00

(Seventh Edition)

in bound form. For sale by
"RADIO," San Francisco



The Authorized Cockaday Coil \$5.50

Specified in Oct. Popular Radio as
Cockaday Precision Coil

The only coil specified by Mr. Cockaday in his New Four Circuit Tuner, with resistance coupled amplification because it meets all his specifications.

The only authorized Cockaday Coil, made in strict accordance with specifications of Laurence M. Cockaday, inventor of the famous Cockaday Four Circuit Tuner. Wound on hard rubber tubing 1/8 inch wall, with No. 18 D. S. C. copper wire which insured selectivity, greater volume, sharp tuning and maximum sensitivity. Guaranteed.

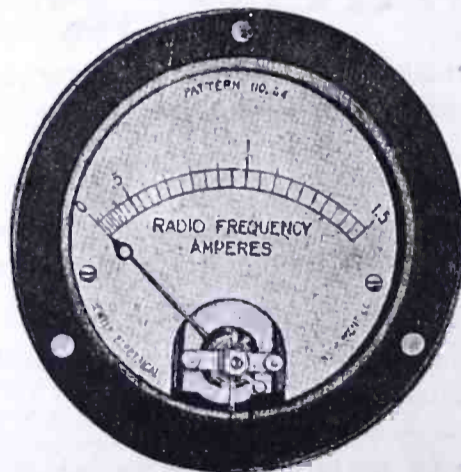
Gets distant stations easily and clearly. Hundreds have substituted this quality coil for those of inferior make and are amazed at the improved reception, selectivity and general D-X results.

At your dealers, otherwise send purchase price and you will be supplied postpaid.

Approved by

L. M. Cockaday

PRECISION COIL CO., INC.
200-C Centre St.,
New York



NO 64—RADIO FREQUENCY AMMETER

ASK ANY AMATEUR--

They are the Real Radio men of this country—and they will tell you that the "Jewell Trio" (Nos. 54, 64 and 74) for Transmitting Sets—have no equal.

¶ The only uniform—one size—miniature line of Radio Instruments manufactured.

¶ Ask any Radio Dealer for our 15-A Radio Catalog.

Jewell Electrical Instrument Co.

C. F. Henderson,
Call Bldg., San Francisco
Thomas Machinery Co.,
American Bank Bldg.,
Los Angeles.

CHICAGO

"25 Years Making Good Instruments"

Eicher & Bratt,
L. C. Smith Bldg., Seattle.
Nixon Kimmel Co.,
187 So. Wall St., Spokane.

APEX VERNIER DIAL



It Brings 'Em In!

Get more stations—greater range—bigger volume—finer selectivity—less interference. Lasts forever. The one big advance yet made in tuning. Ratio 12 to 1. Quickly applied to any shaft. For sale by all good Radio Dealers. If unable to obtain from dealer, enclose \$2.50 for nickel-silver finish, or \$3.50 for De Luxe satin finished gold.



7-Tube Super-Heterodyne for \$97.50

Receive the parts complete to assemble your own set. Coast to coast on an 18-inch Loop. Assemble this 7-tube Microdyne super-heterodyne on a 7x18 in. panel in three hours. Parts complete, including drilled and engraved panels, condensers, sockets, transformers, dials connecting plugs, cables, etc., with drawings, diagrams and instructions. Price of cabinet—to fit—on application. If your radio dealer cannot supply parts for complete Microdyne Radio Set, send check or money order for \$97.50 and name of your dealer.

APEX ELECTRIC MFG. CO., Dept. 12-0
1410 W. 59th Street, CHICAGO



ANT SPEAKER SPEAKER A BAT +
LONG ANT A BAT -
SHORT ANT B BAT +
LOOP B BAT -
PHONE C BAT +
GND Tops Don't Come Off. C BAT -
25 Different Markings.
Scientifically Made. B AMP +
INPUT Beautifully Finished. B DET +
A+ B- + - B DET +

Insist on and get
Genuine EBY Binding Posts
H. H. EBY MFG. CO. Phila., Pa.



RESISTANCE COUPLED AMPLIFICATION

The Resisto-Coupler illustrated is inserted in your set in the place of the ordinary transformer. It is less expensive to install and operate, gives audibly perfect amplification and wonderful volume. We recommend three steps of Resistance Coupling for the most satisfactory service. Sold everywhere.....\$1.25

Get from your dealer the Daven "Resistor Manual," by Zeh Bouck. A practical handbook on Resistance Coupled Amplification. Price 25c

DAVEN RADIO CORP.
"Resistor Specialists"
Campbell St., Newark, N. J.
Pacific Representative:
W. J. RHYNSBURGER
500 Citizens Nat. Bk. Bldg.,
Los Angeles

RADIO MAPS
35c
PACIFIC RADIO PUB. CO.
Pacific Bldg. San Francisco, Calif.

