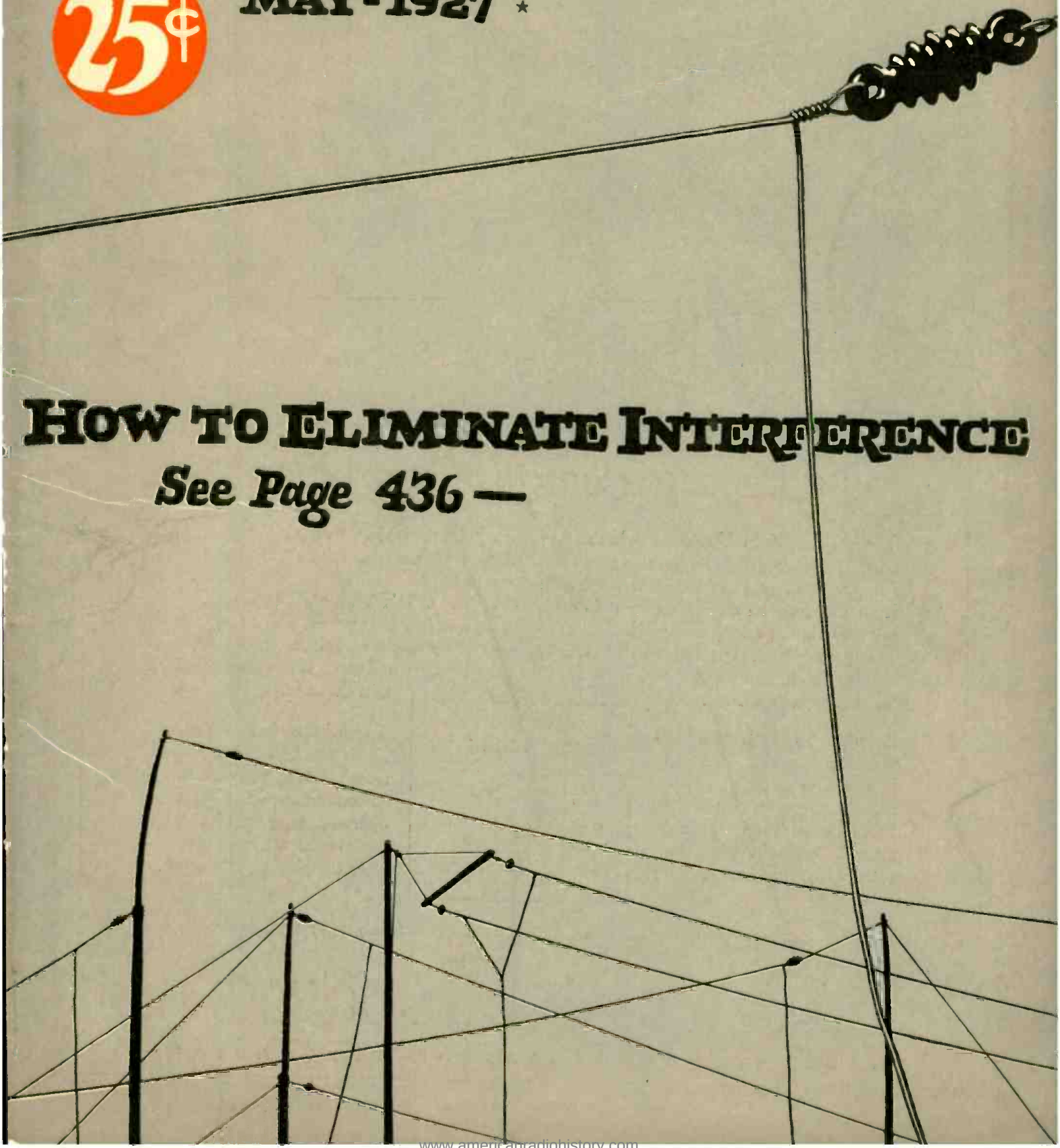
Popular Radio

25¢

MAY-1927 ★



How to Eliminate Interference

See Page 436 —

RCA ANNOUNCES
RADIOTRON UX-240

for resistance coupled amplification

RADIOTRON UX-240 marks another RCA contribution to the radio art. Now amateur and experimental work with resistance coupled amplifiers is made easy, because this specially designed Radiotron will operate on plate potentials that are easily obtainable either by the use of batteries or "B" battery eliminators.

Extensive research with high mu tubes in the designing laboratories of RCA and its associates, points to the fact that a mu of 30 is the closest approach to the ideal in a tube of this character. Above or below this amplification factor of 30, it has not been found desirable to go.

Radiotron UX-240, with its amplification factor of 30, will give excellent results with only two stages of resistance coupling, instead of the usual three, if it is also employed as a detector.

CHARACTERISTICS

Filament Volts 5.00
Filament Amperes 25
Plate Milliamperes (approx.) .2
Amplification factor . . .30

"B" Voltage	Plate Coupling Resistance	Amplifier "C" Volts
180	250,000	−3
135	250,000	−1.5

Stopping Condenser .005 to .05 Mfd.
Amplifier Grid Leak 2 Megohms
Price $2.25

To read the characteristics of Radiotron UX-240 is to realize what RCA has contributed in convenience and practical operation to amateur and experimental work with resistance coupled amplification.

RADIO CORPORATION OF AMERICA NEW YORK CHICAGO SAN FRANCISCO

RCA-Radiotron

MADE BY THE MAKERS OF THE RADIOLA

Eveready Layerbilt "B" Battery No. 486, the Heavy-Duty battery that should be specified for all loud-speaker sets. Price $5.00.

The Layerbilt patented construction revealed. Each layer is an electrical cell, making automatic contact with its neighbors.

Radio is better with *battery* power

RADIO receivers designed for quality reproduction operate best on well-made dry cell "B" batteries. What your ear tells you about the performance of battery-run sets is confirmed by laboratory tests that reveal that batteries alone provide steady, noiseless "B" current, taking nothing from and adding nothing to radio reception. Batteries, and batteries alone, provide pure DC (pure Direct Current). Only such current can give you the best results of which your set is capable.

Battery Power is dependable, convenient, and reliable, under your sole control, ever ready to serve you when you turn on your set. As your "B" batteries approach the end of their service, a slight drop in volume warns you in ample time. You need never miss a single concert if your set is battery-equipped.

Not only in results, convenience and reliability are "B" batteries unequaled, but they are also unapproached in economy, provided, of course, the correct size batteries are used. That means the Heavy-Duty type for all receivers operating loud speakers, as most do nowadays. Smaller batteries are not as economical, though they give you the quality advantages of Battery Power.

For maximum economy, choose the Eveready Layerbilt "B" Battery No. 486. In every test and trial this has proved conclusively to be the longest-lasting "B" battery ever built. Its unique and patented construction is responsible for its astonishingly long life. It is, we believe, the most economical, as well as the most satisfactory, convenient and reliable source of "B" current available. Just remember this: Radio is better with *Battery* Power, and the Eveready Layerbilt "B" Battery No. 486 offers you that power most economically.

NATIONAL CARBON CO., INC.
New York San Francisco
Unit of Union Carbide and Carbon Corporation

Tuesday night is Eveready Hour Night
—9 P. M., Eastern Standard Time

WEAF–*New York*
WJAR–*Providence*
WEEI–*Boston*
WTAG–*Worcester*
WFI–*Philadelphia*
WGR–*Buffalo*
WCAE–*Pittsburgh*
WSAI–*Cincinnati*
WTAM–*Cleveland*
WWJ–*Detroit*
WGN–*Chicago*
WOC–*Davenport*
WCCO {*Minneapolis* / *St. Paul*}
KSD–*St. Louis*
WRC–*Washington*
WGY–*Schenectady*
WHAS–*Louisville*
WSB–*Atlanta*
WSM–*Nashville*
WMC–*Memphis*

Popular Radio

EDITED *by* KENDALL BANNING

FOUNDED 1911

VOLUME XI — May, 1927 — NUMBER 5

CONTENTS

(*Cover design by Frank B. Masters*)

DEPARTMENTS

VOLUME XI — MAY, 1927 — NUMBER 5

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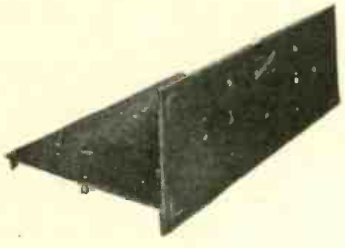
JOHN V. L. HOGAN, *Contributing Editor* — LAURENCE M. COCKADAY, *Technical Editor* — E. E. FREE, Ph.D., *Contributing Editor*

BROWNING-DRAKE KIT

Antenna system—One Browning-Drake space wound antenna coil, mounted on .0005 condenser, with velvet vernier illuminated dial.

Regenaformer system—One Browning-Drake transformer; slot wound primary, space wound secondary, mounted on one .00025 condenser with velvet vernier illuminated dial. Complete with instructions. List price, $25.00.



B-D FOUNDATION UNIT

Consists of front and base panels, drilled and engraved; with sockets, resistor clips, soldering lugs, machine screws and wire. List price, $15.00.

NEUTRALIZER

The Browning-Drake balancing or neutralizing device lists for $1.00. This system of neutralization is recommended by Browning and Drake.

CARTRIDGE RESISTANCE

The cartridge resistance—another Browning-Drake Corporation product. Lists for 75c.

GET ~ DISTANCE

with the *new* Official BROWNING-DRAKE KIT SET

WHAT is believed to be a transcontinental reception record—Los Angeles from Boston—seven consecutive nights—was recently established by a standard factory-built Browning-Drake (confirmation on request). The extreme distance-getting ability of Browning-Drake is well known. The new Official Browning-Drake design for the home constructor, incorporating the Browning-Drake Corporation Kit and Foundation Unit, makes it possible to construct readily a set which will meet the wildest dreams of the DX hound.

Tone quality is almost perfect through the use of impedance and resistance audio amplification. This amplifier was designed for use with a "B" eliminator and power tube.

Complete constructional data is available in booklet form for twenty-five cents, either through your dealer or direct.

BROWNING-DRAKE CORPORATION
BRIGHTON MASS.

DEALERS: There should be at least one distributor in your territory handling complete receivers, as well as all the parts for the Official Kit Assembly. We will be glad to forward the name of our nearest jobber.

BROWNING-DRAKE RADIO

A Page With The Editor

THE fact that President Coolidge, in selecting the personnel of the Radio Commission, picked out capable men who really know something about radio, and that he did not yield to the pressure of some of his political advisors to appoint "lame ducks," augurs well for the broadcast listener and consequently for the radio industry.

* *

DESPITE the failure of the late Congress, which authorized the creation of the Radio Commission, to provide an appropriation for it, the Commission has proceeded to business with a promptness that promises to dispel much of the confusion that has prevailed in the broadcasting field and to stabilize an industry that has been, for many months, in dire need of legalized leadership.

* *

ALTHOUGH the rulings of the Commission may be subject to question by the courts, the general impression prevails that its activities will be of substantial benefit to the industry, and that they will warrant manufacturers to proceed with their plans on a larger scale than ever before—to the great good of the radio fan and of the radio experimenter

* *

FOLLOWING up their article, "How to Build the New Standard Browning-Drake Receiver," in the April issue, Mr. Glenn H. Browning and Dr. Frederick H. Drake, the inventors of this famous circuit, will make another important contribution to the coming (June) number of POPULAR RADIO; it will give the full constructional details of an "ABC" power-pack for the complete operation of the Browning-Drake receiver without the use of batteries.

* *

To the fan who likes to carry a portable set about with him on his summer jaunts, the article by William F. Crosby, on page 431 of this issue, is of timely and practical interest. For this is the time of year to get that portable set ready!

* *

MR. CROSBY does not base his article on mere theory; he has written from actual experience with portable sets drawn from many and long-extended tours by automobile and pleasure boat.

* *

ON page 279 of our March issue POPULAR RADIO inadvertently stepped on the toes of our friends of the Western Union Telegraph Co. The trouble-making sentence read:

"Attributed to radio competition, cable rates have been reduced for the first time in forty years."

WHILE the above observation is technically unassailable, the question may be properly raised as to just how authoritatively and by whom the change in cable rates has been "attributed" to radio competition. So, for purposes of accuracy, we quote below from a letter received from Mr. H. C. Hamilton of the Western Union, even though the quotation makes us violate our inviolable rule against that anathema of all editors, the "free write-up":

* *

"IN December, 1911, the cable companies inaugurated the cable letter service and the week-end letter service, both of which gave the public a lower rate for two entirely new and much needed cable services. In April, 1923, the 25-cent a word rate for fast cablegrams was reduced to 20-cent per word beween here and England."

* *

THE "reformer" has now made his appearance within the realms of the broadcasters. It was inevitable.

* *

AND like all of his meddlesome kind, his purpose is to force his tastes and his ideas and his theories upon the rest of us—whether we like them or not.

* *

THE latest "reformer" of radio broke into the limelight perhaps more spectacularly than he anticipated when he, as the secretary of the "Keep-the-Air-Clean-on-Sunday Society" of New York (which was later reported as having twenty members) protested to station WMCA against the "degrading" and "defaming" of the ether by broadcasting on Sundays such profanities as popular music!

* *

AND as a hint of what might be expected if WMCA did not reform its ways, the writer and the "others" (meaning presumably his associates) threatened to "press the matter with the new radio commission."

* *

IT happened that the particular program feature that inspired this reformer's ire was "Roemers' Homers," sponsored by Mr. Milton M. Roemer, a New York business man.

* *

INSTEAD of indulging in controversy, Mr. Roemer appealed direct to the radio audience. "What kind of Sunday programs do you want?" was the substance of his appeal. "We will try to give you the kind of Sunday program that you yourselves elect."

AND the immediate response to this query was an avalanche of thousands of letters, augmented by scores of telegrams and telephone calls, practically all of them urging the continuance of the popular program!

* *

POPULAR RADIO has long believed and often reiterated its opinion that the radio audience should get and will get pretty much the sort of radio entertainment that it wants. Undesirable features are tuned out too easily to make any other course successful.

* *

UNDOUBTEDLY there is a large and eminently proper demand for the broadcasting of Sunday church services—particularly on Sunday mornings. POPULAR RADIO believes that this demand should be met.

* *

BUT there is even a larger and just as proper a demand for Sunday program features that are *not* of a religious nature—particularly on Sunday afternoons and evenings. POPULAR RADIO believes that this demand should also be met.

* *

THE indiscriminate broadcasting of all kinds of religious propaganda has been so vastly overdone as to assume the proportions of a public nuisance. Only recently has the radio worm finally turned and demanded—and gotten—more popular programs on Sunday afternoons.

* *

IT is probable that the nature of the Sunday religious programs has kept silent on this day millions of receivers that would otherwise have been in operation. The loss has been the fan's, the broadcaster's and the radio industry's alike.

* *

BY all means maintain all the religious programs that the fans want. But by all means maintain all the popular programs that the fans want, too!

* *

THE most efficient and professional installation of a receiving set in a motor car that has yet come to the attention of POPULAR RADIO will be described in the next issue of this magazine.

Kendall Banning

Editor, POPULAR RADIO.

The Coil's the thing! that makes Radio

No Radio Unit is any better than its coils---true of all electrical apparatus where coils are used, but most true of Radio.

EVERY step of Radio progress calls for more and better coils. The strong trend this year toward "A" and "B" power units, battery chargers and other devices to use light socket power, makes the coil of greater importance than ever. Ordinary coils produce only ordinary quality of reception and make a mediocre out of an otherwise fine set.

It is therefore important for radio manufacturers to buy the *best coils* wound from the *best magnet wire.*

It is equally important for every jobber and dealer to *know* what kind of coils are used in every radio unit he sells to his customers. In other words,

Good Coils Make Good Radio Units

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DUDLO MANUFACTURING CORPORATION, FORT WAYNE, INDIANA

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CHICAGO, ILL.

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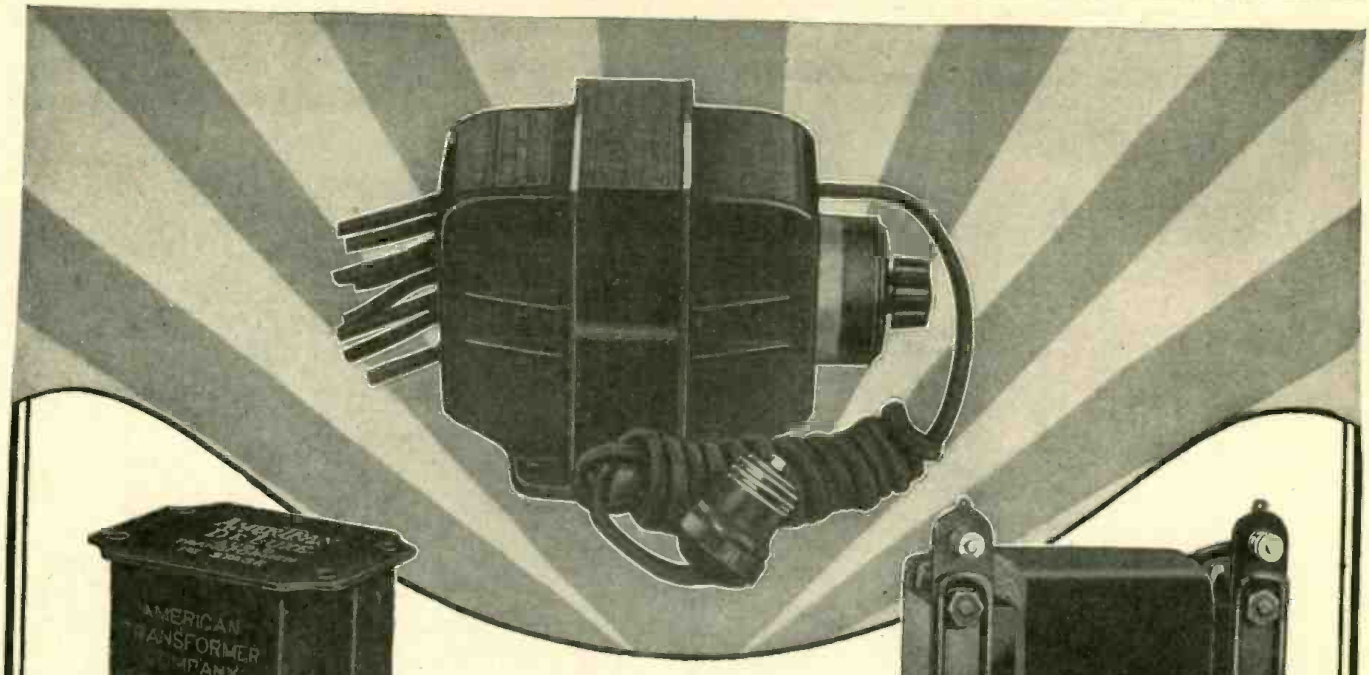


AmerTran Power Transformer
Type PF52, $18.00 Each

AmerTran DeLuxe Audio Transformer. Two Types for 1st and 2nd Stages. $10.00 Each

AMERTRAN
RADIO PRODUCTS

AmerChoke Type 854, $6.00 Each. The AmerTran Power Transformer Type PF64 (unmounted) and 2 AmerChokes Type 854 are specified for use in the Varion Power Pack as described in this magazine

BRING YOUR SET UP-TO-DATE WITH AMERTRAN RADIO PRODUCTS

Today, the better class of broadcast stations are radiating fine programs with the highest quality possible. To take full advantage of this, the audio amplifier in your set should be up-to-date. You can make this improvement by installing a pair of AmerTran DeLuxe Audio Transformers. In so doing, be sure your last tube is a power tube capable of handling the higher plate voltages and current. It will then take care of the greater input signal and not overload or blast. The quality of reproduction will more than repay you for investing in AmerTrans. The tones from your cone speaker will be faithful and lifelike. You will realize a new degree of reality from all good broadcasting.

ELIMINATING BATTERIES

AmerTran Power Transformer Type PF52, AmerChoke Type 854 and the AmerTran Resistor Type 400 will enable you to construct the best of high voltage plate supplies. And with slight changes in your set, you may eliminate entirely all batteries.

Write for further information that will enable you to make your present or contemplated set meet the high standards of modern broadcasting.

Free Booklet, "Improving the Audio Amplifier," and other technical data will be sent on request.

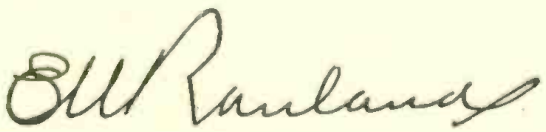
AMERICAN TRANSFORMER COMPANY
178 Emmet Street Newark, N. J.

"Transformer Builders For Over 26 Years"

Sold only at authorized
AMERTRAN
DEALERS

The Most Valuable Information for the Progress of Radio

"Aside from the strictly technical journals, I find POPULAR RADIO *gives me the latest and most accurate knowledge of recent radio developments. Its editorial policy, too, keeps abreast of the times. Undoubtedly,* POPULAR RADIO *is contributing some of the most valuable, as well as interesting, information for the progress of the science of radio."*



PRESIDENT, ALL-AMERICAN
RADIO CORPORATION.

General Electric

Radio Combines Its Senses of Hearing and Seeing

Step by step radio develops its senses—the equivalent of the five senses of mankind. To the perfected ear of the microphone is now added the eye of the motion-picture camera. By this new system of speaking motion picture, Mr. Kolin Hager, studio manager of WGY, is pictured on the film as he speaks into the microphone; the two records are joined on the same strip of film. The camera is motor-driven, to keep the records exactly in step.

Popular Radio

VOLUME XI May, 1927 NUMBER 5

Static's New Job as Life-Saver

The ingenious combination of mind and machine that is at last making intelligible to man the warnings of the direction and approach of one of the most common and disastrous forms of the "acts of God."

By COMMANDER S. C. HOOPER, U.S.N.

"The winds may come and the winds may go,
"But where they go to I don't know."

A FEW years ago this couplet never failed to bring a laugh from the footlights, but to-day, based on revolutionary experiments conducted by the Navy, the modern version should read:

"Cyclones, hurricanes, blow your worst,
"With static bearings we'll get there first."

No more need the mariner blunder into the path of the devastating hurricane of the Caribbean, jeopardizing the safety of his ship and the lives of his crew. No more need there be the loss of a single life when the raging winds, gathering fury as they go, vent their wrath on the coral islands of the West Indies and the populous coasts of our own country.

For while the home-loving public, untouched by the tragedy of a hurricane, peacefully sits by its radio-side, damning static for ruining a musical evening; while the greatest radio minds all over the land have sought a means of subduing or controlling static, modern science, like a fairy godmother, has waved her magic wand and we learn that static, erstwhile step-child of the ether, is a very useful Cinderella indeed.

It has been proved that static is ever screaming a raucous warning and pointing unerringly toward the path of the onrushing storm. It is as if the myriad souls who have met the vengeance of the hurricane are banded together in a spirit choir to show the way to safety.

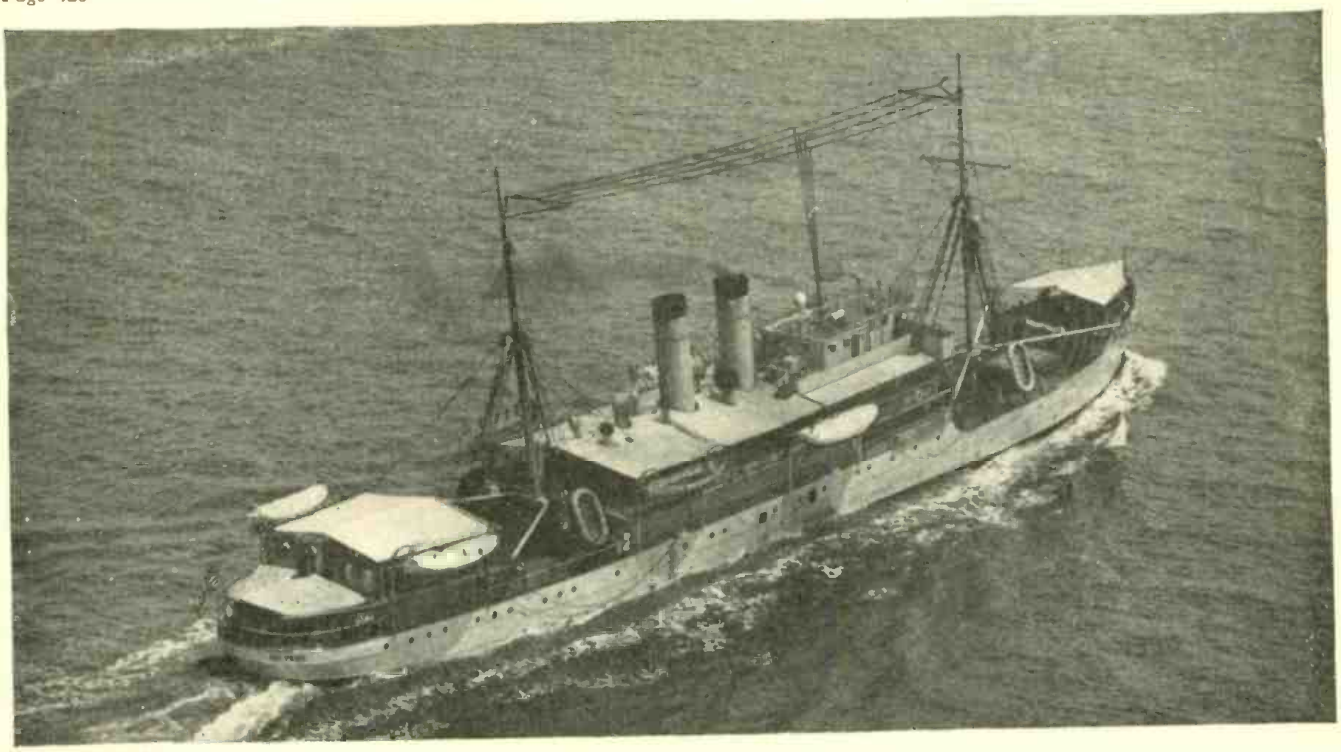
Meteorologists have long been interested in the relation of static to storms, but it remained for an officer of the United States Navy, Lieutenant E. H. Kincaid, to evolve the theory that the strength of the static is proportional to the rate of change of pressure, it already being a known fact that the static emanating from an intense cyclonic area is greatest at or near its center.

The manner in which Lieutenant Kincaid made this discovery, which bids fair to become another boon to humanity brought forward in this decade, and the ingenious method employed to convert this theory to practical use, are of more than passing interest.

For two years Lieutenant Kincaid was the navigating officer of the *U. S. S. Kittery*, a small Naval auxiliary making regular trips between Hampton Roads and the West Indies. During these cruises he noted that the radio operator proved a fairly accurate static barometer. On each occasion when the operator complained of heavy static the weather map showed an area of changing pressure between the *Kittery* and the radio transmitting station with which he was communicating. This recurrent condition led to the belief that there was a definite relation between static and changing pressure.

Other ships had experienced this same static condition, but were content to wait until reception was good and thought no more of it. But Kincaid thought more of it—he thought a great deal of it. In fact, he thought so much of it that he despatched a radio to the Navy Department asking that a radio compass be installed in the *Kittery* on her return to Hampton Roads. He was convinced that this was a study well worthy of investigation. If static insisted on impinging itself upon the eardrums of his operator he would not treat it as an unwelcome guest as others had done. Presuming it had a story to tell he was more than willing to hear it.

When the *Kittery* made her next trip she was equipped with a radio compass of the latest design. And as if the Gods of Chance had stacked the cards in Kincaid's favor, he was given his great opportunity on this voyage to prove his theory beyond the question of a doubt. For while the *Kittery* was throwing off her mooring lines from the dock at Hampton Roads on July 15th, angry storm clouds were gathering in the dol-



U. S. Navy Photo

THE SHIP THAT WAS SAVED BY STATIC

Over this antenna on this small naval auxiliary vessel, the U. S. S. KITTERY, *came the static signals that gave the navigating officer an idea—an idea that is converting the mariners' conception of static from that of enemy to friend and that has already resulted in the saving of many human lives.*

drums. As the little vessel nosed out of Cheasapeake Bay the evil winds had mobilized to the storm king's call and were even then beginning their horrific sweep of death and destruction in what was later named the Nassau hurricane because of its devastating effect upon that island.

Lieutenant Kincaid reasoned that if the static were actually greatest in the center of the hurricane then the radio compass would show a maximum when pointed toward its center and a minimum on such maximum ninety degrees from its center. The radio compass coil was turned by hand at the rate of ten degrees a minute, thereby covering the entire circle in six minutes. The position of the coil at the point of maximum static should indicate the direction of the storm center.

While passing through Crooked Island Passage there were indications in the compass of heavy static in the direction of the Lesser Antilles. It was later proved that this was the position of the Nassau hurricane at that time. The *Kittery* continued to plot the course of this hurricane and the following day, July 24th, put in at Port au Prince, Haiti, as the cyclonic disturbance passed to the northward of Santo Domingo.

Day by day as the *Kittery* was returning to Hampton Roads the track of this hurricane was plotted and verified. Prior to arrival the results were analyzed and it appeared that "the reason the association of static to changing atmospheric pressure had not been definitely established before, was due to the comparative mildness of the static, especially the grinder type, which is generated in sufficient volume only in the *center* of hurricanes for bearings to be obtained without the use of precision instruments." Static, which is so annoying in receivers, is generally believed to be very strong, but actually, in relation to man-made electricity, it is quite faint under nearly normal conditions. This indicated that the personal error of the operator would have to be reckoned with and showed the need of a static recording instrument to obtain precise results under all conditions.

It had been noted while making experiments with the Jenkins radio weather map recorder that static, as well as any other disturbance in the ether, left its mark on the map. This fact made it possible to utilize the instrument as a static graph recorder, and on the September trip of the *Kittery* it was hooked up to the radio compass with surprisingly good results. The circular static graph shown on the facing page, is a reproduction of the data recorded by the Jenkins instrument. These graphs give little more than the quantity of static in any particular direction. It remains for an additional attachment which the Bureau of Engineering, U. S. Navy, and other interests are developing, to give the relative intensity of the individual impulses.

Once again Fate dealt to Lieutenant Kincaid from the bottom of the deck, for the month of September, 1926, was marked by an unusual degree of storm activity in tropical regions of the North Atlantic. In addition to the hurricane which devasted Miami on the 18th, there were no fewer than four other storms of tropical origin. The tracks of the Bermuda hurricane, the Swan Island disturbance and the Miami hurricane were faithfully and accurately plotted by means of the static graph instrument. Being thus forewarned, the *Kittery* by artful dodging evaded every blow and carried out her schedule on time.

Many others were not so fortunate. The American steamship *Haleakala* and the British steamship *Loyal Citizen* were lost with all on board; in addition, an appalling number of smaller vessels were sunk or helplessly beached while lying in presumably sheltered harbors.

Yet luck served no part in carrying the *Kittery* safely through this storm; it was the practical application of a scientific theory that enabled this little vessel to ride out the hurricane without any discomfort.

"Having plotted the position of this hurricane twice daily," writes Lieutenant Kincaid in his official report, "it was predicted that the center would pass suffi-

ciently to the northward of Cape Hatien for the *Kittery* to reach that port according to schedule. This prediction was correct. However, all precautions were taken for encountering heavy weather.

"The ship left Cape Hatien before dark and rode out the storm in comparative safety in the lee to the northward of Tortuga Island, which juts up abruptly from the sea to a height of 1200 feet, with deep water close up to it. The *Kittery* steamed in the lee all night, where the apparent strength of the wind was reduced to gale force and the seas were negligible, although in the upper air above the island the wind could be seen by the cloud movement to be of hurricane violence."

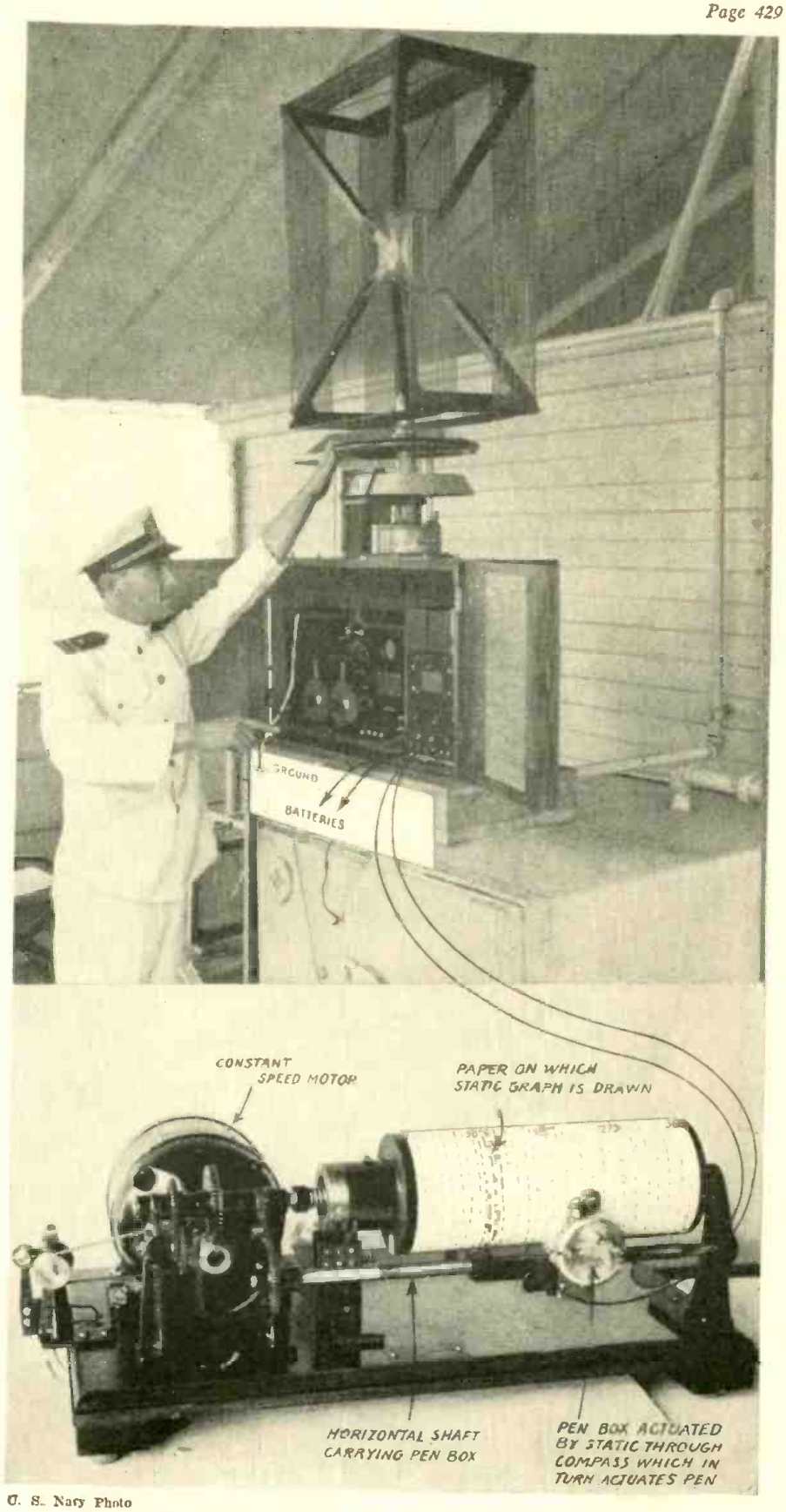
On this occasion the southerly winds were so strong that innumerable birds, blown from their nests in Haiti, became attracted by the ship's lights and fell exhausted upon the decks. Their piercing shrieks could be heard above the violence of the winds.

There is an old seagoing superstition that whistling about the decks will cause the winds to spring up. There is no record of Kincaid having whistled on these trips, but nevertheless he must have had some sort of understanding with the God of Storms, for the weather was made to order for him on every occasion. He had but to show himself in the Caribbean when along came a hurricane. Even on his honeymoon which followed shortly after the Miami disturbance had subsided, a playful hurricane disported itself about the ship on which he was making his wedding trip to Bermuda.

This personal attraction for hurricanes would make Kincaid a doubtful asset as a shipmate, yet had the *Kittery* not encountered all these typical disturbances within such a short interval of time, it might have required several years of observation to obtain adequate data on his theory. As it happened, conclusive proof was happily derived from two successive voyages.

And now, when vessels are equipped with radio compasses and static graph recorders, they can, by application of this theory, readily anticipate the hurricane's track and thereby avoid its fury. The element of surprise and unpreparedness which has been the primary cause of previous disasters would be entirely eliminated.

The hurricanes of the late summer and fall invariably originate in the Atlantic doldrum near the west coast of Africa and move in a general westerly direction. It is proposed to utilize existing Naval radio compass stations in practicing the picking up of directional static and if satisfactory results are obtained the next logical step would be to erect an outpost of such stations on several islands of the



U. S. Navy Photo

HOW THE MOVING FINGER OF STATIC WRITES ITS WARNING

At the top is shown a standard type of compass connected to its receiver and amplifier. Two leads run down to the Jenkins "static recorder," operated by motor, that prints a graph of the static impulses on the rotating cylinder. These records give warning of approaching storms and even go so far as to tell the direction from which they may be expected to break and their approximate intensity.

WHEN A STORM IS FORMING AND—

The curved lines on this weather map show the location and general character of the atmospheric disturbance; the effect of it on the static record is indicated on the raylike circle around the ship.

—WHEN THE STORM BREAKS

Note the concentration of the storm area and the corresponding effect on the static record. (This record was made September 16, 1926, while the U. S. S. KITTERY *was riding the Florida hurricane.)*

West Indian group in a line between Trinidad and Porto Rico. These stations would take simultaneous static bearings of the hurricane's center almost at its inception, and in any event before it reaches inhabited islands or the usually traveled shipping lanes. By means of triangulation the path and progress of the storm would be readily obtained.

Radio warnings based on these observations would then give all vessels ample opportunity to seek a haven of refuge removed from the track of the hurricane and would permit those on shore to make such preparations as are practicable to insure the minimum property damage. In the West Indies there are thousands of natives who place their entire dependence in the trade winds to assist them in making their living. The fishermen of these islands rely upon the winds almost to a point of religion. They may be seen bound out to sea at daylight sailing wing and wing on the land breeze and returning with the sea breeze as the sun is getting low. Their daily excursions are as regular as the ebb and flow of the tides. Every hurricane that comes along takes a tremendous toll of these natives. The same applies to the sponge divers of the Bahamas and all others who depend on the sea for their livelihood. Accurate hurricane warnings would be most valuable to the heavily populated areas bordering the southeast coast of the United States which even yet has not recovered from the ravages of the recent hurricane.

The Weather Bureau has done excellent work in locating storms and in predicting their path by means of meteorological observations. When the static method is placed in operation it will, according to those who are developing it, substantiate this Bureau's reports and make certainties of predictions.

Investigations of static relative to storms have been pursued for many years by this country as well as the nations of the world. As early as 1901, observations of static were used by at least one meteorological observatory as a supplementary means of forecasting certain types of weather. In 1921 the Navy attempted to make use of static bearings by utilizing the radio compass stations along the southeast and gulf coasts of the United States with sufficiently good results to show that this was practicable. However, communication between these stations was difficult and the work was finally abandoned due to lack of facilities and to other more pressing demands.

Interest was revived upon the advent of improved instruments and more reliable static graph recorders, and the impetus derived from the *Kittery's* experiments during the past year will result in unflagging effort on the part of the Navy and other Government departments to convert these theories to practical use for the good of mankind.

For Operating the Browning-Drake Receiver Without Batteries

In the next number of POPULAR RADIO*—for June—will appear another constructional article by Glenn H. Browning and Dr. Frederick H. Drake, the inventors of the famous circuit that bears their names. This forthcoming contribution will follow up their article in the April issue; it will give the full constructional details of an "A," "B" and "C" power-pack for the complete operation of the Browning-Drake receiver without the use of batteries.*

¶ This is the time of year to get ready the compact receiver that you can carry about with you on your summertime jaunts; here are some helpful hints for going about it

EFFICIENT AND PRACTICAL PORTABLE SETS

By WILLIAM F. CROSBY

MODERN radio equipment, 1927 model, lends itself more readily than is generally supposed to summertime uses, on the automobile camping trip, on the hike or afloat on a motor boat cruise.

This is true, of course, of home-made sets as well as of commercial portable receivers. There are several small portable outfits which will receive broadcast programs satisfactorily—and with proper volume over considerable distances. Most of these sets, however, are better adapted to motor boats and automobiles, as their weight usually precludes the possibility of their use on hiking trips.

The home-made radio set, with from one to three vacuum valves, is probably better adapted to the type of vacation on which equipment must be packed over rough country. These sets may be built up in extremely small cabinets and the batteries (the most weighty part of the equipment) may be arranged in a separate container, thereby permitting the load to be more equally distributed.

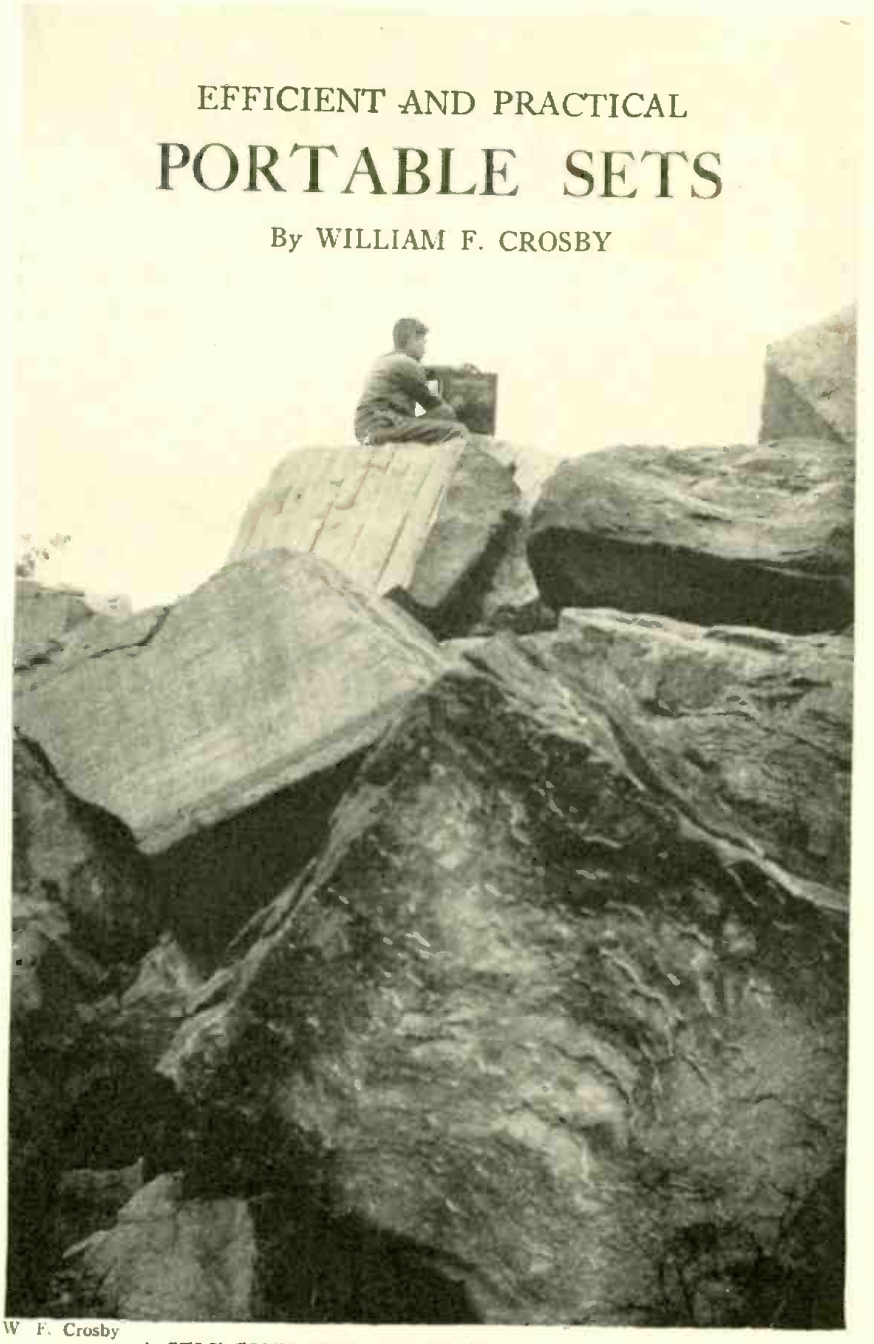
In equipment of this type it is best to disregard completely the use of a loudspeaker. The ungainliness of such equipment, as well as its fragility, makes its transport on foot an extremely difficult undertaking at best. Of course, the smaller the set, the lighter it will be, and as even a one-valve receiver will permit the use of several pairs of headphones, it is apparent that such an arrangement is ideal when weight is the prime consideration. Furthermore, the headphones may be easily packed away in a blanket roll and will add but a few ounces to the total weight.