MAGNADYNE REFLEX COILS
TWO DOLLARS A PAIR
Adaptable to practically every set.
Efficiency of operation
Get more enjoyment from your radio set. Mail us check for \$2.00 and receive a pair of coils, post paid.

Advantages
Efficiency of operation
Reduces dielectric losses
Minimizes distributed capacity

COAST COUPLER CO.
EAST SEVENTH ST.
Long Beach, California

Model A
2400 Ohms
\$4.00
LIST

Model B
3000 Ohms
\$5.00
LIST



Repeater Phones

'Single Pole'

Guarantees Matchless Reproduction
From all parts of critical America, from wireless workers, amateurs, and from those who just insist upon the best, comes enthusiastic indorsement for Repeater Phones. Distance is annihilated, obstacles vanquished by Repeater.

This matchless tone quality is due chiefly to the 'Single Pole' feature, exclusive with Repeater.

All the power of the air unleashed flows evenly, smoothly through Repeater's 'Single Pole'—you are certain of exact, faithful reproduction.

ASK FOR
our illustrated booklet containing complete details.

DEALERS
In Repeaters you will find a popular appeal. Our discounts will interest you. Write for Merchandising Plan.

The New Improved "Repeater"
Moss-Schury Mfg. Co., Inc.
Radio Division
2009 Franklin St., Detroit, U. S. A.

Poly Plug



is the only phone plug equipped with the wonderful "tension slot" which permits you to pull and tug the cords all you want and still

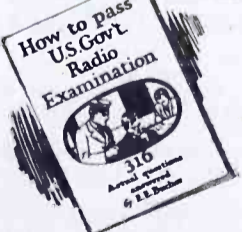
Positive contact always maintained

It's Genuine Bakelite, too!
At your dealer's or by mail on receipt of purchase price.

Polymet Mfg. Corp.
70-74 Lafayette St., N. Y.

75¢
"WORTH IT"

How to Pass U. S. Gov't. Radio License Examination
By E. E. Bucher



Of inestimable value to those desiring Commercial or Amateur Radio License. Covers transmitters, receivers, storage batteries, motors and generators, radio rules and regulations. 316 actual questions answered! Written by a radio expert, author of Practical Wireless Telegraphy, etc. Over 150,000 copies sold. Send 50 cents in stamps or coin for your copy, postage prepaid to any point in the U. S., Canada or Mexico.

RADIO INSTITUTE OF AMERICA
326A Broadway New York City

Radio Tubes Repaired

All Models of Cunninghams and Radiotrons ^{except 11s and 12s.....} **\$2** and postage

If you have no burnt-outs, we will send you repaired RADIOTRON tubes for \$2.50 each, or the famous NEW German Radex tubes for \$2.85 each. These are high-grade four-dollar tubes. 30 cents credit given for burnt-outs, on orders for new tubes.



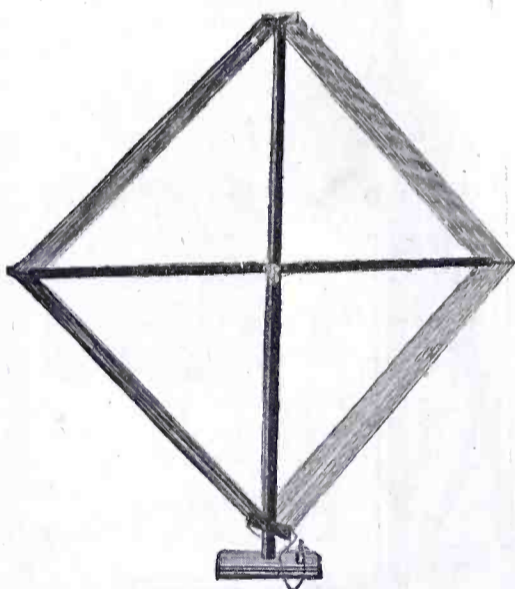
Announcement: The policies of this company are now directed by Volney G. Mathison, author of "On the Trail of the Tube Sharks," "The Radiobuster, etc. Our guarantee, as heretofore. Satisfaction or money refunded. Dealers write.