Another smaller set for the hiker, and a set that is extremely easy and cheap to make, is the crystal set, consisting of a variometer, a fixed condenser or so, a crystal detector and a pair of headphones.

As the headphones can usually be taken apart, a pair of campers need not burden themselves with an extra pair of phones, but may share the two ear pieces between them.

This set may be built in a box just large enough to hold the variometer and detector, with binding-posts for the antenna, ground and the headphones. No batteries are required for its operation and the weight may be reduced to almost nothing. For all practical purposes an antenna about 75 feet long will do the work. Usually the range of such a set is a maximum of twenty-five miles, but there are instances of much greater distances being covered. Of course summer weather will cut this down somewhat anyway, and by assuming twenty-five miles as the greatest distance for the set, we will prevent disappointment. Everything depends on the crystal in the detector and the better this is, the better the set will work.

For a trip into the wilds, either by pack horse or afoot, one of the best pieces of equipment is a single or two-valve set, operating entirely from dry-cell "A" batteries and using the smallest kind of "B" batteries. In fact, with modern low-amperage vacuum valves it is practical to use a small 4½-volt "C" battery to replace the usual cumbersome dry "A" batteries; this will not only save several pounds in weight, but it will also reduce the size of the complete outfit. Such a small battery will last several weeks, at the least, in normal operation; if an extended trip is to be



W. F. Crosby

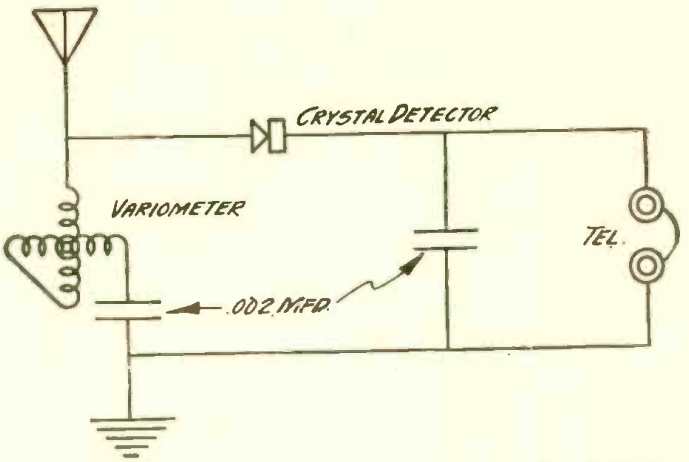
A SELF-CONTAINED RECEIVING SET NO BIGGER THAN A SATCHEL

The compact little instrument pictured above is a portable superheterodyne with self-contained batteries and reproducer; it may be carried into almost any accessible place and may be set up and put into operation in an instant.

W. F. Crosby

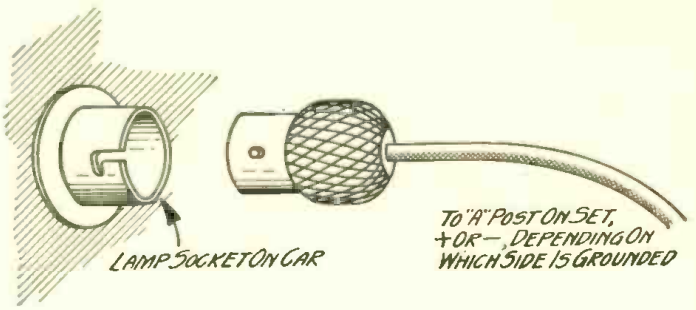
HOW TO RIG UP A TEMPORARY ANTENNA IN A TREE TOP

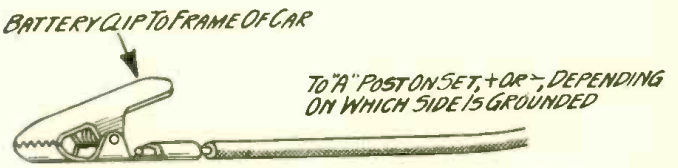
Just tie a stone to the end of a rope and throw it over a convenient branch; then tie the antenna wire to the rope and pull it up. Such an antenna is suitable for any of the sets described in this article. However, under particular circumstances in which hikers or tourists frequently find themselves, other types of antennas may be found more convenient or practicable. Several such cases are described in the text of the article.



A SIMPLE CRYSTAL CIRCUIT FOR A PORTABLE SET

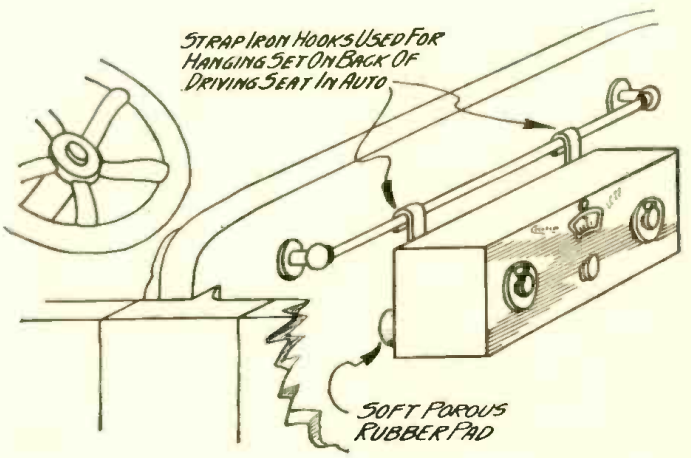
A variometer and two fixed condensers with a crystal detector and mounting may be placed in a small box and carried by the hiker.





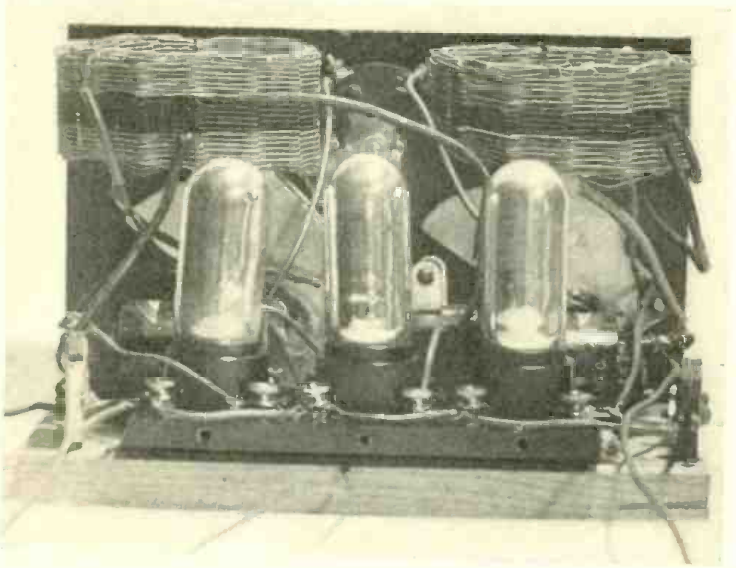
HOW TO TAP THE MOTOR CAR BATTERY

With these two simple connections the storage battery in an automobile may be used for supplying current to portable tube sets.



ONE WAY TO MOUNT A RECEIVER IN AN AUTOMOBILE

Most five-passenger cars have a robe rail on the back of the front seat; it is a simple matter to install a receiving set on this rail, as indicated in the drawing above.



A POPULAR PORTABLE

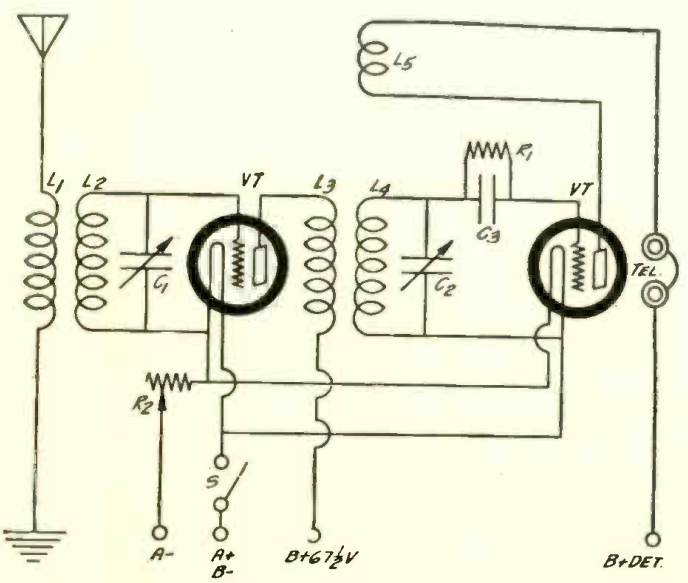
This portable three-tube set employs a straight regenerative detector and two stages of low-frequency amplification with UX-199-type tubes. It may be installed in a simple box that also holds the batteries, as shown in the illustration at the right.

W. F. Crosby

taken, it is a simple matter to carry two or three spares along as replacements. Even with this the size and weight will be below that of the ordinary battery equipment.

The circuit may take any one of several different forms; it may be the ordinary regenerative detector with one stage of low-frequency amplification or it may be a reflex circuit in which the first valve acts as both low-frequency and a high-frequency amplifier with the second valve acting as a detector. This type of set, though, is apt to be unstable unless it is carefully designed. Probably the best arrangement is the circuit that embodies one stage of tuned high-frequency amplification with a regenerative detector. This will give plenty of volume for the headphones and will also prove to be sufficiently powerful to bring in distant stations under adverse conditions. Of course, a third valve may be added as a single stage of low-frequency amplification, but the added volume may not be necessary or desirable.

If you will take the trouble to look around the radio stores you will find that there are many makes of small instruments which will be suited to the assembly of such a diminutive receiver. Last year, the author made a three-valve reflex receiver, using UX-199 type tubes on a panel only 8½ inches wide by 5 inches high. The panel of this little set contained the two tuning controls, a rheostat knob, a jack for the headphones and the antenna and ground binding posts. A practical cabinet was made from some soft lumber and given two coats of dark green paint.



THE SCHEMATIC CIRCUIT FOR A SIMPLE TWO-TUBE SET

This drawing gives the connections for one stage of high-frequency amplification with a regenerative detector It employs small valves that may easily be built up into a portable receiver.

The set was placed in the upper half of this cabinet and the four 22½-volt "B" batteries and the 4½-volt "C" battery were placed below. Since UX-199 type valves were used, the "C" batteries were used as "A" batteries and lasted all summer.

All connections except the antenna and ground wires and the headphones were contained inside the set. The shelf on which the apparatus was mounted was cut away at the back to permit flexible rubber-covered leads to be brought down to the batteries.

The top of the cabinet was hinged so that the vacuum valves could be easily reached, and it was arranged to fasten down when closed. A handle on top permitted the set to be carried about

easily. The entire front was hinged so that it would come down and form a sort of desk; to this was secured a piece of paper which acted as a log sheet. The tubes were mounted on a flexible base; it was not necessary to remove them. In fact they were far safer in the sockets than they would have been kicking around with the rest of the camp duffle.

The antenna used with this outfit consisted of 100 feet of enamelled, stranded wire, which worked well without insulators of any kind, as the enamel on the wire acted in that capacity. This fact alone saved considerable time in erecting the antenna, and it also saved some weight. Instead of going through the tedious process of throwing a wire over the branch of a tree or (worse yet) of climbing to the upper branches to make the wire secure, the antenna wire was simply run through the woods as far as it would go and then fastened to some convenient sapling, possibly six or seven feet above the ground. The sapling was bent slightly before the wire was made fast and when allowed to straighten up, it pulled the wire up and kept it taut.

Incidentally, this wire came in handy on several occasions as a suitable place to dry out bathing suits or to air the camp bedding!

All sorts of "grounds" were tried. Spikes were driven into trees, short wires were thrown into nearby bodies of water, a length of pipe was driven a few feet into the earth and even a counterpoise was tried. In one instance an automobile was used as a counterpoise—and it worked surprisingly well at a distance of about 150 miles from New York.

The counterpoise is probably the best bet of all for the varying conditions of camp radio work. It necessitates, however, the transportation of another coil of wire, and it is questionable whether this is the easiest to handle, or a short length of wire which may be thrown into the water. As most camps are located near water of some kind, it is an easy matter to secure a good "contact" in this way. If a dry camp is made, though, the antenna wire may be cut in half and the counterpoise arrangement resorted to. If the camp is a short distance from some broadcasting station, it is often possible to use the body of the automobile as the antenna and then drive a tire iron or some other handy piece of metal into the earth to form the ground side of the circuit.

In case the automobile is used for a camping trip. the problem of weight is simple, for it is safe to assume that the set will never get far away from the machine. In fact, it is easy to hang it on a small bracket which can be hooked over the robe rail on the back of the driver's seat.

Regular "B" batteries may be carried in a box under the radio set and the 6-volt storage battery used for starting and lighting may be tapped as a source of "A" supply. Most automobiles have one side of this battery "grounded" to the frame of the car, and in every one so far examined this has been found to be the positive side. As most radio sets have their negative "A" battery lead grounded, care must be used to see to it that there is no direct short circuit if the body of the car is used either as an antenna or counterpoise.

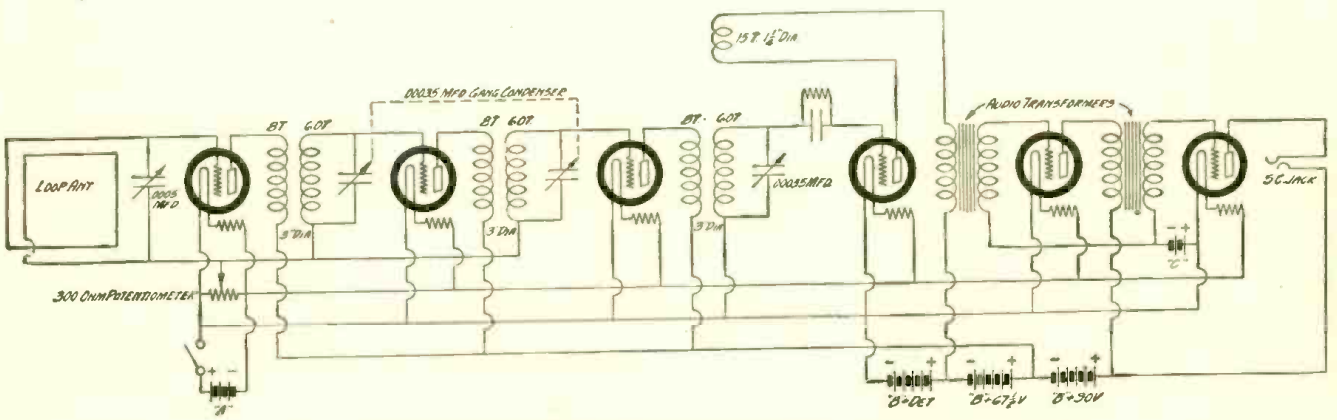
Some of the larger cars have locker arrangements where small sets may be installed and then locked up securely. Under such circumstances the body of the car may be used as a counterpoise, while an insulated wire arranged as an "inside antenna" will form the other half of the circuit. Such a scheme has been successfully used on several cars.

In one unique installation, the radio receiver, the loudspeaker and all the batteries were arranged in a big box which was secured to the running board of the car. This was a two-story arrangement, with the set above and batteries below, and when it was not in use it could be closed and securely locked. The owner claimed that his set probably had the privilege of hearing more broadcasting stations than any other set in the country, for he was both an inveterate tourist as well as radio fan, and he carried his call book with him in order to keep track of nearby broadcasters. When he was in the vicinity of a station he had never heard before, he promptly pulled up along the roadside and tuned in. His log book contained most of the stations of the country and would be the despair and envy of any "DX" radio enthusiast.

Hence, summertime radio is a good deal better than it used to be; with a good set many an enjoyable evening may be spent in some otherwise lonely camp, far from civilization. In addition to the usual program features—music and humor—you will be able to keep in touch with the world's news events. And if you are so unlucky as to strike a stretch of rainy weather, radio will be a big help in keeping the camp company in good cheer. For many an otherwise delightful camping trip has ended in a row because of the weather's pranks.

Try radio on your trip this summer—and see what happens!

Because many broadcasting stations have increased their power to the point where their signal strength is higher, even at a distance, than is the atmospheric "noise level," the problem of the fan has been simplified. Also, broadcasting stations are so numerous now that almost any location is within "summer" reception range of half a dozen stations or more.

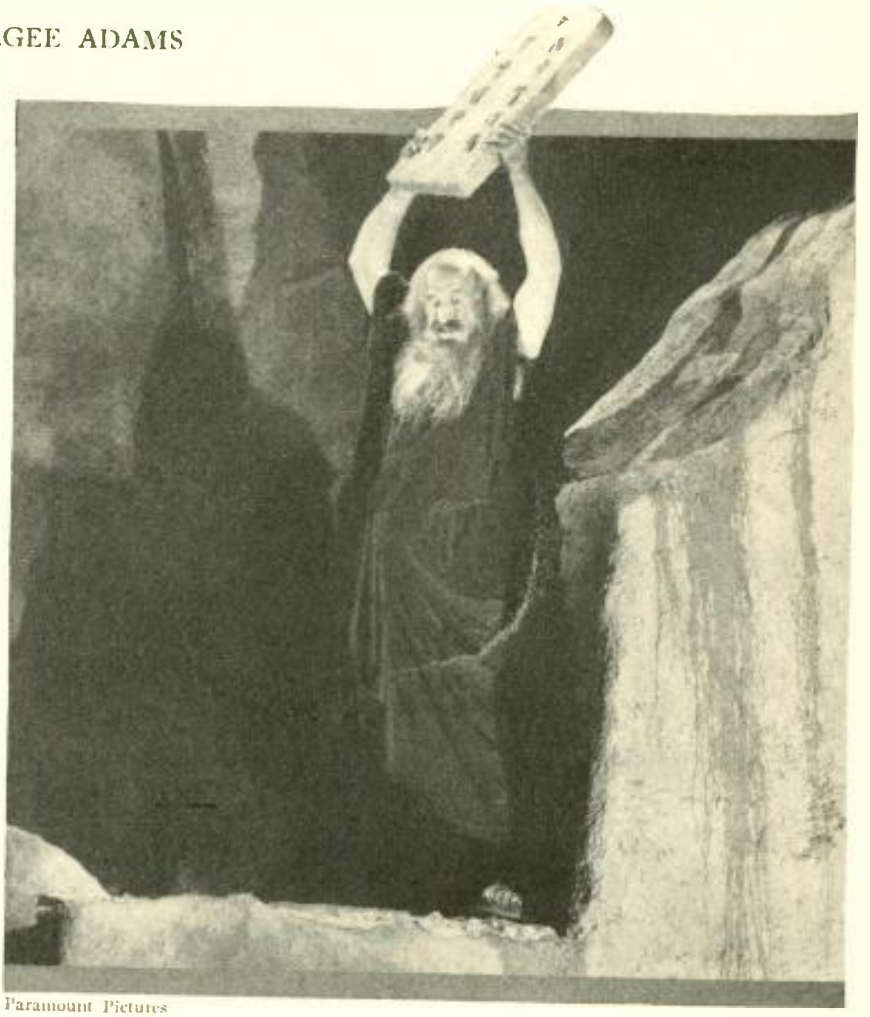


A GOOD CIRCUIT FOR A RECEIVER THAT IS USED IN AN AUTOMOBILE

The electrical connections shown above are for three stages of high-frequency amplification coupled to a regenerative detector and two stages of low-frequency amplification. The second and third stages of amplification are tuned with a double condenser. The regeneration in the detector circuit greatly adds to the sensitivity of the set. This feature, together with the simplicity in tuning and the easily handled loop antenna employed, makes this set an ideal one for installation in a car.

The XVIII Commandments of Radio

By CHARLES MAGEE ADAMS



Paramount Pictures

RULE 1. Should your friend, while visiting you, remark (as some uncouth persons will) that his receiver is much superior to yours, agree without dispute or reservation; explain modestly that your own receiver is merely a "tolerably good job."

RULE 2. Never offer suggestions regarding the operation of the friend's receiver, or evince the slightest desire to operate it. On the other hand should a friend who visits you manifest a wish to operate your receiver, surrender the dials to him immediately.

RULE 3. If a friend states that his receiver brings in stations at greater distances than your own, accept the assertions with complete credulity, not offering in rebuttal any facts regarding the performance of your own receiver.

RULE 4. Should a friend's wife, while visiting you, inadvertently continue talking while you attempt to tune in a distant station, thereby causing the call letters to be indistinguishable, do not request her to cease speaking; on the contrary, extend your courtesy to the point of encouraging her to continue her discourse.

RULE 5. If a friend's child ruins your new cone speaker in a youthful spirit of play, remark nonchalantly that "That is nothing—nothing at all!"

RULE 6. In the event that you are favored above your fellows in receiving Europe, say nothing about it the next day at your office or club; remark merely that you found the reception tolerably good last evening.

RULE 7. Should your friend indicate that he wishes advice in the selection of a receiver, or assistance in correcting defects, hesitate before tendering aid.

RULE 8. As women express the inexplicable idiosyncrasy of preferring mere programs above the accepted practice of ascertaining how many stations can be logged during a given evening, you should yield to this peculiarity.

RULE 9. If your wife, while wearing the headphones, inadvertently shouts, do not comment on the fact; while wearing the phones yourself, keep your voice modulated to refined quietness—particularly when announcing the reception of a distant station.

RULE 10. If your wife betrays displeasure when you spill battery acid on the living-room rug, maintain a gentlemanly silence.

RULE 11. A refined radio enthusiast will always tune in programs that please other members of his family, completely disregarding his own wishes.

RULE 12. If your maid or a member of your household thoughtlessly causes your tubes to become burned out by crossing battery wires or otherwise disturbing your receiver while cleaning it, never mention the fact.

RULE 13. Should a service man or other trades person whom you summon to correct defects, state that you need new tubes or batteries, immediately order the accessories mentioned, without question; at the same time refrain from keeping any check on the time used by the fellow in remedying the trouble.

RULE 14. When static, the squeal of a neighbor's receiver or the noise of his heating pad blots out the call letters of a station to which you are listening, the correct expression is, "How exceedingly unfortunate," spoken in a tone of mild humor.

RULE 15. Should an announcer to whom you are listening make a remark which is ostensibly intended to evoke mirth, laugh in a spontaneous manner.

RULE 16. Should the sponsors of a program suggest that they would welcome letters of comment, write immediately—expressing refined appreciation.

RULE 17. In the remote event that you hear the same dance number more than once during the same evening, refrain from the boorish practice of tuning it out.

RULE 18. The perfect radio gentleman will give close and careful attention to all broadcast announcements that are calculated to arouse a desire for certain products and commodities offered for sale, and act immediately on the suggestions of the broadcaster.

From a photograph made for POPULAR RADIO

THE PRE-SELECTOR IN OPERATION

FIGURE 1: *The instrument described in the following article will make* ANY *receiver ultra-selective—and will even improve the selectivity of an already selective receiver without decreasing sensitivity or volume.*

HOW TO ELIMINATE INTERFERENCE WITH

The PRE-SELECTOR

By S. GORDON TAYLOR

This unit is designed for use with *any* receiver, to overcome the general interference suffered as the result of the large number of broadcasting stations operating at the present time. It provides, in addition to other advantages, a degree of selectivity heretofore obtainable only with the finest superheterodyne receivers.

COST OF PARTS: *Not more than $33.00*

HERE ARE THE PARTS THAT WERE USED IN THE LABORATORY MODEL OF THIS RECEIVER—

A and B—S-M plug-in coils, No. 110A, equipped with coil sockets, No 515;

C1 and C2—General Instrument "Metralign" variable condensers, .00035 mfd.;

C3—Cardwell Balancet midget condenser; No. 613A;

C4—Any approved fixed condenser, with grid-leak clips, .00025 mfd. (Polymet condenser illustrated);

C5—Any approved fixed condenser, .0001 mfd. (Polymet condenser illustrated);

D1 and D2—Karas Micrometric vernier dials;

D3—Kurz-Kasch 1½-inch bakelite knob;

R1—Any approved rheostat, 30 ohms, equipped with knob (Carter rheostat illustrated);

R2—Any approved grid-leak, 4 megohms (Lynch grid-leak illustrated);

RFC—Precision high-frequency choke coil, No. 400;

S—Yaxley jack switch, single-pole, double-throw;

V1 and V2—Any approved cushion-type sockets (Na-ald sockets illustrated);

W—Cabinet (see Figure 10 for dimensions);

X—Bakelite panel (see Figure 6 for dimensions);

Y—Hardwood baseboard (see Figure 8 for dimensions);

Z—Bakelite binding-post strip, including six engraved binding posts (see Figure 9 for dimensions).

THE fly in the ointment of the radio enthusiast today is, undoubtedly, the interference between broadcasting stations that has resulted from the crowded condition of the ether, due, in turn, to the large number of stations that have started operation within the past few months.

In too many cases this condition prevents the full enjoyment of radio because the wavelengths of desirable stations are "blanketed" by the broadcasting of a powerful nearby station. To eliminate this trouble, fans have rushed toward the use of wave-traps of one kind or another. Such a device may be easily built at home for a few dollars and does prove helpful in most cases in

eliminating the interference caused by a single station.

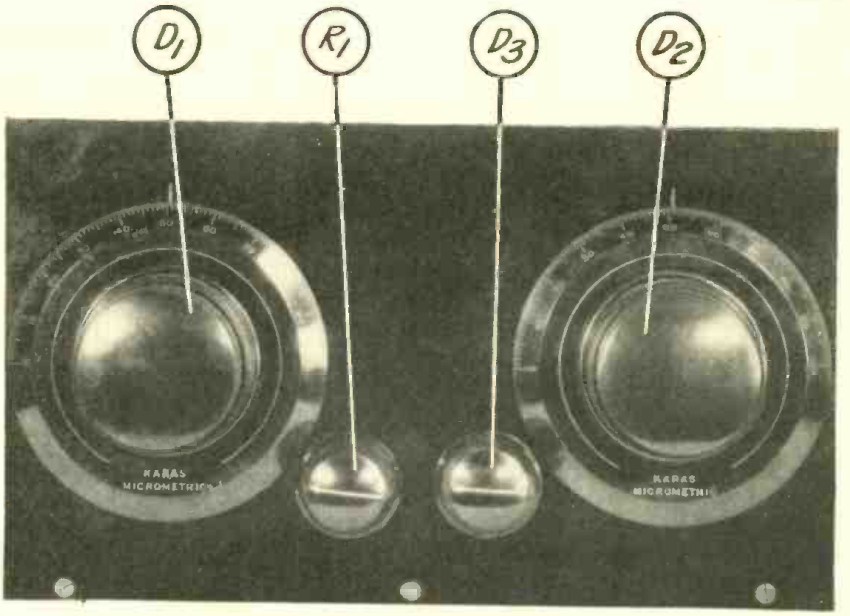
On the other hand, a wave-trap will eliminate only a single interfering station and has the disadvantage that it adds another tuning control to the receiver with which it is used.

POPULAR RADIO has believed for some time that some device could be designed that would present far greater advantages than does a wave-trap; its experiments have led to the developments of the unit described here.

The name "Pre-selector" has been given to this device; it is both appropriate and descriptive of the apparatus, because its function is to provide selectivity *before* the signals reach the receiver. All tuning is accomplished in the Pre-selector itself; the receiver controls need not be used, although full advantage is taken of the high-frequency amplification in the receiver proper.

The advantage of this arrangement over any type of wave-trap is evident. Instead of rejecting the signals from a single interfering station, as does a wave-trap, the effect of the Pre-selector is to reject signals from *all* stations other than the station to which the operator of the receiver desires to listen. In other words, the Pre-selector acts as an acceptor only for the signals from the single frequency to which it is tuned, and rejects signals from all other stations, no matter how powerful or close these other stations may be.

The Pre-selector functions as a frequency changer. That is, the receiver, with which this unit is to be used, is tuned to any wavelength above the broadcast band and the Pre-selector changes the frequency (wavelength) of all incoming signals to this wavelength. It is during this frequency-changing process that the selectivity is obtained.

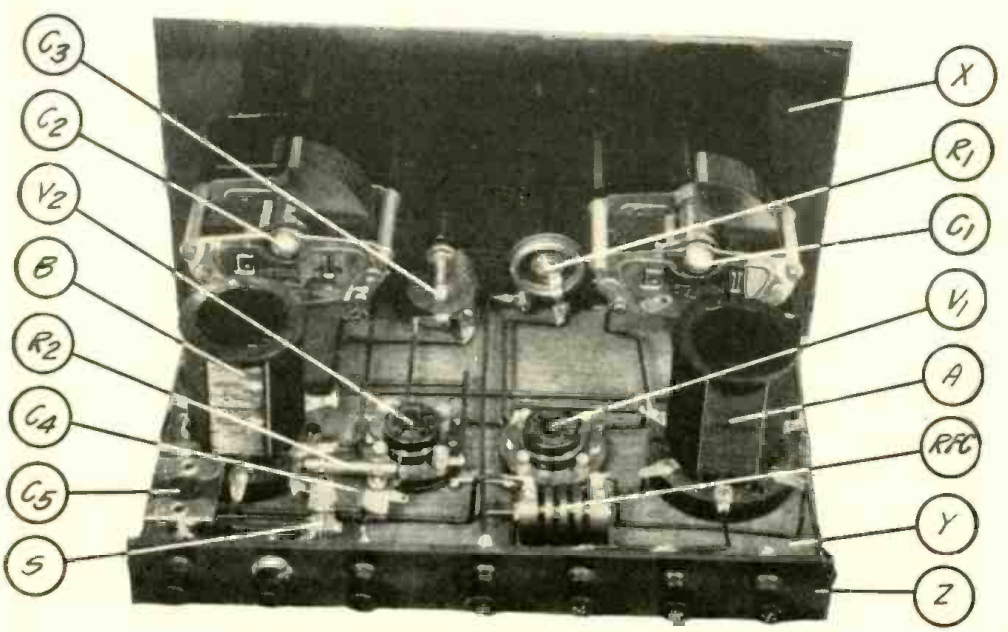


A FRONT VIEW OF THE PRE-SELECTOR

FIGURE 2: *The receiver with which the Pre-selector is used does not require tuning; when the receiver dials are set in resonance, the two large vernier dials on the Pre-selector do it all.*

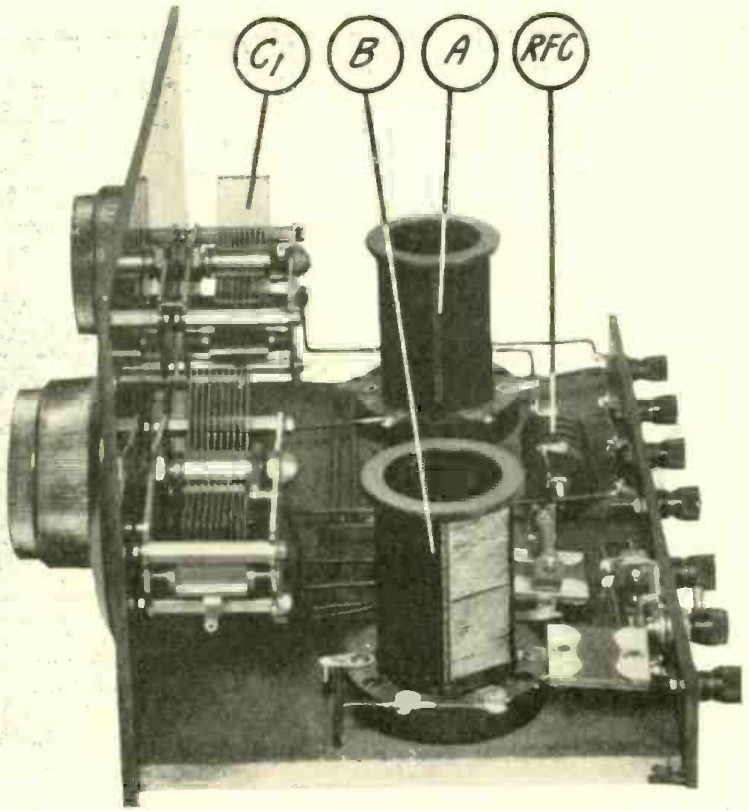
The fundamental principle involved in this frequency-changing process is an old one, well known in experimental work.

It is difficult to be specific in describing a degree of selectivity. The mere listing of all the stations tuned in on a receiver operating in New York City, for instance, even though some of these stations be only 2 or 3 meters apart, means little to the man who is operating a receiver in Chicago. To say that the Pre-selector enables even a broad-tuning receiver to cut out Station WRNY in favor of an out of town station 10 meters lower in wavelength means much to the fan who lives in the upper west part of New York City—it almost means the achievement of the impossible. To the fan in some other city, however, this does not seem like much of a feat. The truth is that this station covers the whole dial on many receivers operated in homes along the upper part of Riverside



THE ARRANGEMENT OF THE INSTRUMENTS

FIGURE 3: *This view shows the compactness and simplicity of the unit. The "two plane" method of wiring as described in the text is clearly illustrated here.*



THE END VIEW OF THE PRE-SELECTOR

FIGURE 4: *Note that while the unit is compact, there is nevertheless plenty of room to get at the connections and thus make the job of wiring the instruments an easy one.*

Drive and the vicinity. But when the Pre-selector is used with these same receivers, this station can be cut out absolutely in favor of other local and distant stations that operate 10 meters away from the wavelength of this particular station.

Furthermore, the majority of receivers in New York City cannot cut out the local stations that operate on 315.6 meters, in favor of Pittsburgh, which is on a wavelength of 309.1 meters; in fact, many of them cannot completely separate a local station which works on 303 meters from the ones on 315.6 meters, unless an extremely short antenna is used. It is even more difficult to tune in between these to hear KDKA without interference from the locals. When the Pre-selector is used these feats are easily accomplished even when a large antenna is used.

Some Other Features of the Pre-selector

While extreme selectivity is the outstanding feature of the Pre-selector, it is not its only valuable property, by any means, as is shown in the following tabulation of this unit's merits:

1. It may be used with any receiver, from the old regenerative receiver with its detector and two stages of low-frequency amplification to the more modern receivers which include one or more stages of high-frequency amplification:*

2. It converts any receiver into a two-control set, regardless of the number of tuning controls on the receiver itself:

3. No change whatsover is necessary in the wiring, location or connections of the receiver with which this device is to be used:

4. The Pre-selector permits the use of a large outdoor antenna, even in locations where the average receiver would require a small antenna in order to obtain any degree of selectivity:

5. It permits the use of a loop antenna with any receiver which is ordinarily capable of reception with a short antenna:

6. The inclusion of a sensitivity control and variable coupling in the antenna coil of the Pre-selector permits the operator to vary the selectivity to fit his requirements. The poorest selectivity obtainable with this unit is better than that obtained with the average receiver:

7. It increases the sensitivity of the receiver in many cases, and in any event, does not decrease the efficiency except in the case of some of the old type three-tube regenerative receivers that do not employ any high-frequency amplifier:

8. If it is desired to use the receiver alone, it is necessary merely to throw a switch which is included in the Pre-selector unit; this cuts the Pre-selector out of the circuit and transfers the antenna to the receiver direct:

9. The Pre-selector adds no appreciable drain on the batteries, as its filament consumption is only slightly more than 1-10 of an ampere and the plate current only 3 milliamperes:

10. The filament and plate current for operating the Pre-selector may be drawn from the same source that is used to supply the receiver:

11. Although UX-199 type valves are used, their filament current may be supplied from either a 6-volt or from a 4½-volt source. The resistance of the filament rheostat specified is sufficient to cut either of these supply voltages down to the required 3 volts.

How to Construct the Pre-selector

The front panel should first be prepared and drilled and the baseboard cut to the correct size, as shown in Figure 8. Complete specifications for size and for drilling the panel will be found in Figure 6.

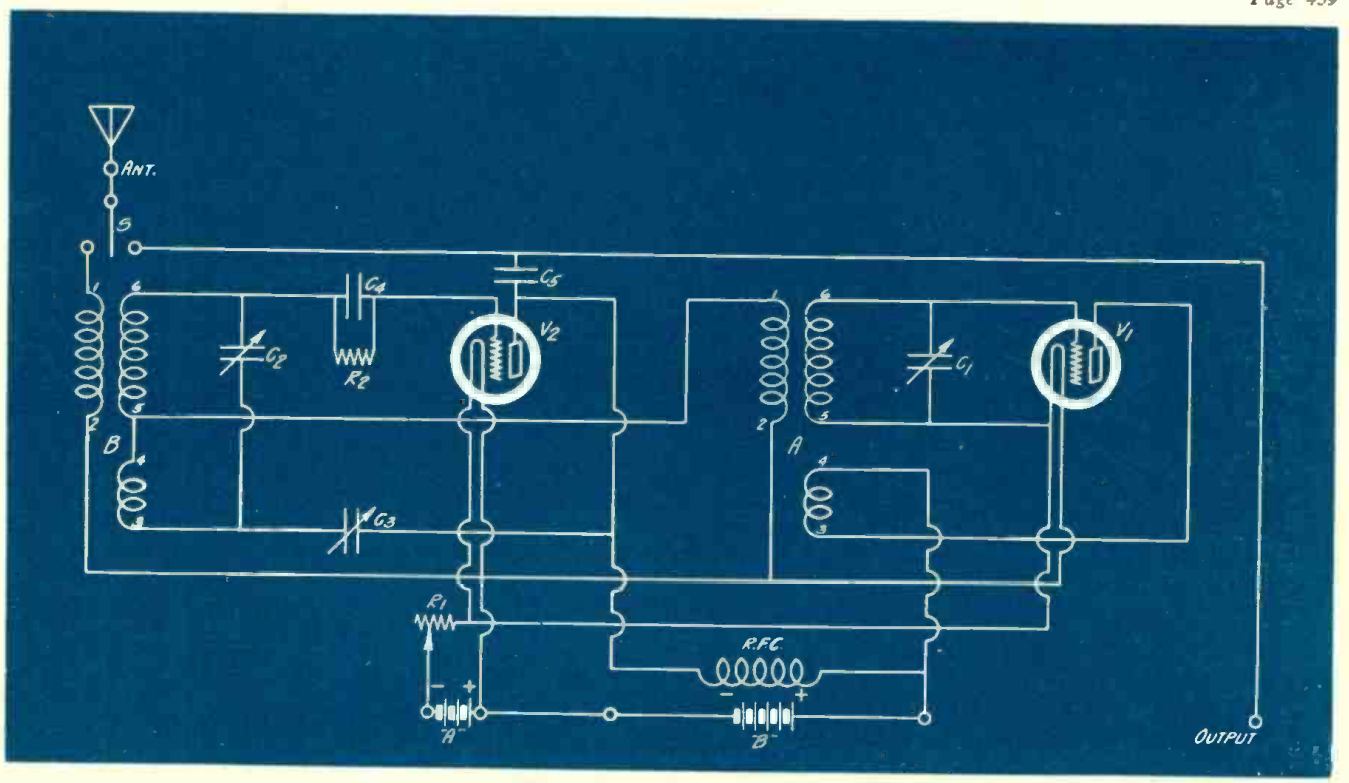
The three condensers, C1, C2 and C3, and the rheostat, R1, may then be mounted in their proper positions on the panel. The position of the screw holes in the panel will indicate the positions in which to mount the condensers. The rheostat should be mounted with its terminals at the bottom.

It is a good plan to attach the panel to the baseboard at this time, in order to obtain the correct locations for the mounting screws on the edge of the baseboard. Then the panel should be removed from the baseboard and laid aside for the time being.

The binding-post strip, Z, should now be prepared, as indicated in Figure 9,

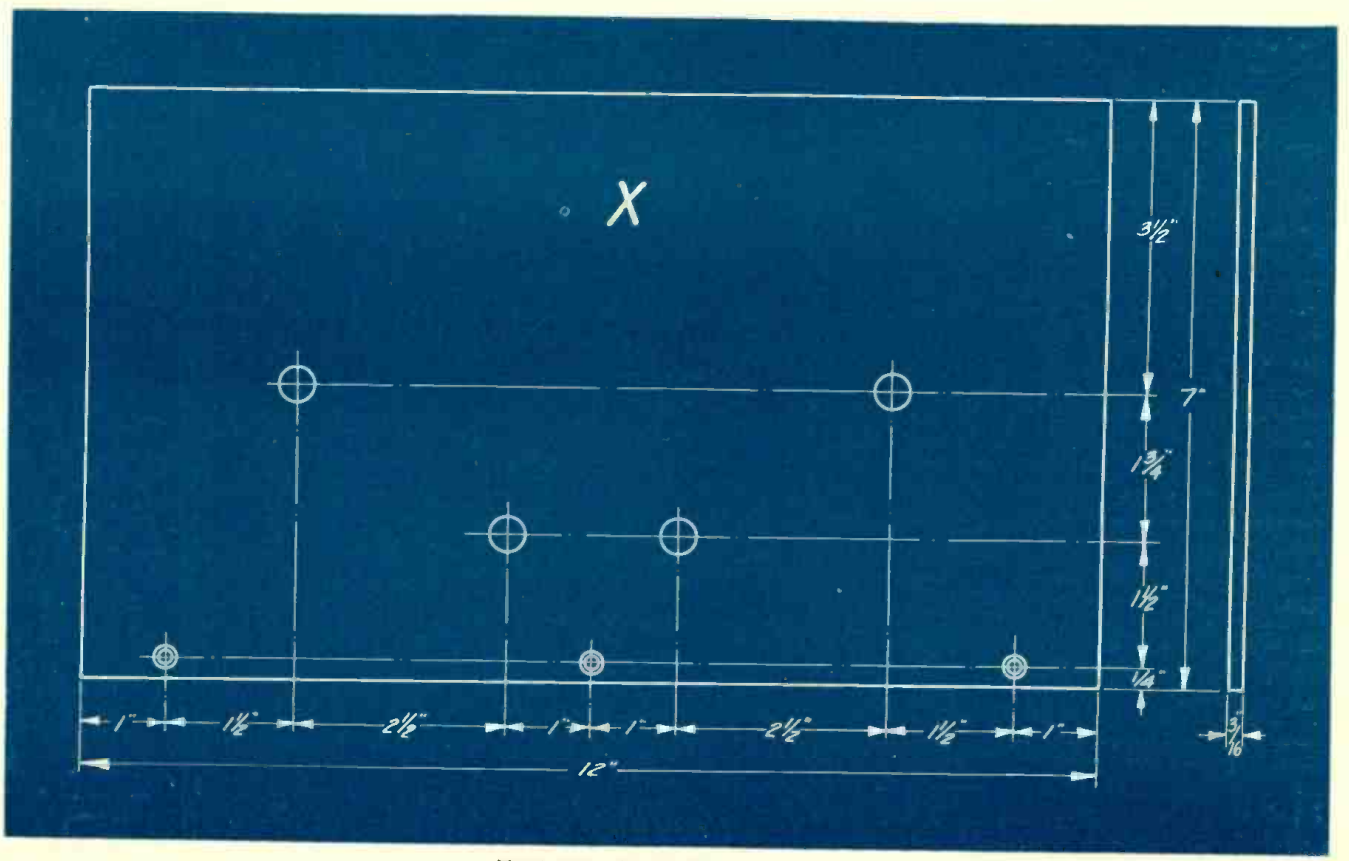
*Note.—This statement is based on tests made with 15 different receivers which included both home-made and factory-built models ranging from simple 3-valve sets up to the more modern 6- and 7-valve receivers.