S. P. HANKINS & COMPANY

General Offices:
447 Pacific Building
San Francisco, California

Shipping Warehouse and
Mail Order Section:
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SIGNOLA PORTABLE LOOP AERIAL



Folds like an umbrella—has third tap for use on super and other sets.

100 feet of silk covered, flexible non-kinkable wire wound on genuine Formica spreaders, entirely insulating windings from frame.

Wood parts are hand rubbed, dark mahogany finish. Metal parts are highly polished, heavily nickel-plated. Binding posts are insulated from base by Formica strip.

Turns easily in metal socket. Can be taken apart and put together in a few seconds.

Price \$8.50

Your dealer can supply. Write us for folder of this and other Signal radio products.

SIGNAL Electric Mfg. Co.

Factory and General Offices:
1913 Broadway
Menominee, Mich.

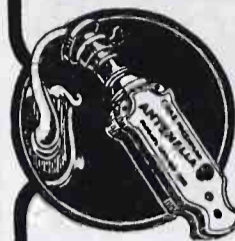
Boston Chicago Seattle Minneapolis Montreal New York Los Angeles
Pittsburgh Havana, Cuba St. Louis San Francisco
Toronto Philadelphia Winnipeg

You'll find our local address in the Telephone Directory.

Don't Miss the January Issue of "RADIO." It Will Contain the New Best Super-Heterodyne Scoop.

The Complete Efficient and Economical Aerial ANTENNELLA

No Aerial or Antenna Needed



Why pay \$10.00 or more to have an aerial spoil the appearance of your home?

Antennella eliminates all unsightly wiring, lightning arresters, etc., and precludes the possibility of dangerous grounding on a power line. It also stops "canary bird" re-radiation from nearby oscillating sets interfering.

\$1.25

ANTENNELLA

is not only a real distance getter but also successfully overcomes static annoyances.

At your dealer, otherwise send purchase price and you will be supplied postpaid.

Chas. Freshman Co. Inc.
Radio Condenser Products
106 Seventh Ave. New York

\$1.00 Brings You "RADIO" for Six Months. Subscribe Right Now!

Statement of the Ownership, Management, Circulation, Etc., Required by the Act of Congress of August 24, 1912, of Radio. Published Monthly at San Francisco, Calif., for October 1, 1924.

State of California, County of San Francisco, ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Henry William Dickow, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Radio, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations:

1. That the names and addresses of the publisher, editor, managing editor and business managers are: Publisher, Pacific Radio Publishing Company, Pacific Building, San Francisco, Calif.; Editor, Arthur H. Halloran, Berkeley, Calif.; Managing Editor, None; Business Manager, Henry W. Dickow, San Francisco, Calif.

2. That the owner is: Pacific Radio Publishing Co., Pacific Building, San Francisco, Calif.; Arthur H. Halloran, Berkeley, Calif.; Henry W. Dickow, San Francisco, Calif.; H. L. Halloran, Berkeley, Calif.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

H. W. DICKOW,
Business Manager.

Sworn to and subscribed before me this 28d day of September, 1924.

[Seal] JOHN EISMAN,
Notary Public in and for the City and County of San Francisco, State of California.

(My commission expires August 14, 1923.)

RADIOADS

A Classified Advertising Section Read by Better Buyers

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

ADS FOR THE JANUARY ISSUE MUST REACH US BY DECEMBER FIRST

C. W. and RADIO PHONISTS—Our new converters will satisfy your need for a more efficient and durable direct current plate supply. No armatures to burn out. Output from seven hundred to two thousand volts at 4 amperes. Synchronous Motors, Transformers and other parts sold separate. Write immediately, Kimley Equipment Mfg. Co., 290 Winslow Ave., Buffalo, N. Y. (tc)

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

Vacuum Tube Hospital
We repair and guarantee them.
Agents, Dealers, and Customers Wanted.
Radiotube Co., 903 Broad St., Newark, N. J. tc

BIG Money and Fast Sales—every owner buys gold initials for his auto. You charge \$1.50, make, \$1.44. 10 orders daily easy. Samples and information free. World Monogram Co., Dept. 68, Newark, N. J. (SAS)

RADIO GENERATORS—500V 100 watt \$28.50
Battery Charging Generator \$8.50. High Speed Motors. Motor Generator Sets, all sizes. MOTOR SPECIALTIES CO., Crafton, Penna. (tc)

AGENTS WANTED TO ADVERTISE OUR GOODS and distribute free samples to consumers; 90c an hour; write for full particulars. American Products Co., 2132 American Bldg., Cincinnati, O.