¶ *The list of parts given above includes the exact instruments used in the set from which these specifications were made up. The experienced amateur, however, will be able to pick out other reliable makes of instruments which have been approved by* POPULAR RADIO *and which may be used with good results. But we recommend that the novice follow the list, as the diagrams in this article will tell him exactly where to bore the holes and exactly where to place the connections. If instruments other than the ones listed are used, the only change that will be necessary will be the use of different spacings for the holes that are drilled in the sub-base for mounting the instruments. To any reader who has difficulty in obtaining any of the parts which are necessary in making up these model receivers and power units,* POPULAR RADIO SERVICE BUREAU, *627 West 43rd Street, New York City, will gladly assist in seeing that his requirements are promptly supplied.*



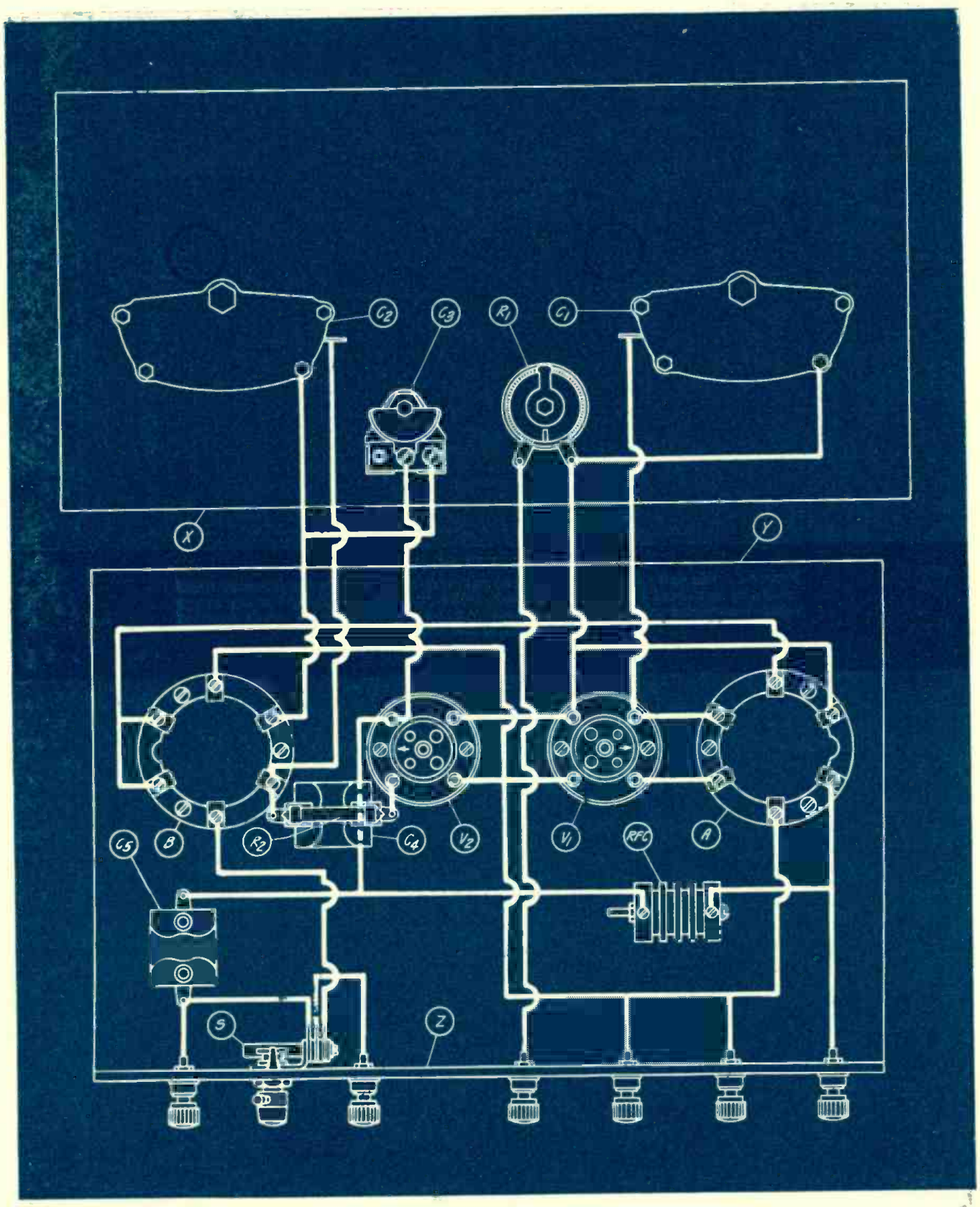
THE COMPLETE HOOK-UP

FIGURE 5: *The valve at the left and its circuit receive and amplify the incoming signal while the right-hand valve is the oscillator which furnishes the high-frequency energy which heterodynes with the incoming signal frequency, resulting in the action described in the text of the article.*



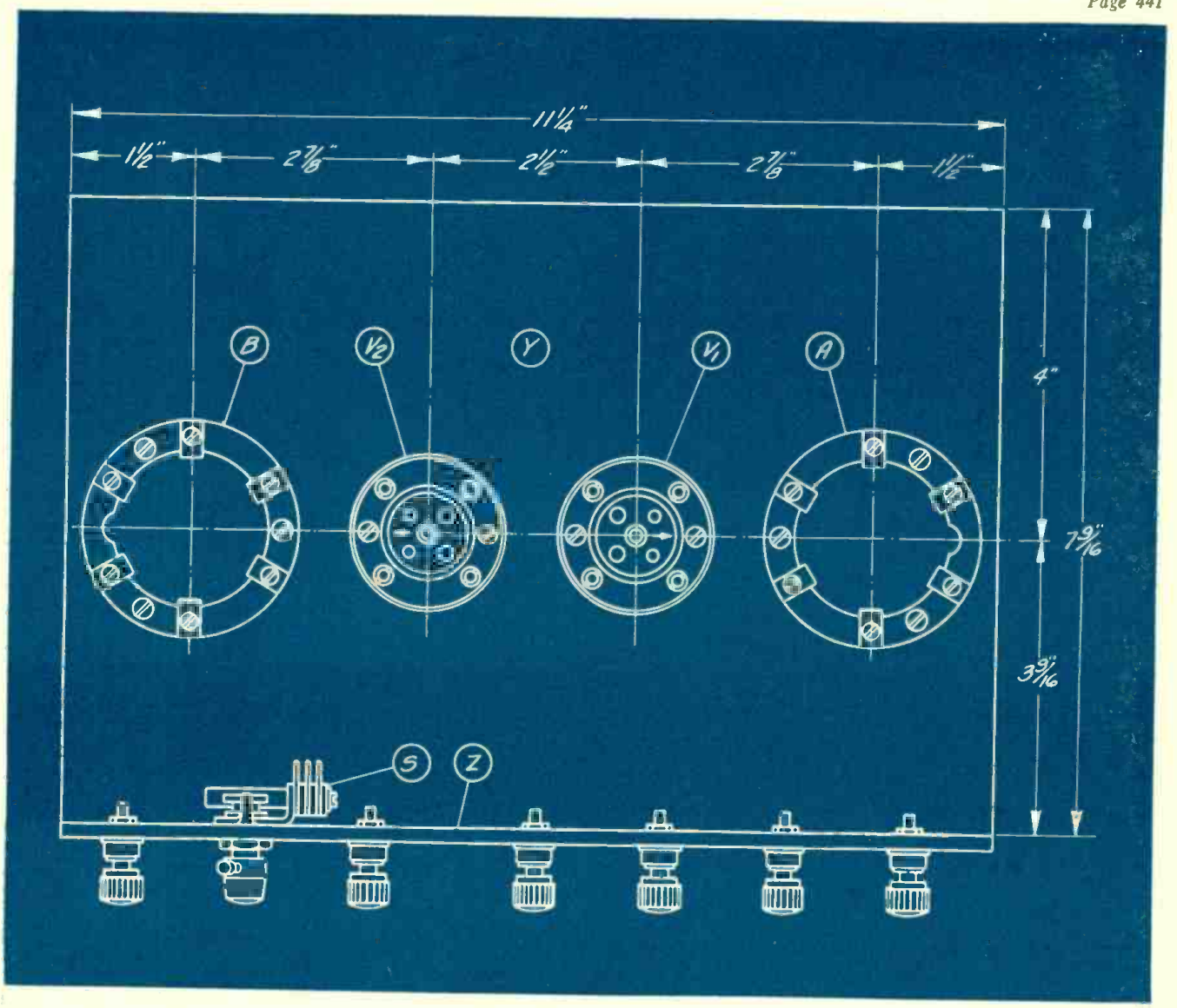
THE EXACT PANEL LAYOUT

FIGURE 6: *The panel should be laid out and drilled exactly as shown here. The diameter of the holes will depend on the size of the shafts and screws used. All the instruments employed are of the single hole mounting type.*



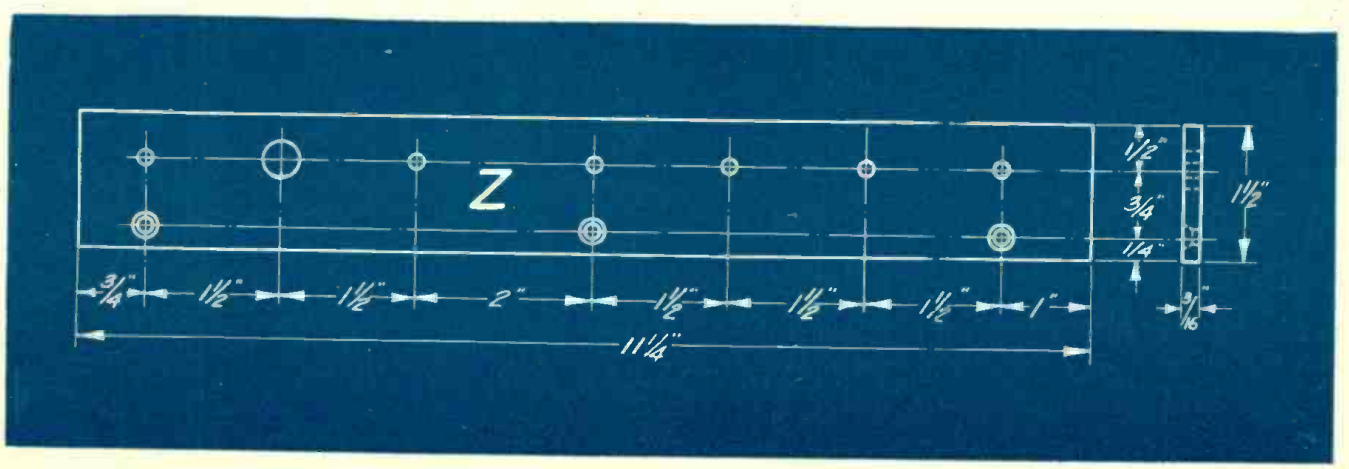
THE WIRING LAYOUT

FIGURE 7: *All instruments are shown here in a slightly altered position, in order to facilitate the illustration of the wiring. The wiring is represented by the heavy white lines. To simplify the wiring, much of it can be completed before the panel is mounted on the baseboard. This plan is described in the text.*



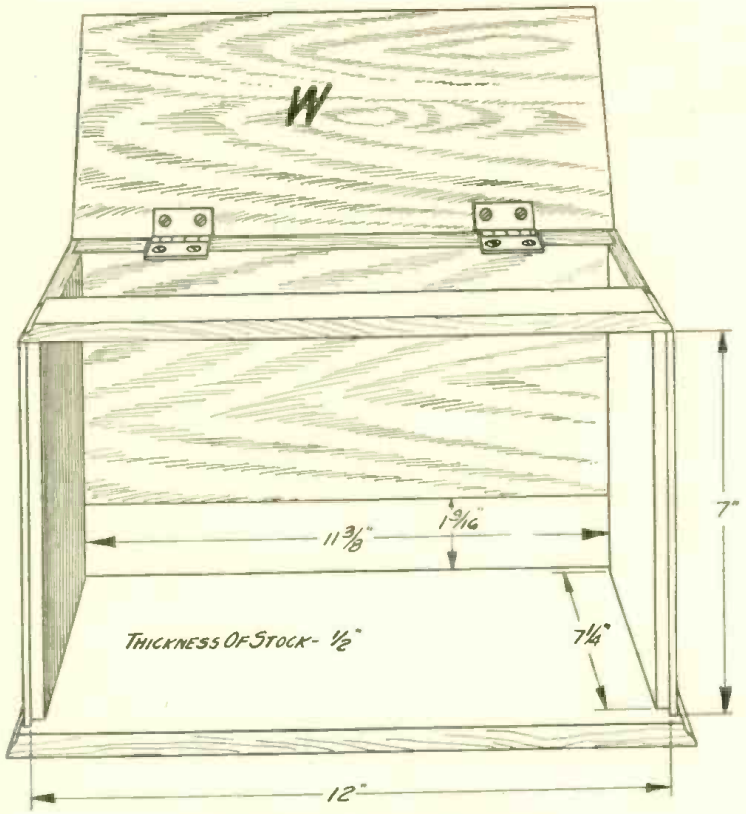
THE BASEBOARD LAYOUT

FIGURE 8: *The baseboard is shown here with all dimensions for its preparation and for the mounting of the instruments. The choke coil and fixed condensers are not shown because they are supported by the wiring and are not mounted on the baseboard. The binding post strip is shown in position.*



THE BINDING POST PANEL

FIGURE 9: *Complete specifications for the preparation of the binding post strip are given here. After the drilling has been completed the binding posts and switch are attached, as shown at the bottom of* FIGURE 3.



THE CABINET SPECIFICATIONS

FIGURE 10: *The cabinet used with the model of the Pre-selector is a standard stock size. For those who may wish to construct their own cabinets, however, the specifications are given here.*

and the binding posts and jack switch S mounted in their proper positions. If engraved binding posts are used they should be mounted in the following order, beginning at the left hand end: B+, B—, A+, A—, Antenna, and an Output Post. The switch should be mounted between the last two posts. The completed binding-post strip is then ready to be permanently mounted on the rear edge of the baseboard.

The two coil sockets and the two vacuum-tube sockets should be mounted on the baseboard by means of two wood screws each. Then, mount the choke coil, RFC, in a horizontal position by means of a right angle brass bracket (or it may rest on the baseboard and be held in position by the connecting wires if desired). Do not, in any case, try to remove the brass bolt that runs through this choke. The positions of all these instruments are given in Figure 8.

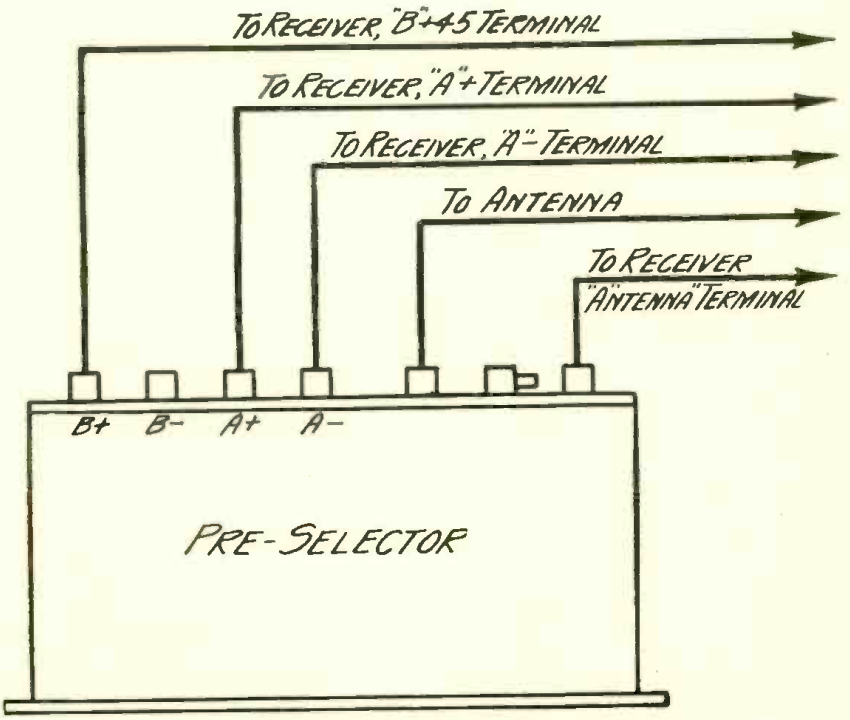
This completes the construction work, except that the front panel has not been attached to the baseboard. This may be left off for the time being, as a goodly portion of the wiring can be completed without it.

How to Wire the Pre-selector

In wiring the Pre-selector, the constructor may use either bare or insulated bus wire, but the latter is to be preferred. The free use of soldering lugs is recommended, especially at the terminals of the coil sockets. It goes without saying that all connections should be securely soldered.

Refer constantly to the diagram in Figure 7 in wiring up the unit. It will also be helpful to remember, in this connection, that all of the connecting wires which run in an end-to-end direction (in reference to the baseboard) should be kept down against the baseboard; these connections should be made first, before the panel is attached to the baseboard. All connections which run in a front-to-rear direction should be kept up about a half inch from the baseboard. This "two plane" method of wiring not only eliminates confusion, but also adds to the appearance of the completed job.

The wiring of the filament circuits should be tackled first. The rear "F" terminals of valve sockets V1 and V2 should be connected and this connector should be extended back to the "A" (+) binding post at the rear of the unit. Next, connect together the front "F" terminals of the two valve sockets and extend this connector on over to terminal 5 of coil socket A. Join together terminals 4 and 5 of coil socket B and extend this connector almost the full length of the baseboard to terminal 1 of coil socket A, as in Figure 7.



HOW TO CONNECT UP THE PRE-SELECTOR

FIGURE 11: *The same batteries may be used to operate the Pre-selector that are used with the receiver. The connections for this arrangement are shown above. (Be sure to read the text carefully before connecting the Pre-selector.)*

Connect terminal "G" of valve socket V1 to terminal 6 of coil socket A, and terminal "P" of this same valve socket to terminal 3 of this same coil socket. Connect terminal 2 of coil socket A to the "A" (+) plus binding post on the rear terminal strip and also to the "B" (—) minus post. Terminal 4 of this coil socket should then be connected to the "B" (+) plus binding post at the rear and another connecting wire run from this same coil socket terminal to the nearest terminal of the choke coil, RFC.

From the other terminal of RFC make a connection to the "P" terminal of valve socket V2. Later, another connection must be made from this last wire to one terminal of the fixed condenser, C5, so it is well, if insulated bus wire is used, to bare a space on this wire before it is actually soldered into place.

The switch, S, should next be wired up. Its top terminal should be connected to the antenna binding post at the rear, and the middle terminal to the extreme right-hand binding post (output) on the binding-post strip at the rear of the unit. Then, connect the bottom terminal to terminal 1 of coil-socket B.

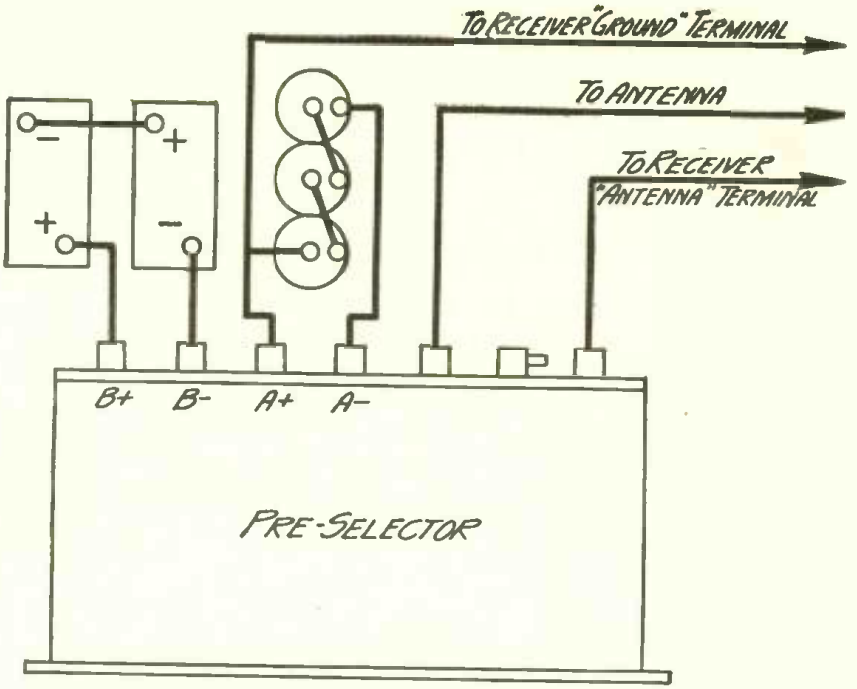
It is now time to connect in the fixed condenser, C5. Solder one of its terminals to the output binding post at the rear, and make a connection from the other terminal to the spot previously bared on the connecting wire which runs from RFC to the "P" terminal of valve socket V2.

Finally, connect the grid condenser, C4, into the circuit, with one of its terminals going to terminal "G" of valve socket V2, and the other to terminal 6 of coil socket B.

One more connection may be made before the panel is mounted. Connect the rotor terminal of the midget condenser, C3, to the rotor terminal of condenser C2. The panel may then be attached to the baseboard.

Now connect the rotor of condenser C2 to terminal 3 of coil socket B; the stator terminal of this same condenser should be connected to terminal 6 of coil socket B. The stator terminal of C3 should next be connected to terminal "P" of the valve socket V2.

The rotor terminal of condenser C1 should be connected to terminal 5 of coil socket A and terminal 6 of this coil socket should be connected to the stator of this condenser. When this has been done, connect the terminal of the rheostat R1 which is nearest to condenser C1 to the front "F" terminal of valve socket V1 and the other terminal of the rheostat to the "A" (—) minus binding post at the rear.



CONNECTIONS FOR THE USE OF SEPARATE BATTERIES

FIGURE 12: *If the receiver is an AC operated device, the use of separate batteries for the Pre-selector will be necessary. The proper connections are shown here. The batteries used in the set-up shown here are described in the text.*

How to Install the Pre-selector

The Pre-selector may be installed at the end of the receiver nearest to the receiver antenna terminal. Disconnect the antenna from the receiver and reconnect it to the antenna binding post of the pre-selector. The "output" binding post of the Pre-selector should then be connected to the "Antenna" binding post of the receiver.

No ground connection is made to the Pre-selector unless the filament circuit of the receiver is ungrounded. This latter condition may be determined by connecting a buzzer or 6-volt lamp to the "ground" binding post of the receiver, and the other side of the buzzer or lamp to first the positive and then the negative terminal of the "A" battery or of the receiver. During this test the receiver should be turned "on." If the lamp lights or the buzzer sounds it is an indication that one side of the filament circuit of the receiver is grounded. If the test shows that the filament circuit is not grounded then it will be necessary to connect the ground terminal of the receiver to the "A" (—) minus terminal of the Pre-selector.

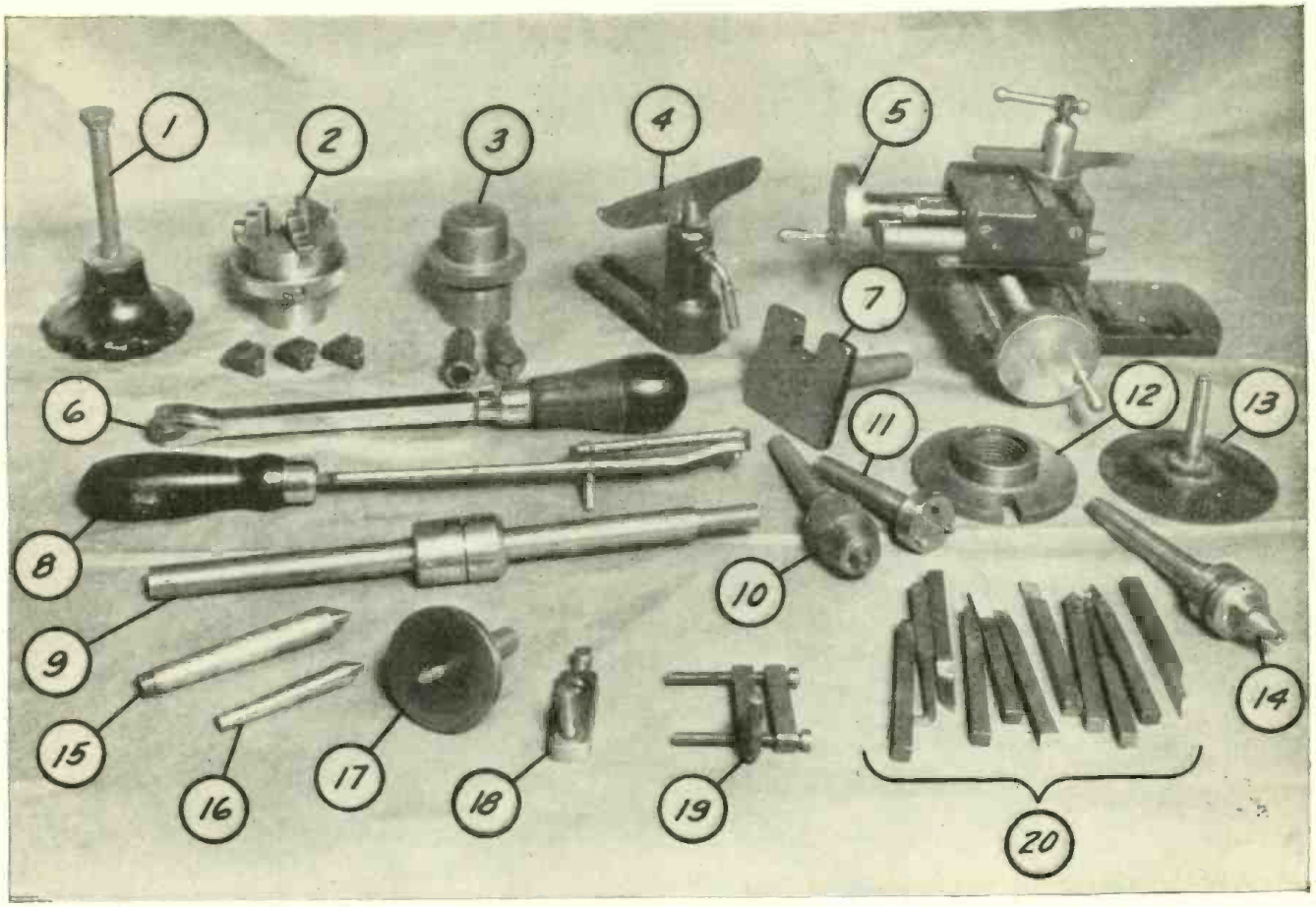
All connections from the receiver to the batteries or power-pack should be left as they are. No changes whatsoever are needed in the receiver connections except in the "antenna" connection as described above. The Pre-selector requires a 45-volt "B" supply and either a 4½-volt or a 6-volt "A" supply. The same "A" supply as is used for the receiver may be used for the Pre-selector. UX-199 type valves are used in the Pre-selector.

It is also practicable to use the receiver "B" supply for the Pre-selector. Connections for this arrangement are shown in Figure 11. It should be noted that no "B" (—) minus connection is made to the Pre-selector. This is because "B" (—) minus is already connected to one side of the "A" battery in the receiver.

In case the receiver uses an AC supply for the filaments (as with McCullough AC valves) it will be necessary to use separate "A" and "B" batteries with the Pre-selector. Connections for this arrangement are shown in Figure 12. The "A" battery should consist of three 1½-volt No. 6 dry-cell batteries, connected in series as shown in the diagram, and two midget-size "B" battery blocks of 22½ volts each. The low current-consumption of this unit makes a larger size of "B" batteries unnecessary. The midget size (2 lb.) will provide several hundred hours' service, and the life of the dry-cell "A" battery mentioned will be in excess of 200 hours.

With the connections made, as shown in Figure 11 or in Figure 12, the unit is ready for operation. When the switch at the rear of the Pre-selector is thrown to the left the Pre-selector is connected into the antenna circuit between the receiver and the antenna. When this switch is thrown to the right, the antenna

(*Continued on page 496*)



From a photograph made for POPULAR RADIO

THE COMPLETE KIT OF LATHE TOOLS

FIGURE 1: *Here is a complete set of attachments (with the exception of the jig-saw) for the lathe described in the first article of this series in the April issue. With this equipment the experimenter becomes independent of outside shops for his wood and metal finishing. The particular use of each attachment is described in the text.*

Your Laboratory Tools

ARTICLE NO. 2

From this article the home experimenter may learn how to multiply the capacity of his shop in many ways through the use of the simple attachments to his lathe described in this article.

By LOWELL MADDEN, JR.

THE purpose of this installment is to acquaint the reader with the use of the sundry gagjits that are made to increase the range and capacity of the lathe described in the first article of the series.*

A lathe, even more so than mother's sewing machine, is perhaps the most "attached" tool in all of machinedom. Rarely is it used in its naked form and rarely does the operator (providing he knows his mechanical onions) come upon a job that cannot, by some hook or crook, be tossed off neatly and quickly. In some instances he may have to do a little thinking, but he will eventually come upon a method that will solve his immediate problem. After all, the range of work that may be done on a lathe depends to a large extent upon the ingenuity and inventive talent of the operator.

The device marked 1 in the illustration is a clamping nut that holds the slide rest, 5, and the tee rest, 4, in place. This is also pressed into service in holding the jig-saw attachment and the saw table for the circular saw. The bolt of this clamping device comes up through the slot in the center of the lathe bed and it engages with a second slot in the attachments mentioned. The slot of the tee rest, illustrated at 4, is plainly visible.

There is no substitute for a lathe chuck and unless a lathe is equipped with one the operator is confronted with a handicap that is practically impossible to overcome, no matter how clever he may be in arranging makeshifts. A little scroll chuck for use in connection with this lathe is illustrated at 2. This is screwed directly onto the live center of the lathe. The knurled portion of the chuck is turned to move the jaws in or out. An extra set of outside jaws greatly increases the range of the size and form

*See POPULAR RADIO for April, 1927.

of the pieces that may be held in the chuck.

A chuck of a different type, and one that is extremely useful in turning down and cutting off small metal rods, is illustrated at 3.

This tool is called a compression chuck and it is provided with slotted bushings, two of which are shown immediately in front of it. When the knurled collar of this chuck is turned, the bushing is pinched in such a way that the three slotted portions or jaws are forced together. It will be seen that the range of movement of these jaws is restricted to a small distance; consequently only metal rods approximating the diameter of the hole in the bushing can be held tightly enough for turning. As there is a hole through the center of this chuck which is in line with the hole in the center of the live spindle, long pieces of rod may be fed through the spindle of the lathe. This will be found particularly convenient when the operator has a large number of pieces of rod that have to be cut off.

A tee rest is an attachment used especially for the turning of wood and light metal by the use of hand tools. It derives its name from the fact that it is shaped like a T and that it offers support for the cutting tool while it is being manipulated. Such a device may be identified at 4. The height of the rest is made adjustable by the use of a small set screw.

Unless a lathe is provided with a slide rest, the operator will at all times have to resort to the use of hand turning tools. In the case of turning wood, hand turning tools are, of course, preferable, but only the crudest sort of work can be accomplished by the use of such tools in turning metal. After all, very little control can be exercised over hand tools and real accurate turning by their use is practically impossible. The slide rest made especially for the lathe under discussion is illustrated at 5.

An examination of this attachment will reveal two sliding portions, each one controlled by feed screws. The feed screw shown at the lower right drives the cutting tool in a direction parallel to the work revolving between the lathe centers, while the manipulation of the feed screw at the left drives the cutting tool in a direction at right angles to the work in the lathe. Tools of different character intended for special cutting jobs may be placed in the tool post which is shown mounted on the top of the slide rest. A later installment will give more detailed information concerning the manipulation of this very important attachment.

Since knurled edges are used on binding posts and adjusting screws and nuts, the radio enthusiast will want to have his lathe equipped with the necessary means for producing knurled surfaces. This work is accomplished in a surprisingly simple manner. A little tool with a roller mounted in the end of it is all that is necessary. The roller is of hardened steel and it carries on its surface the impressions that are to be duplicated to the work revolving in the lathe. A knurling tool is shown at 6.

In the handle of this particular tool there is a set of rollers which produce different knurled effects. These rollers are interchangeable.

In 7 is illustrated what is known as a "table rest." This fits into the same holder as the tee rest. Such an attachment is very useful for grinding down or squaring off surfaces when an abrasive wheel is revolving in the live spindle.

When this particular lathe is used for drilling, it becomes necessary to move the tail stock spindle forward. While this may not be done with a feed screw placed on the end of the live spindle, a more rapid feeding of the work may be had by the use of a handle or lever. Such a lever is illustrated at 8 and its position on the lathe was shown in one of the photographs of the first installment. Its real name is a hand feed lever.

In using a circular saw and saw table in connection with this lathe, the operator has at his disposal a most important wood working tool. With it he may cut bakelite and rubber panels with ease and with every assurance of their being absolutely square, for the saw table is equipped with guides which makes straight sawing a matter slight of accomplishment. By the use of special saws, metal may also be cut with this attachment. The saws for this use, whether for metal or wood cutting, are mounted on the arbor 9.

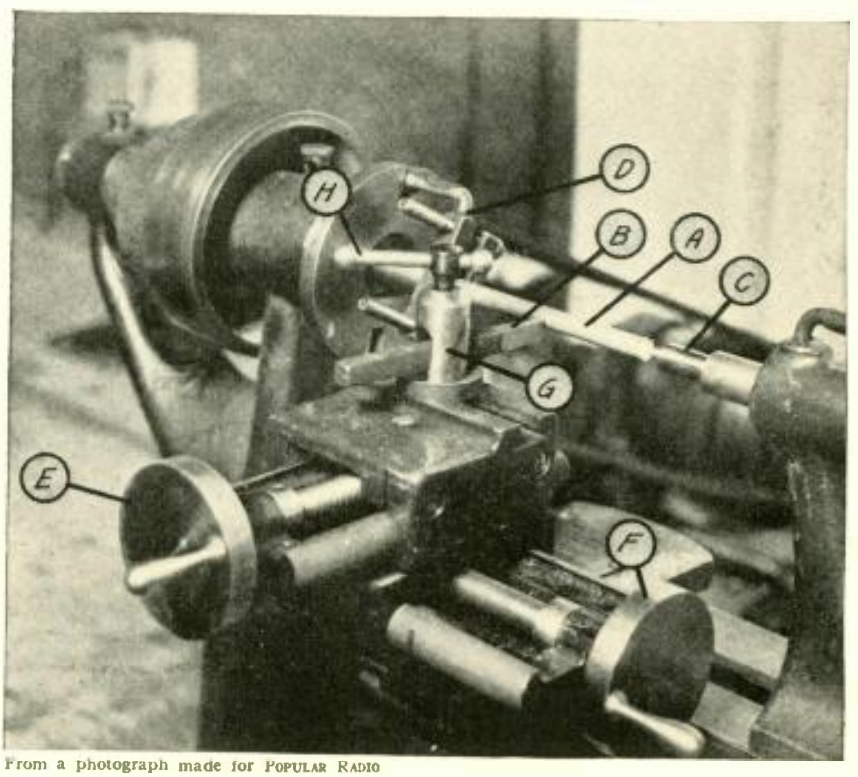
This arbor is turned down at one end so that the lathe dog at 18 will fit it; the dog in turn engages with one of the slots in the slotted face plate at 12.

This face plate is, of course, mounted on the live spindle of the lathe.

The saw arbor revolves upon the lathe centers 15 and 16.

The reader may expect more details covering the operation of this circular saw installment in a later installment of this series; what the writer is attempting to do here is to give the reader merely an outline of the use of the various attachments so that he will not get into trouble in attempting to do things that he should not do.

At 10 the reader will find an illustration of a drill chuck. This is provided with a standard No. 1 Morse taper which is the taper used in the live spindle of the lathe. Thus the chuck is held in position merely by forcing it into the taper of the live spindle with a twisting motion. The chuck accommodates drills ranging



From a photograph made for POPULAR RADIO

THE LATHE AT WORK

FIGURE 2· *This shows how the slide rest, slotted face plate and dog are used. D is the dog, C the dead center, A the work to be turned, H the handle of binding post of the tool post G, and E and F are feed screws for the slide rest. B is the cutting tool.*

in size from sixty to one-quarter inch.

As it is not customary (and indeed it is often impossible) to use a scroll chuck in turning wood, some other means must be employed to grip the work so that power may be transmitted to it from the live spindle of the lathe. The tool used for this is illustrated at 11 and is called a "spur center."

This spur center is provided with an extremely sharp center and three sharp spurs mounted at the points of an equilateral triangle. The spur center also carries a No. 1 Morse taper, so that it may be inserted and held in the live spindle. When this tool is used, the wood to be turned is forced against it until the sharp spurs sink into it and are completely lost to view. The opposite end of the work to be turned revolves on the dead center of the lathe—always, of course, with the aid of a drop of oil.

The face plate for this lathe carries two slots and is shown at 12. These slots may be used in holding pieces of metal to the plate for various turning jobs. The plate screws onto the live spindle of the lathe.

When drilling is being done with this lathe, it will be necessary to use the attachment illustrated in 14. This is called a "drilling pad," and it fits into the dead center or tail stock spindle. Here a No. 0 Morse taper is used which is the taper provided for in the tail stock spindle. In drilling, the work is rested against this pad and is carried forward to the drill by the manipulation of the feed lever illustrated at 8.

It is an easy matter to mount an abrasive wheel in this lathe by the use of the attachment 14. This is called a "grinding wheel arbor," and as it is provided with a No. 1 Morse taper, it may be inserted in the live spindle of the lathe in a jiffy. A clamping nut presses the grinding wheel tightly against a shoulder, thereby preventing it from slipping while work is being done. Naturally the bushing in the grinding wheel must correspond to the diameter of the arbor. This particular attachment may also be used for holding, polishing or buffing wheels.

A lathe without centers is really no lathe at all, for in every case of turning either wood or metal the operator must revolve his work between centers. One center, the live center, revolves with the work, holding it at the same time in a central position while the dead center (on the tail stock) remains stationary. Lathe centers should be ground accurately and they should be made of especially hard steel. When the centers of the lathes are inaccurate the accuracy of the whole tool also suffers. This is by way of a warning to the amateur operator. If he wants to preserve the accuracy of his lathe he should by all means take good care of the centers and see to it that they do not become battered or rusted.

The two centers used with this particular lathe are illustrated in 15 and 16. The large center, which is used in the live spindle, is a No. 1 Morse taper shown in 15, while the dead center is a No. 0 Morse taper, which is illustrated in 16.

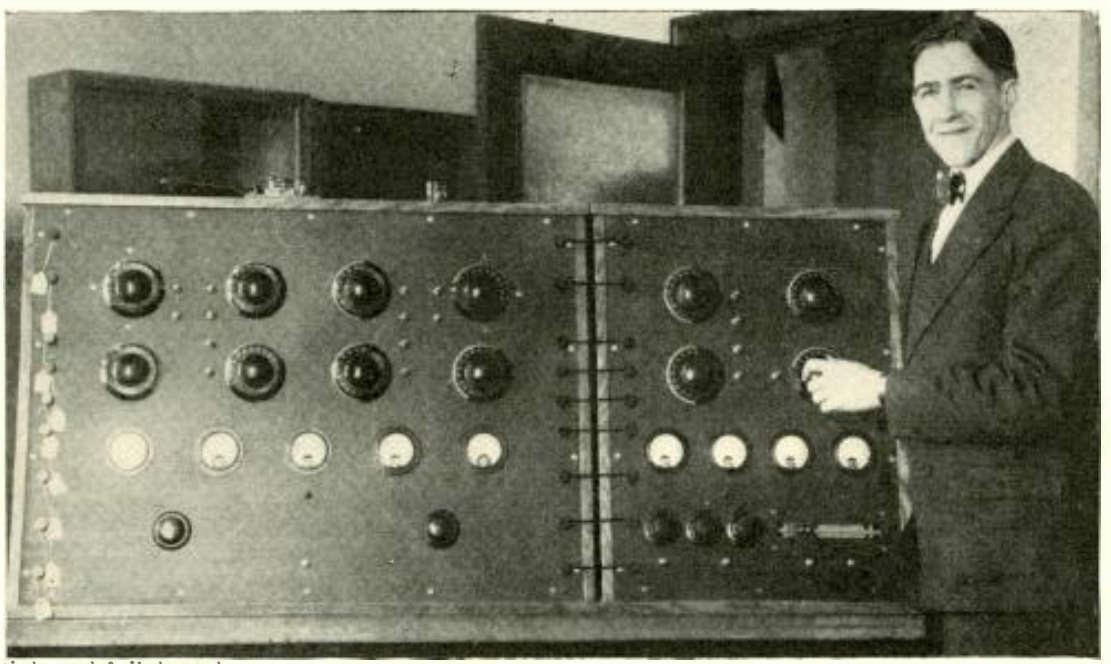
In turning flat pieces of wood, it is necessary to employ a screw center. Such a center will be found at 17. It, too, is provided with a No. 1 Morse taper, so that it may be forced into the live spindle. An ordinary wood screw is mounted in the center of this device and the wood to be turned is held in such a manner.

Two different types of lathe dogs are presented in 18 and 19.

It is the work of these dogs to transmit power to metal revolving between the lathe centers. Their use is a little too complicated to be described in this installment; consequently the writer is withholding this informaation until the next installment of the series when the description will be given over to the subject of metal turning between centers.

Included in the bracket at 20 is a group of lathe tools for use in the slide tool rest which was previously described. Special cutting jobs require special tools. and a set of 12 tools with cutting edges of different shapes and sizes are really necessary. For instance, it would be a poor mechanic who would attempt to cut off a piece of metal rod with a finishing tool or to cut a thread with a cutting-off tool. One of the most important things in learning how to operate a lathe is to know when and how to use the different cutting tools.