TELEGRAPHY—Morse and Wireless taught at home in half usual time and at a trifling cost. Omnigraph Automatic Transmitter will send, on Sounder or Buzzer, unlimited messages, any speed, just as expert operator would. Adopted by U. S. Government and used by leading Universities, Colleges, Technical and Telegraph Schools throughout U. S. Catalog free. Omnigraph Mfg. Co., 16 J. Hudson St., New York City.

AGENTS WANTED TO ADVERTISE OUR GOODS and distribute free samples to consumers; 90c an hour; write for full particulars. American Products Co., 2132 American Bldg., Cincinnati, Ohio.

New Receiving Sets, fully guaranteed, at much below cost prices, because our customers are almost entirely BCL'S, who do not take to amateur receivers:
Zenith 1-R Receiver and 2-M Amplifier... \$90.00
Jones No. 503-J Detector and 3-step... 125.00
Kennedy Intermediate with Amplifier... 100.00
Grebe CR-5 Receiver... 50.00
Grebe CR-8 Receiver... 50.00
Grebe CR-12 Receiver... 125.00
Grebe RORN Radio Frequency Amplifier... 25.00
Federal No. 8 Detector and 1 step... 20.00
THE RADIO STORE,
560 E. Colorado Street, Pasadena, Calif.—(TC).

STORAGE "B" BATTERIES are easily made in one evening. Use my genuine Edison elements.
A. J. Hanks, 107 Highland Ave., Jersey City, N. J. (3T)

EVERYTHING FOR THE HAM
8BIN
1407 First North Street - Syracuse, N. Y. (2T)

RADIO Parts at Cost. Send for list. E. S. Morrison, Ashland, Oregon. (2)

Purest Virgin Aluminum for sale. Particulars upon request. 2EM.—(2T)

MAKE BIG MONEY OUT OF RADIO

Thousands of People want to buy a good Radio instrument. They have read that vast improvements have been made and they are ready to buy now if you show them the best.

It is one thing to make a good radio instrument for your own amusement, but why not cash in now on your experience? Let us send you full particulars of the Ozarka Plan which shows you how to

"MAKE \$120 WEEKLY"
selling long-distance Radio sets. The season is on right now. Let us tell you how to combine the clear signal of the crystal detector with the distance of the vacuum tube. Write today and don't fail to give the name of your county.

OZARKA INCORPORATED
814 Washington Blvd., Chicago

Model "C" super-heterodyne, loop, ten "A" tubes, Willard "A" and "B" batteries, large Magnavox. Complete outfit, \$325.00. Write for description.
E. S. Morrison, Box 22, Ashland, Oregon. (2t)

MAKE YOUR NEUT REACH OUT—Same panel, same layout, fewer parts. Our \$5.00 kit includes the one different part, 22 feet real gold sheathe wire, lithographed print of Kladag Coast To Coast Circuit, and complete, simple instructions. Nothing else to buy. Gives selectivity with deep, resonant volume. NOT obtainable elsewhere. We originated this and can name scores of buyers it has delighted. Satisfaction Guaranteed. Retail at 10c. Kit prepaid anywhere, \$5.00. New 48-page catalog, thousands of items, many exclusive, for stamp. We accept postage stamps, same as cash.

KLADAG RADIO LABORATORIES, Kent, Ohio.

We are adding to the line constantly. Our Acknowledgment and Applause Cards being used by scores of satisfied amateurs. Get samples free. Wireless Acknowledgment Card Company, 325 Sixth Avenue, McKeesport, Pa.

WANTED—10 or 20 Watt Transmitting Set complete. Forward inventory, wavelength and description with photo of set. H. N. Krenkel, Carville, Louisiana.

FOR SALE—Crosley Tryrdyne with tubes and Magnavox R-3, \$50. H. N. Krenkel, Carville, Louisiana.

Bargains Transmitting Sets cost Government \$250.00—\$25.00 Storage Batteries, 6 volts 8 amperes \$4.00 worth \$10.00. Navy Tubes \$2.50. Tube free with every order. 824 North Fifth, Philadelphia, Penna

NAVY SLIGHTLY USED APPARATUS—Sperry 50—1000 meter receiver with AUDION CONTROL \$55. S. E. 143—250 to 3000 meters \$60. Listen to the foreign Arcs on Navy Types S. E. 95-A, C. N. 239, C. N. 240. 1000-10000 meter range, with binding posts for loading coils for above. Each of these sets in perfect condition. Cost \$500, price \$45. C. N. 113, 300 to 2500 meters, cost \$150. Price \$21.50. All of the above prices include express charges. Send 5 cents for the photo of the set you are interested in. List on request. George Eaton, 1915 S. 12, Philadelphia, Penna.