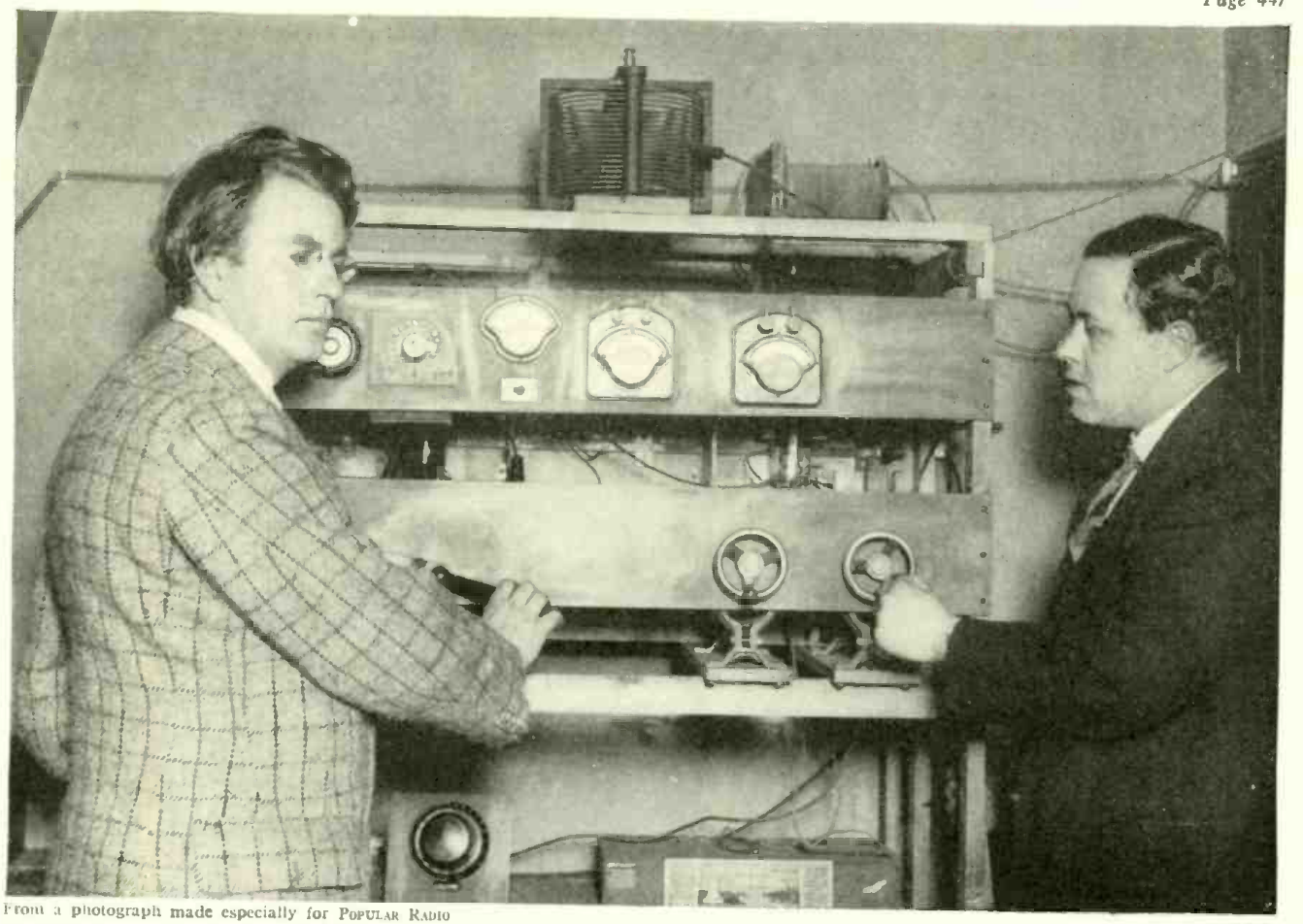
Every tool will be treated separately as this series of articles progresses.



Underwood & Underwood

THE INSTRUMENT THAT WILL STANDARDIZE WAVELENGTH MEASUREMENTS

This harmonic amplifier, just completed by the Bureau of Standards Radio Laboratory, has been designed to set the standard to which the wavelengths of all radio stations in the country may be adjusted. With this instrument to regulate wavelengths and the Radio Commission to adjust broadcasting congestion, the ether should soon be relieved of congestion.



From a photograph made especially for POPULAR RADIO

THE WORLD'S FIRST "TELEVISION BROADCASTER"

From this transmitter, at Station 2TV, in London, Mr. Baird (at the reader's left) made the first trials of broadcasting pictures and real scenes, all of which could be picked up by anyone who has the proper receiving apparatus. When television has been perfected and cheapened (as it is sure to be soon, either by Mr. Baird himself or by some other of the many experimenters now at work), this apparatus may have the same historic interest that the first broadcasting transmitters have to-day.

THE LATEST EXPERIMENTS WITH

Television and "Black Light"

¶ Human faces have been translated into sound and that sound has been sent by radio and recorded on phonograph records.

¶ Individuals have been "seen" by television in an absolutely dark room in which the unaided human eye sees nothing.

¶ These are among the recent accomplishments of the English experimenter, Mr. John L. Baird. In this exclusive article Mr. Baird describes, for the first time over his own signature, the details of the recent experiments which have attracted international attention to his work.

By JOHN L. BAIRD

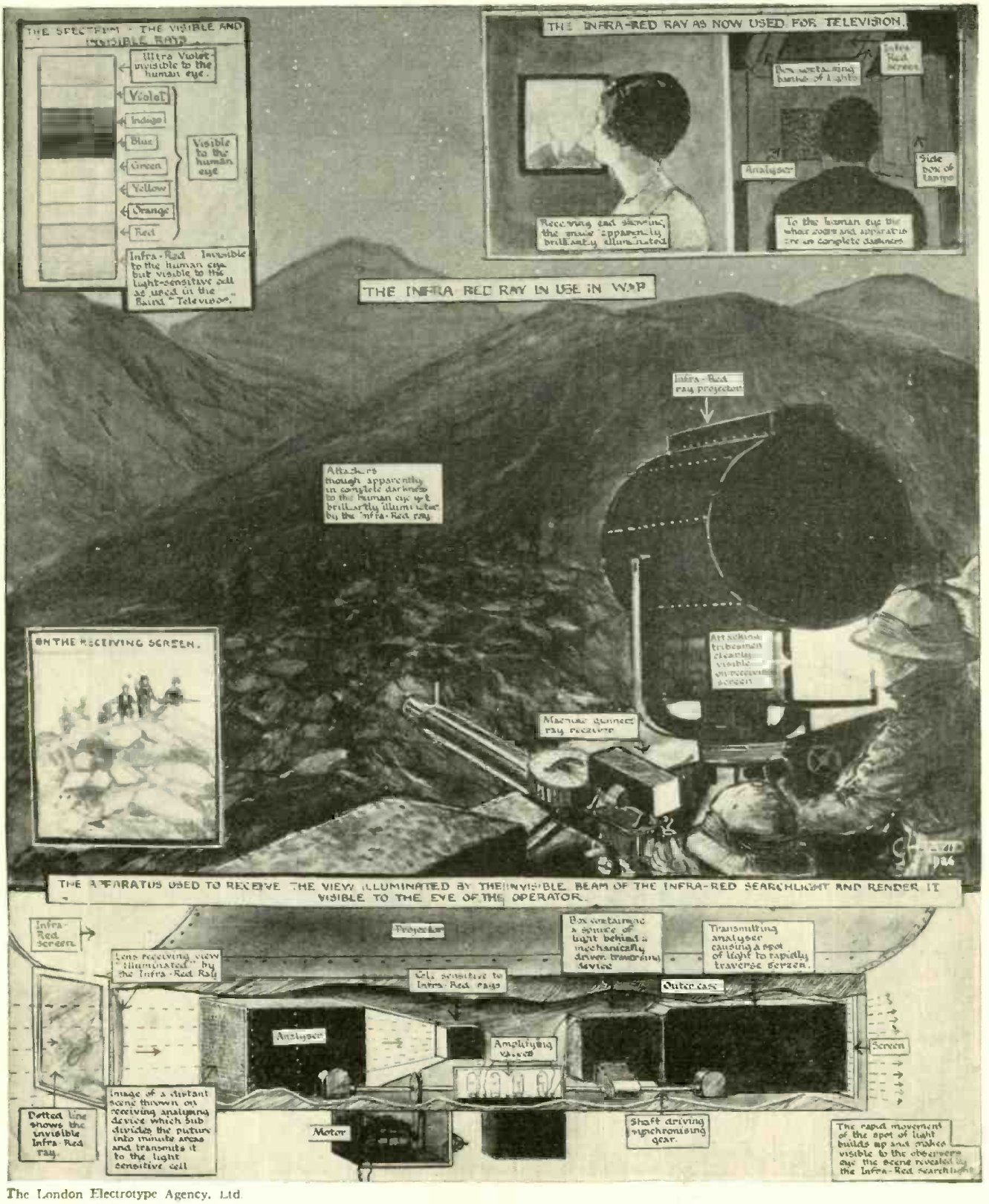
TELEVISION may be described briefly as the transmission of the images of actual scenes by radio or telegraphy with such rapidity that they appear instantaneously to the eye of the observer at the receiving end.

Fortunately for the success of television, the eye has a time lag; the images, therefore, need not actually be transmitted instantaneously. In fact, if they are transmitted at the rate of eight per second the transmission appears to the eye to be instantaneous.

In television, then, we have to transmit at least eight images per second.

These images, it should be clearly understood, are *not* photographs, but images of the actual living scehe.

The transmission of eight photographs per second would not give television, but would be the transmission of a cinemato-



The London Electrotype Agency, Ltd.

An Artist's Conception of How the "Black Light" Televisor Might Be Used in War

Mr. Baird's apparatus may be operated by the invisible infra-red rays, often called "black light," just as it can by the rays of visible light. In this drawing, Mr. G. H. Davis, of London, imagines a force, attacking in complete darkness, detected by the defenders, powerful beams of infra-red rays being reflected back into the Baird televisor. Critics may object that no way is known, at present, to produce beams of infra-red rays having the enormous intensity necessary for this feat, but it is conceivable that new infra-red searchlights can be perfected if they become necessary. At the bottom of the drawing is an outline of the Baird apparatus. In the upper left-hand corner is the complete spectrum of light rays, showing the place of the infra-red rays, in the invisible region just below the red

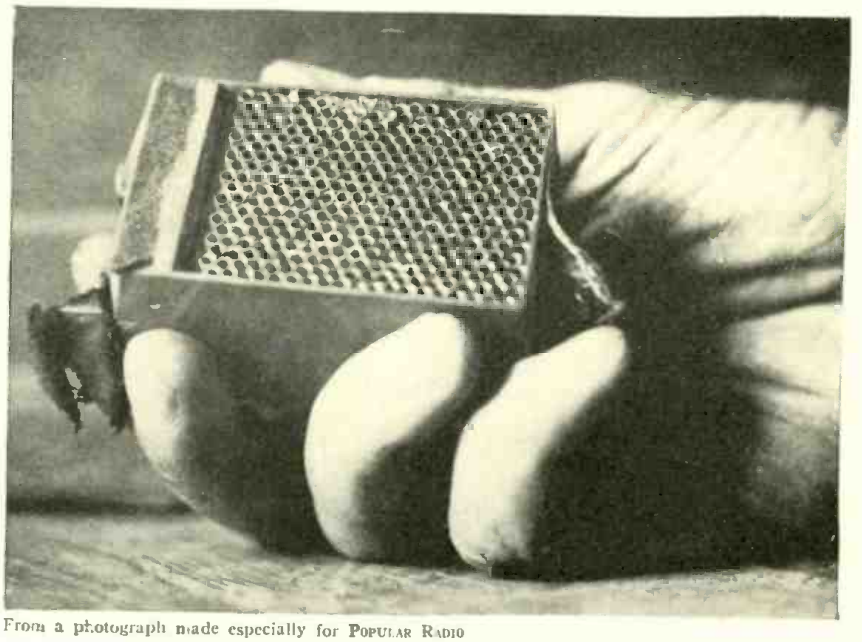
graph film, or "telekinematography."

Nor is the transmission of a single photograph, in any space of time, television. That is another science altogether, "known as phototelegraphy."

The problem of television has been approached by two different methods. The first, and most obvious, was to build an apparatus in imitation of the human optical system.

The human eye consists essentially of a lens which casts upon the retina an image of the object viewed. The surface of the retina consists of several millions of hexagonal cells into which come nerve endings from the optic nerve. These nerve endings are believed to be immersed in a light-sensitive substance known as "visual purple." This substance is ionized by light, changing its color from purple to a grayish yellow.

Present-day theories of vision assume that the ionization of the visual purple sends impulses along the nerve fibres to the visual centers of the brain. In life, the visual purple is continually renewed so that, in effect, the eye might be compared to a cinematograph camera—with the difference that in place of using a moving film, coated with a light-sensitive emulsion, the light-sensitive emulsion itself is continually changed.



From a photograph made especially for POPULAR RADIO

THE CELLULAR STRUCTURE OF THE PROJECTOR

By this series of metal tubes, reminding one of the many-leused structure of the eye of an insect, the scene to be transmitted is split up into a large number of small units, one unit being seen through each of the small tubes. The slotted disks of the transmitter revolve behind this cellular structure, so that the units of scene corresponding to the individual tubes are exposed in succession and allowed to pass into the photoelectric cell, to be sent out in the same succession over the radio wave to a synchronized receiver.

From a photograph made especially for POPULAR RADIO

SEEING AND HEARING BY RADIO

In this latest experimental model of the Baird television receiver, a loudspeaker is incorporated in the same cabinet, so that speech and sight can be received simultaneously. The receiving apparatus inside the case reproduces, in regular order, the signals corresponding to the scene units sent by the transmitter. The action is so rapid that these individual units of light or shade blend to make a complete reproduction of the original scene. The limited number of units into which the scene is divided means, however, that some detail is lost.

In the human television system the scene viewed is transmitted to the brain as a mosaic consisting of an enormous number of little areas, each of which is transmitted at the same time to the receiving centers of the brain.

Artificial vision models on these lines were actually made by several early television workers. In 1906 Rignoux and Fournier constructed an apparatus the transmitter of which consisted of a wall covered with 64 large selenium cells; each of these cells was connected to a rresponding shutter at the receiving station, so that when light fell on any cell its corresponding shutter opened at the receiving station and a spot of light appeared on the receiving screen.

By covering the transmitting wall with large stencils, shadowgraphs of letters and geometrical figures were transmitted. The stupendous number of cells, wires and shutters required, however, made the practical development of such a scheme out of the question.

The second line of attack was to use one cell only and cause each of the elemental areas to fall in succession upon this one cell, the varying current from the cell to be transmitted to the receiver and there control the intensity of a point of light traversing a screen in synchronism with the traversal of the image over the cell. This point of light was

to be bright at the high lights and dim at the shadows, and was to make eight complete traversals of the screen per second, so that persistence of vision would cause the whole image to appear instantaneously to the eye.

To devise optical apparatus capable of causing an image to traverse a cell proved to be a comparatively simple matter and a considerable number of similar devices were invented at an early date.

Had this been the only problem, television would have been achieved forty years ago.

But the real problem was to obtain a light-sensitive device capable of giving an adequate response at the immense speed of signalling necessary. The early workers had only the selenium cell to work with, and this was found to be far too sluggish. Later, when the photo-electric cell was discovered, it was eagerly seized upon by television workers, but although the response of the photo-electric cell is instantaneous, its output is so minute as to be insufficient for the purpose.

The modern development of thermionic tube amplifiers altered the whole aspect of the problem by giving a means of amplifying the most minute currents to almost any extent, and an attempt was made to use tube amplifiers in conjunction with the photoelectric cell.

Again, however, disappointment was in store. Even the stupendous amplification now obtainable was insufficient.

Using a potassium cell, to obtain an adequate reponse would require, I estimate, an amplification at least one thousand times greater than that obtainable with the present thermionic tube.

When the number of stages of amplification is increased beyond a certain point, the intrusion of parasitic noises due to battery irregularities and other causes sets a practical limit to the amplification obtainable. By using great care this limit can be extended, but even then a further limit is reached when noise due to the irregular electron emission of the tube filament makes its appearance.

The tube, however, in conjunction with the potassium photoelectric cell, while it did not produce television, enabled shadows to be transmitted, for with shadows the light problem does not arise. The cell has only to distinguish between complete darkness and a light which may be almost as intense as we like to make it.

In television, however, only the light reflected back from the elemental areas of the image is available, and this light is infinitesimally small.

The first problem, then, was to produce a device capable of giving an adequate reaction to this very minute stimulus.

Four years ago, when I decided to devote my entire time to an effort to achieve television, the problem seemed comparatively simple. Two optical exploring devices working in synchronism, a light-sensitive cell and a controlled varying ligbt source capable of rapid variation were all that were required, and these appeared to be, to use a patent-office term, already "known to the art."

The problem of synchronism had, apparently, already been solved in multiplex telegraphy. A number of optical exploring devices were already known. The photoelectric cell in conjunction with the thermionic tube appeared to offer a ready-made light-sensitive device, and the glow discharge lamp an ideal light source.

The only ominous cloud upon the horizon was the fact that in spite of the apparent simplicity of the task, no one had produced a demonstrable system of television.

The trouble lay in the cell.

After six months of work, however, I managed to get shadows through. The step from shadows to images by reflected light proved extremely difficult, but in April, 1925, I had the satisfaction of transmitting simple outlines by reflected light.

The outlines transmitted with this first machine were crude and flickering, and were simply outlines; no gradations of shading and no details were visible. The mechanical details of the transmitting and receiving apparatus used in these early experiments have already been described in these pages.*

The next step—to produce a real image with light gradations and detail—was a good deal more difficult than I anticipated. The image persisted in coming through simply in black and white.

After six months of effort, however, the remaining difficulties were overcome, and I had the satisfaction at last of seeing on the receiving screen a real image with gradations of shading and detail.

An open invitation was extended to members of the Royal Institution and on January 27th, 1926, forty members witnessed what was, I believe, the first demonstration of true television ever given.

In describing the results I cannot do better than quote from the report published in the *Electrician* on June 25th, 1926:

> "A young lad, one of the office staff, first took his place in front of the transmitter, and was clearly recognizable, not as a silhouette, but with half-tones and detail, in appearance similar to the early cinematographs."

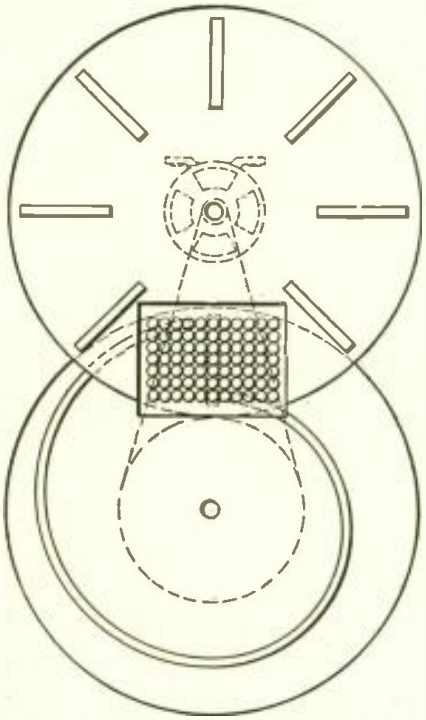
The images obtained during the first demonstrations of real television were flickering and imperfect, and their improvement is one of the problems in which I am now engaged.

Three methods of casting an image are known. A lens, a mirror or a pin-hole may be used. I have, however, devised another method by means of which an image may be projected; this method, which has been used by me in some recent experimental work, may prove of interest to readers of POPULAR RADIO.

A cellular structure is built up of a bank of tubes of very small bore. A view of the arrangement is shown on preceding page.

Each of the tubes conveys a small elemental area of illumination, so that we now have the image split up into scores of tiny round sections or dots; it only remains to impress the light values represented by each individual dot on to the light-sensitive cell in its proper sequence.

This can be done by means of two discs revolving between the tube block and the cell. For this purpose I have retained two of the discs of my original machine. One of these discs has a long spiral slot in it, whilst the other has a series of radial slots. These are mounted immediately behind the block of tubes, in such a manner that the discs overlap, the overlapping portions moving past each other in opposite directions as the discs revolve. The diagram on this page shows the arrangement.



THE REVOLVING DISCS

At the two discs revolve behind the cellular structure of the projector, the combination of the spiral slot of one disc with the radial slots of the other disc exposes the unit tubes of the cellular structure, individually and in succession, thus creating the signals to be sent.

*See POPULAR RADIO for November, 1926.

The spirally slotted disc, revolving comparatively slowly, exposes layer after layer of tubes to the light-sensitive cell, shifting its opening across the block in a vertical direction. The slots in the other disc, which revolves at a high rate of speed, are so arranged, however, that the light ray of only one tube at a time is exposed to the light-sensitive cell.

Thus, while the lower layer of tubes is open to the cell through the spiral slot, the slots in disc swing rapidly along the line and flash the light of each tube in turn onto the cell. Then the next row of tubes is dealt with, and so on, until the entire image has been flashed over the cell.

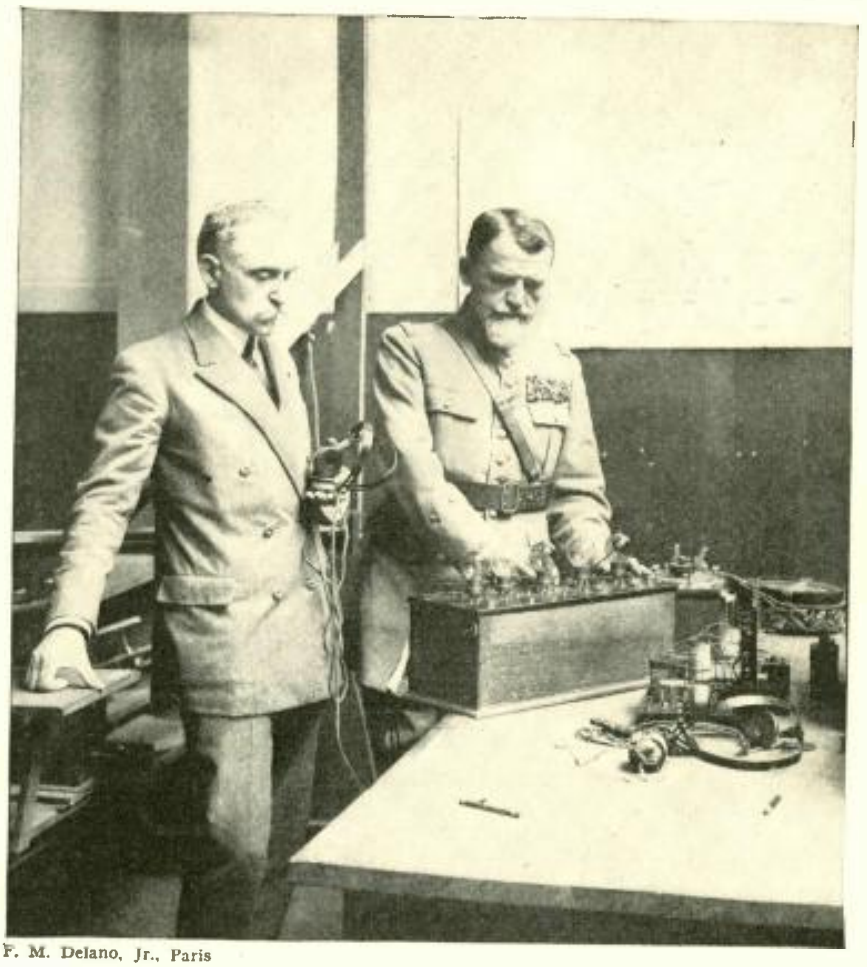
At the receiving end exactly similar apparatus is installed, only the light-sensitive cell is replaced by a source of light which is varied by the incoming electrical impulses, which are strong for high lights, medium for half tones, and zero for dark parts of the picture.