100 Volt Edison Type "B" battery, knocked down. Parts and plans complete, \$12.50.
LANE MFG., 2935 W. Lake, Chicago.

LOWEST LOSS Acme glass enclosed, silver-plated, vernier condensers—\$4.95. Plenty in stock. Fox Instrument Company, 1665 Third Avenue, New York.

DEALERS—Write for our illustrated catalog of reliable radio Merchandise. Rossiter-Manning Corporation, Dept. C, 1830 Wilson Ave., Chicago, Ill.

HAMS: Before buying CW parts elsewhere, write for advance information on our new line of transmitting equipment out soon.—Seattle Radio Laboratory, 3335 33rd Ave., South, Seattle, Washington.

Large Edison elements, wired with pure nickel wire, **WELDED CONNECTIONS**, .07 1/2 per pair prepaid. Sample 10 cents. Separators 1/2 cent. Save by making your own Edison "B." Instructions with order. Arthur Chapelle, Woodburn, Ore. 7NX

NEW "CALRAM" REFLEXED SUPER PLIODYNE
Distance, volume, and clear as a bell. Three tubes, either kind, two controls, beautiful mahogany cabinet. Price \$29.50, less accessories. With "Auth" loud speaker \$35. Shipped anywhere.
CALIFORNIA RADIO MFG. CO.
507 Mission St., San Francisco

Agents to travel by automobile to introduce our fast selling, popular priced household necessities. The greatest line on earth. Make \$10 a day. Complete outfit and automobile furnished free to workers. Write today for exclusive territory. American Products Co., 2134 American Bldg., Cincinnati, Ohio.

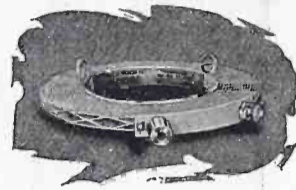
1500 VOLTS FOR \$45!!!!!! Brand New General Electric ball bearing dynamotors, made for U. S. Naval Air Service, 24 volts D.C. input, 1500 volts 233 M.A. rated output for \$45.00. Will actually deliver about 600 M.A. for reasonable periods. With shafts extended, make fine D.C. double current generators, and will give above from low and high tension ends. Shafts extended for \$3.00 extra. Make fine battery chargers. Also fine for portable sets, and can use on lower input voltages and get lower plate supply. 6 volts will give approximately 375 volts, 12 input 750 volts, etc. Also with 750 volt tap for regular operation on smaller tubes. Prices F.O.B. San Francisco, Cal. D. B. McGown, 1247 47th Avenue, San Francisco, Calif.

BUSINESS

SPECIAL FREE OFFER.—100,000,000,000 GERMAN MARKS, 5,000 POLISH MARKS, AND 10 RUSSIAN CZAR PRE-WAR ROUBLES ABSOLUTELY FREE with every 25c order for 100 KRONEN HUNGARIAN GOVERNMENT 5 1/2% BONDS, interest coupons attached. Send 25c order today and receive latest quotations. PUBLIC STATE BANK, Dept. 611, CHICAGO.

Inch Display Advertisement 166 Magazines Year \$50. Wood's Popular Services, Atlantic City.

EXTRA SPECIAL BARGAINS. Thermo-Couple Ammeters, 0-2.5 or 0-5 amps.—\$7.00. D. C. Voltmeters, 0-1500 volts—\$15.00, 0-500 volts—\$8.50. D. C. Milli-Ammeters, 0-250 or 0-500 milli-amps.—\$5.50. All these meters are manufactured by the General Electric Co. Other specials—Hot Wire Ammeters 0-2.5 amps. manufactured by Roller-Smith Co. \$3.25. D. C. Milli-Ammeters, 0-150 milli-amps. \$3.25. Spark Transmitters, 75 watt, portable, made for the U. S. Army Aeroplanes, Government cost \$45.00. Our price \$5.00. Bakelite Sheets, 30x38 inches, 1/4 inch thick, regular price \$29.50. Our price \$12.50. Jewell A. C. Filiment Voltmeters, 0-15 volts—\$6.00. All merchandise is new and guaranteed. References, American Radio Relay League. Send for our complete price list. American Sales Agency, 38 Park Row, N. Y.



Tuned Transformer Coil No. 14
Price \$2.00

SICKLES DIAMOND WEAVE COILS

PATENTED AUGUST 21, 1923
HOLD THAT STATION!

You can get and hold the station you want, and keep out the others, with Sickles Diamond Weave Coils. Sickles Tuned Transformer Coil No. 14 and the Knockout Reflex Coil No. 8, especially designed for popular circuits, make a receiving set remarkably selective.

The No. 14 Tuned Transformer Coil is absolutely self-neutralizing when placed at the proper angle in a set.

Write for particulars.

THE F. W. SICKLES CO.,
338 Worthington St.,
Springfield, Mass.



Knockout Reflex Coil No. 8
Price \$4.00 a Pair

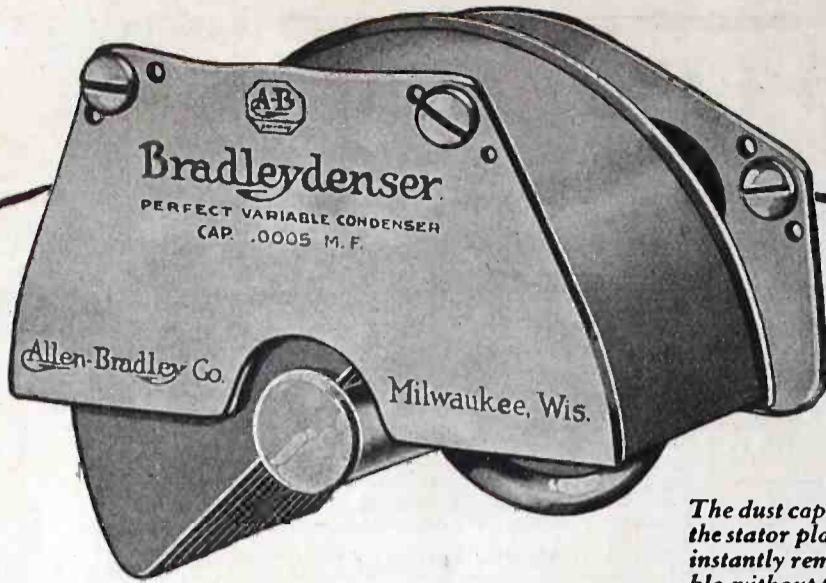
NATIONAL VELVET VERNIER

Dials and Condensers
Stand the Gaff!

This test proves it. At the Radio World's Fair, New York, two National Velvet Vernier Dials, driving two National DX Condensers operated by an electric motor, ran the entire seven days of the show for a total of 324,429 revolutions. At the finish, they showed no evidence of lost motion, or back lash—and still possessed that velvety smoothness that makes Nationals so desirable. Write for Bulletin 104R.

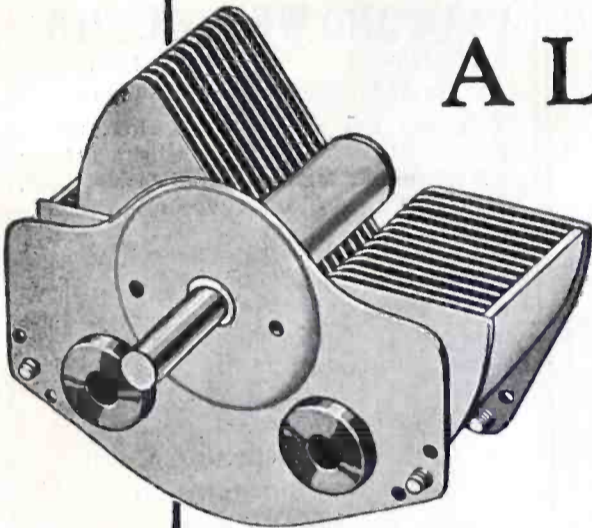
You know somebody who would be delighted to receive a National Condenser or Dial for Christmas. Put them on your list.

NATIONAL COMPANY, INC., Cambridge, Mass.
Established 1914
Engineers and Manufacturers



The dust cap over the stator plates is instantly removable without tools.

A Low-Loss Condenser for Selective Receivers



All plates are solid brass, carefully soldered at all joints. The Bradleydenser resistance does not increase, even after long use.

Standard Ratings and Prices

0.00025 M.F. \$4.50
 0.0005 M.F. 5.00
 0.001 M.F. 6.00

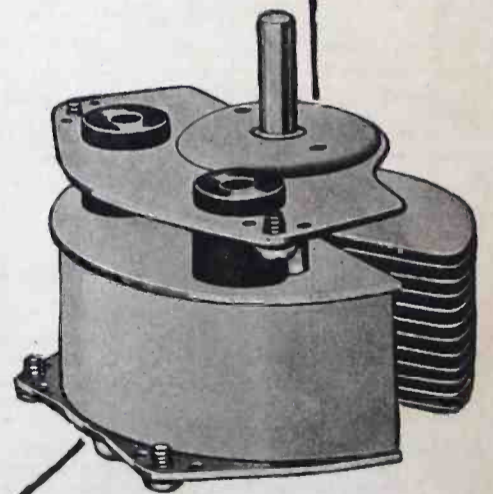
The Bradleydenser has no vernier plates. The shaft is $\frac{1}{4}$ in. to fit any standard dial.

THE New Bradleydenser embodies many new and important features that contribute to its high efficiency and low loss. One of the most significant innovations is the omission of the outer end-plate and the substitution of a unique bearing that maintains rigid alignment of the rotor plates without the use of unnecessary insulating or di-electric end-plates. There is almost no di-electric material in the Bradleydenser to absorb energy from the antenna oscillations.

The minimum capacity also is low, affording a wide range of control. This is an important advantage in sets to be operated from loops.

We shall be glad to send you complete information about the Bradleydenser. Drop us a line, to-day!

Allen-Bradley Co.
 Electric Controlling Apparatus
 288 Greenfield Avenue
 Milwaukee, Wisconsin



Notice the amazing reduction of insulating material to two small spacers. The di-electric loss is, therefore, very low

Sales Offices

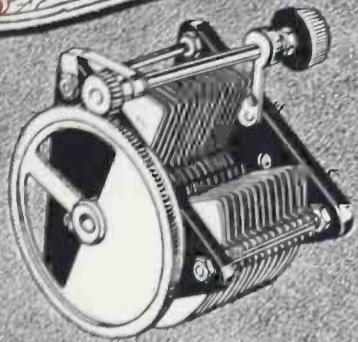
Baltimore	Knoxville
Birmingham	Los Angeles
Boston	New York
Buffalo	Philadelphia
Chicago	Pittsburgh
Cincinnati	Saint Louis
Cleveland	Saint Paul
Denver	San Francisco
Detroit	Seattle



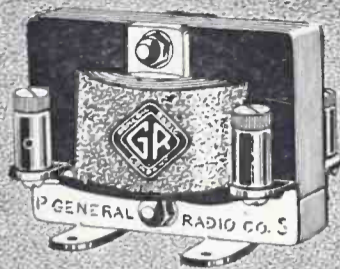
Another Allen-Bradley Radio Device of the same perfection and quality as the Universal Bradleystat

Quality - Easily Recognized

Gifts that will bring joy to any Radio BUILDER



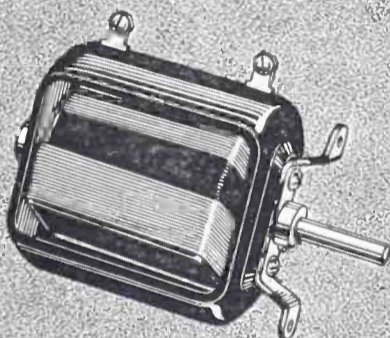
TYPE 247-H
Geared Condenser
Price \$5.00



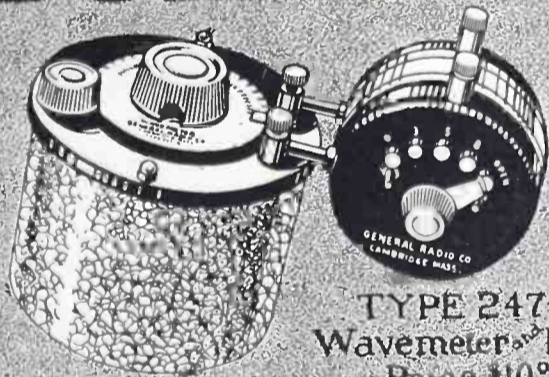
TYPE 231-A
Amplifying Transformer
Price \$5.00



TYPE 268
Variocoupler
Price \$3.50



TYPE 269
Variometer
Price \$5.00



TYPE 247-W
Wavemeter & Filter
Price \$10.00

For a Merry Radio Christmas

Acceptability

In selecting articles for Christmas giving, those who choose with the true Yuletide Spirit consider *acceptability* and *practicability*.

To the radio builder who knows the necessity of good apparatus, nothing is more acceptable and practical

Practicability

than General Radio parts, which are scientifically designed by radio engineers.

A set built with General Radio parts is your unfailing assurance of quality reception. Ask the man who has built one.

GENERAL RADIO Co
Cambridge, Mass.,
U.S.A.



The Service Behind **OZARKA** Makes This Distance Possible



Why Ozarka Receives from Honolulu

OCCASIONALLY some owner of a radio instrument receives from London, England. But did you ever hear of any one receiving Honolulu, Hawaiian Islands? We will gladly give you the names of the writers of the letters reproduced here, as well as send copies of many letters showing how other Ozarka owners have had results from London, England; Cardiff, Wales and Glasgow, Scotland.

These cases are exceptional, of course, but they must prove to every thinking person that the Ozarka is the greatest distance receiving instrument known today.

In the ownership of an Ozarka Instrument, you are assured of not only the last word in radio, but you will receive expert service, which is far more important than the instrument itself. This is a point you should keep well in mind when you buy radio. Be absolutely sure that the person or the firm from whom you purchase is thoroughly capable of keeping that particular instrument in perfect condition. The situation in Radio is exactly the same as that of the automobile. Both are mechanical—both have little things go wrong at times, and both are quickly and easily fixed by the man who knows how.

The Ozarka Radio instrument is sold only by trained factory representatives who know every part, every wire of this instrument. Before he can wear the Ozarka gold button he must satisfy our engineers that he is thoroughly capable of delivering trained service.

4 Tube Ozarka Radio \$39.50 and Up

The Ozarka representative will gladly set up this Ozarka instrument in your own home on trial. He will not make any claims but will let you operate it and prove to yourself that it absolutely has no equal for volume, tone, distance and ease of operation. This will not obligate you in any way.

And as for price, you will, no doubt, be agreeably surprised because Ozarka Four Tube Instruments, for loud speaker operation, are sold as low as \$39.50. Let us send you more information about Ozarka, including hundreds of letters giving the most marvelous results ever received on a radio instrument. Drop us a card for our free illustrated book No. 200. Please give name of your county.

OZARKA, Inc., 807 Washington Blvd., CHICAGO

Pittsburgh, Pa.
Ozarka, Inc.
Chicago, Ill.
Gentlemen:—I want you to know that I think I have received the greatest distance possible on my Ozarka—KGU, Honolulu, Hawaiian Islands.
A great many friends who have radio instruments of all kinds and bought at one in this city to my knowledge ever received from such a great distance. To say that I am pleased with my instrument is putting it mild. Yours very truly,
H. J. R.

Alden Bridge, La.
Ozarka Incorporated,
Chicago, Ill.

Gentlemen:—A few nights ago I heard the beautiful Hawaiian Orchestra, direct from Honolulu, territory Hawaiian. When you consider the distance that this is from Alden Bridge, I certainly think it ought to be a record. This music came in beautiful and clear, in fact, it could not have been any better.
Yours very truly,
W. H. B.



More Men Wanted To Sell Ozarka

RADIO offers today an exceptional opportunity for the right kind of a man to build up a permanent, substantial and profitable business of his own. Ozarka factory representatives are today building up very satisfactory incomes for themselves.

In territory which is not now covered there is still an opportunity for a mechanically inclined man who is willing to place himself under our training. We can show such a man how it is possible, to build up a business in his own town, possibly in spare time to start with, but sooner or later will justify giving it all of his time.

We are looking for men who realize that there must be some way of improving their condition. We prefer men who know absolutely nothing about radio, because we can then train them according to our own method.

The man we are looking for has a good reputation, is well and favorably known in his community, may not be a salesman but can talk convincingly on something he knows perfectly and firmly believes in.

The Ozarka Plan will give such a man his first real opportunity to establish himself in a business of his own. Investment of money is small but necessary.

All we must make sure of is that you are determined and willing to put forth the effort. If you will do this just write and say: "Send me your Ozarka Plan Book No. 100." It may be the turning point in your life. Don't fail to mention the name of your county.

Nashville, Tenn.
May 14, 1924
Ozarka, Inc.
Chicago, Ill.
Gentlemen:—I consider my best night when I successfully connected in with the following stations: CKAC-Montreal, KGU-Honolulu, WBAF-Fort Worth, WGN-Chicago, WBZ-Springfield, WOAI-San Antonio, KDKA-Pittsburgh, WCAL-Northfield, Minn., WFAA-Dallas, WGY-Schenectady. On a recent night Station KYW-Chicago gave a special program lasting all night.
Yours truly,
O. C.



This Button identifies Ozarka Representative in your city—your assurance of complete radio satisfaction