Immediately in front of the block of projecting tubes, at the end remote from the spinning discs, there is a ground glass screen upon which the picture appears, a reproduction of the original, complete with even gradations of light and shade, and showing the movements of the sitter as would a movie film.

A peculiarity of a cellular structure is that the image it projects has no focal depth; that is to say, if the structure is held up so that an electric light bulb can be seen through it, the image of the bulb will remain exactly the same size, whether the structure is held close to the light or several feet away from it. The only noticeable difference is that the further away it is held the more blurred the image becomes.

Whereas my original machine, employing a combination of shutters and lens discs to project the image onto the light-sensitive cell, tended to produce at the receiver a picture made up of closely-fitting narrow strips, the new method gives a picture made up of tiny dots, like a newspaper reproduction. The grain can be made finer by this method, and the picture can be reproduced on a larger screen, but even so the ultimate degree of fineness obtainable, when enlarging the screen, is necessarily limited by mechanical imperfections. Obviously there is a limit to the number and thinness of the projection tubes which can be employed, as also there is a limit to the speed at which the discs can be revolved.

My next step, therefore, was to find an exploring method free from these limitations, and I have now succeeded in doing this. Unfortunately, I am not yet at liberty to describe this latest development, owing to the patent situation, but it can be stated that, by means of it, *any* degree of fineness of grain can be optically obtained, and there is no mechanical limit to the speed of the operation.



F. M. Delano, Jr., Paris

A FRENCH SCIENTIST'S REPORT TO "POPULAR RADIO"

"I have seen a demonstration of Mr. Baird's system of television. I saw the image of a youth on an illuminated screen. It was very small, but I could see him open and close his eyes and mouth, turn his head, and so on, as requested. Although the image was not perfect, the youth could be recognized. Without doubt, Mr. Baird has demonstrated true television."—GEN. GUSTAVE FERRIE.

One interesting phenomenon in connection with television is that if the output currents of the light-sensitive cell are listened to in a telephone receiver, they are heard as sounds, every object or scene having its own peculiar characteristic sound.

For example, the fingers of a hand held in front of the transmitter will give rise to a sound similar to the grating of a very coarse file, while the human face will cause a high-pitched whistle which will vary in pitch as the head is turned or even when the features are moved.

I have had a few phonograph records made of the "sounds" made by the faces of different persons; by listening carefully to the reproductions of these records it is possible to distinguish between one face and another by the sounds they make! With practice, faces may even be recognized by the sounds produced.

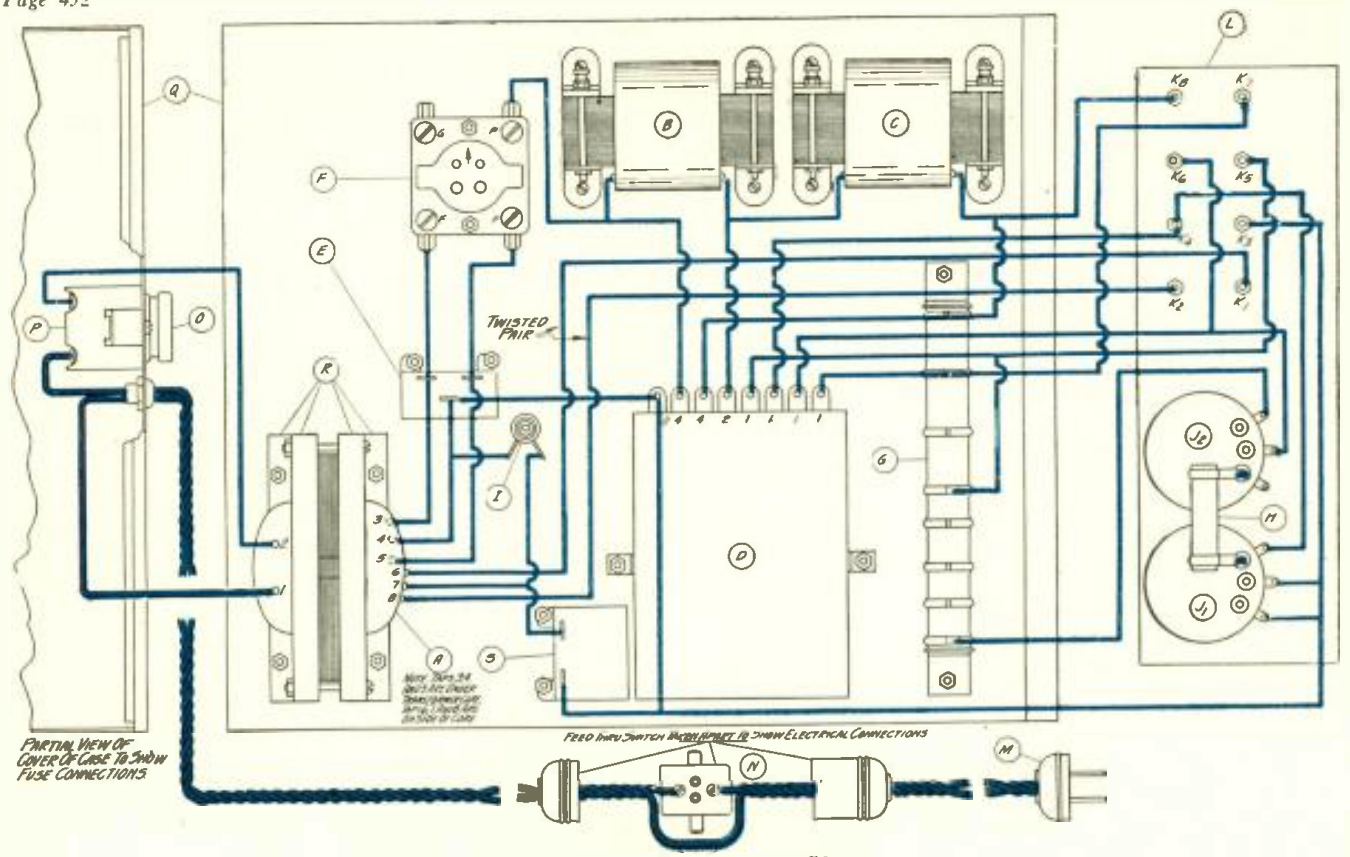
A further interesting point is that these records may be turned back into images by making them vary the current at the receiver, so that we can now store a living scene in the form of a phonograph record as well as in the form of a cinematograph film! There is room here for the imaginative to indulge in speculation on the scope for future development along these lines.

In the first demonstrations of television it was necessary to use an intensely brilliant illumination, and this caused the sitters considerable discomfort. I was told that even a vaudeville star would shrink from such an intense spotlight.

While working on reducing the light necessary, the thought occurred, why not dispense with light altogether and use rays outside the visible spectrum? But would the light-sensitive cell respond?

First of all I experimented with ultra-violet rays, but these proved troublesome

(*Continued on page 498*)



THE PICTURE WIRING DIAGRAM

FIGURE 1: *Here the wiring is shown in heavy* BLUE *lines; the instruments themselves and the various parts and accessories are drawn in* BLACK. *The rectangle at the right shows the connections to be made on the binding post panel, the large middle rectangle those to the instruments mounted on the bottom half of the metal case. At the left is indicated the wiring of the instruments on the top half of the case.*

How to Build the Varion Power-Pack

Here are the exact constructional details for building a high-powered unit that uses the gaseous type of full-wave rectifier tube. This unit will supply the proper voltages for any set. Simple construction and complete shielding are among its features.

By LAURENCE M. COCKADAY

COST OF PARTS: *Not more than $58.00*

HERE ARE THE PARTS THAT WERE USED IN THE LABORATORY MODEL OF THIS RECEIVER—

A—AmerTran transformer, PF-64 (unmounted);
B and C—Amerchokes, No. 854;
D—Sangamo Varion condenser block, 14 mfds. total capacity;
E—Sangamo Varion condenser block, (two .1 mfd. units with one common terminal);
F—Eby UX-type socket;
G—Ward-Leonard Varion resistance unit, 12,000 ohms total resistance;
H—Ward-Leonard resistance, 5000 ohms;
I—Ward-Leonard resistance, 2250 ohms;
J1 and J2—any approved heavy-duty potentiometers, 2000 ohms (Centralab units illustrated);
K1, K2, K3, K4, K5, K6, K7 and K8—any approved binding posts (Eby posts illustrated); marked Fil., Fil., "C" battery—, "B" battery—, "B" Det. +, 67-volt, 90-volt +, and "B" amplifier +, respectively;
L—Drilled and engraved bakelite panel, 2 inches by 9 inches by ⅛-inch;
M—Attachment plug;
N—Beaver Feed-thru switch;
O—Any approved fuse plug, 6 amperes (Economy plug illustrated);
P—Hart & Hegeman receptacle, No. 9154;
Q—Stamped and drilled metal case;
R—Mounting brackets for transformer;
S—Tobe filter condenser, 2 mfd.;
3 dozen—6/32 brass machine screws, ¾-inch long;
4 6/32 brass machine screws, 1½-inch long;
1 6/32 brass machine screw, 2½-inches long;
6 feet standard lamp cord.

MOST of the descriptive articles on power-packs have dealt with a construction wherein the various instruments used in the pack were to be mounted on a wooden baseboard. This style (commonly called "breadboard mounting") has proved satisfactory for amateur use. If the whole unit were to be assembled on a metal chassis that could be totally shielded so that the high-voltage wiring could be protected from the hands of the operator, there would be a considerable advantage, however.

This latter type of construction, which

The list of parts given above includes the exact instruments used in the set from which these specifications were made up. The experienced amateur, however, will be able to pick out other reliable makes of instruments which have been approved by POPULAR RADIO *and which may be used with good results. But we recommend that the novice follow the list, as the diagrams in this article will tell him exactly where to bore the holes and exactly where to place the connections. If instruments other than the ones listed are used, the only change that will be necessary will be the use of different spacings for the holes that are drilled in the sub-base for mounting the instruments. To any reader who has difficulty in obtaining any of the parts which are necessary in making up these model receivers and power units,* POPULAR RADIO SERVICE BUREAU, *627 West 43rd Street, New York City, will gladly assist in seeing that his requirements are promptly supplied.*

has been followed in the new unit, eliminates any possibility of electric shock to the operator of the set with which it is to be used.

In designing the new unit, special consideration was given to wide variation of intermediate voltages necessary on commercial types of receivers; therefore taps have been provided for voltages of 67-volts, 90-volts, and the high-voltage tap which goes up to 200-volts, as well as a variable voltage for the detector valve and a variable "C" battery voltage for the last power tube.

A further feature of the new unit is the ability to supply alternating current at 5-volts for the UX-171 type power valve. By means of a simple adapter any set may use a power valve in the last stage and obtain its "A," "B" and "C" voltages direct from the power-pack, while the other vacuum valves in the set may be supplied from a storage battery or from an "A" power-pack.

The unit is also equipped with a fuse and an extension cord for plugging into the light socket with a separate switch for turning it "on" and "off."

The power-pack is designed especially for the use of the new gaseous rectifier valves and the following tubes have been approved for use with the unit:

1. Raytheon 85 mil. double-wave rectifier valve;
2. Q.R.S. 85 mil. double-wave rectifier valve;
3. Edlo BH double-wave rectifier valve;
4. Speed double-wave rectifier valve;
5. Schickerling double-wave rectifier valve.

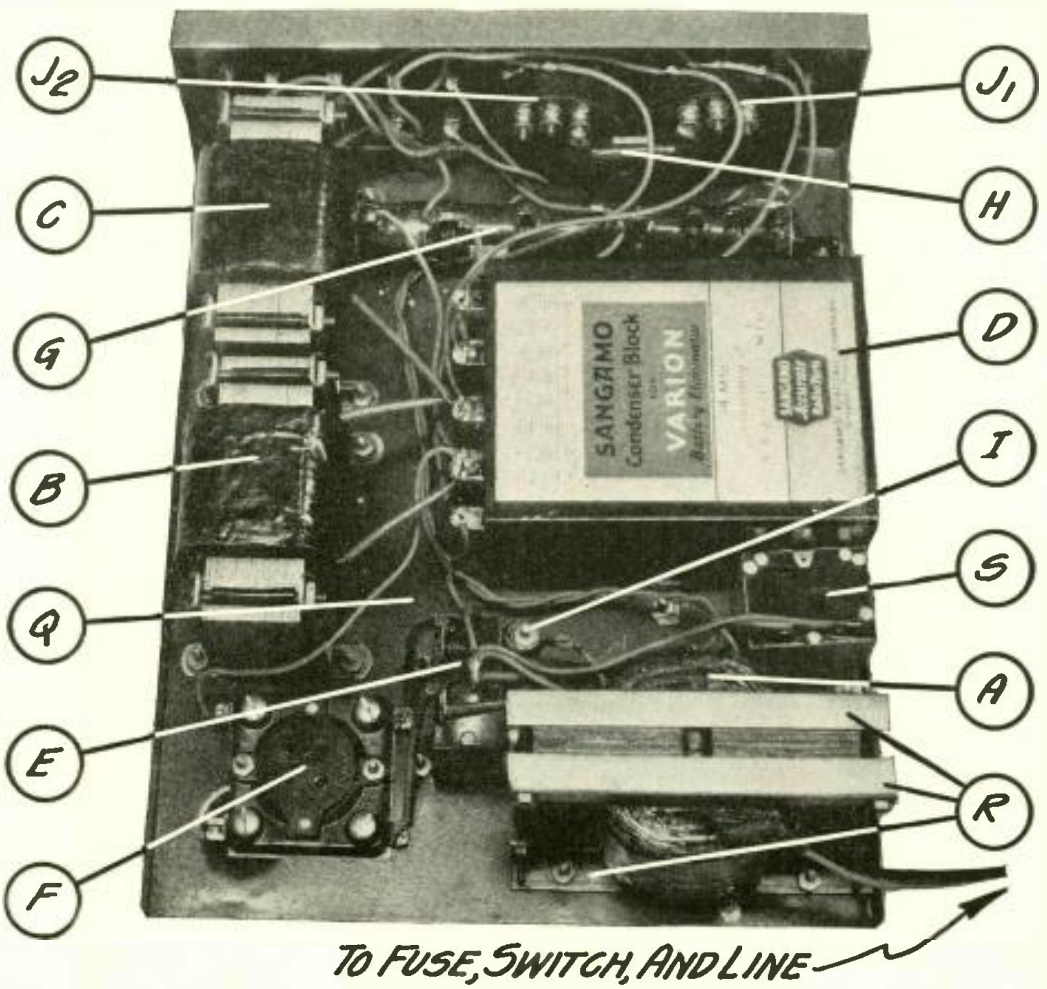
The condensers have been especially grouped into two compact blocks with handy terminals for wiring up. The resistance elements also have been made in special tapped units that make for simplicity in connection.

The Varion power-pack may be used to furnish power for any type of set now on the market or with any type of receiver that may be built by the experimental radio fan.

The circuit diagram for the power-pack is given in Figure 3.

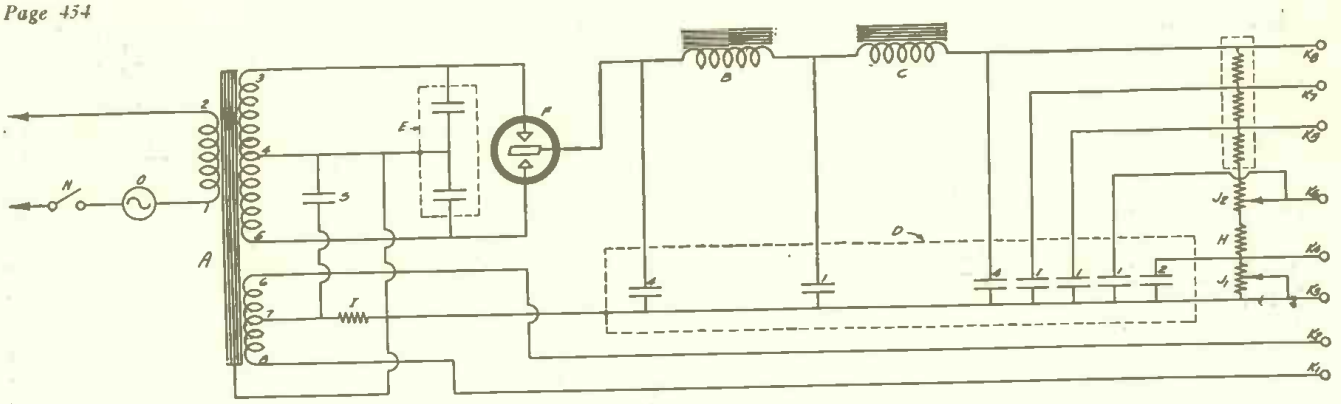
How to Construct the Unit

After all the instruments and material for building the power-pack have



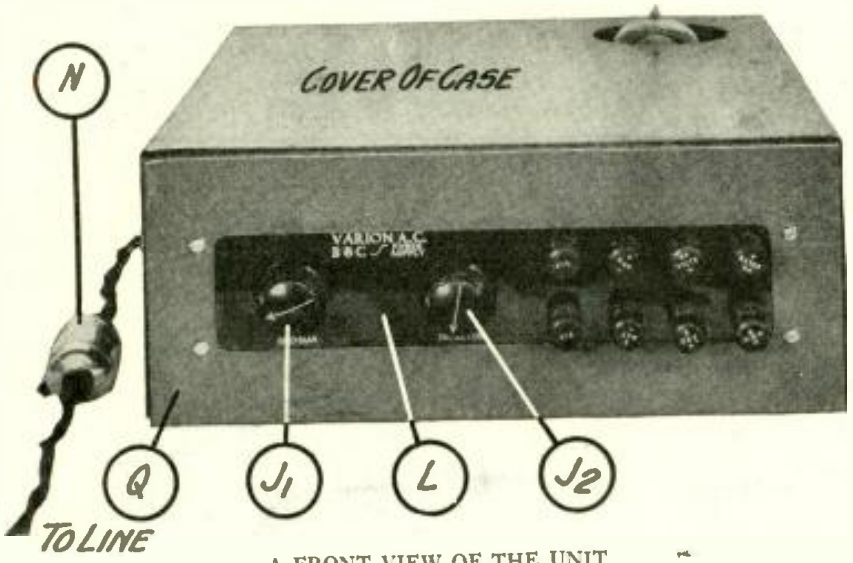
THE INNER ARRANGEMENT OF THE POWER-PACK

FIGURE 2: *The parts of the power-pack are screwed to the metal case in the simple arrangement pictured above, showing the pack with the top of the metal case off. (All of the parts shown in this illustration are designated by letters that correspond to the list of parts and the constructional data given in the text of the article.)*



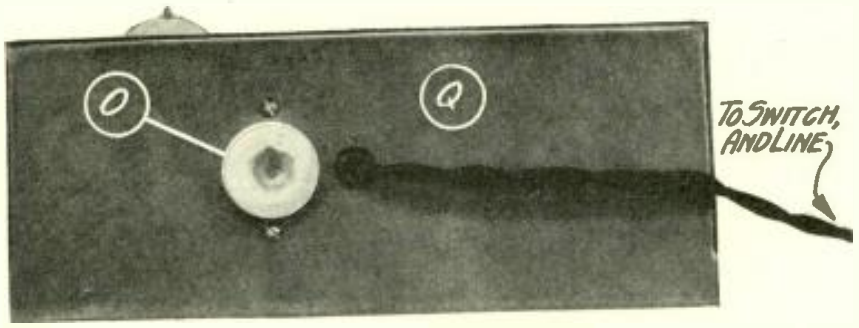
THE SCHEMATIC WIRING DIAGRAM

FIGURE 3: *This drawing gives the electrical circuit and connections of all the parts that are used in this new unit—a unit that is designed to give increased power and more stable operation when connected to a radio receiver.*



A FRONT VIEW OF THE UNIT

FIGURE 4: *At the left is the switch, N, which turns the unit "on" and "off." The two variable voltage controls, J1 and J2, are located on the small panel. The tube itself is inserted in the opening at the rear right-hand corner of the unit. The metal case completely covers all of the live parts of the unit.*



A REAR VIEW OF THE UNIT

FIGURE 5: *The fuse plug, O, is mounted on this end of the metal case, Q. The double wire goes to the switch, N, shown in Figure 4, and to the lighting socket plug that makes connection with the lighting lines. The power-pack is built to operate on an alternating circuit of 110 volts and from 50 to 60 cycles.*

been procured, the unit may best be put together in the following manner:

First of all, mount the binding posts, K1, K2, K3, K4, K5, K6, K7 and K8, on the small connection panel, L, and mount the two potentiometers, J1 and J2, as shown in Figures 1, 2, and 4.

The resistance, S, need not be mounted until the set is wired up.

When these parts have been mounted on the small panel, L, the panel may be fastened to the bottom half of the metal case, Q, by means of four machine screws and nuts.

Next, mount the resistance unit, G, on the metal case, Q, by means of two machine screws and nuts, as shown in Figure 1.

Then mount the two choke coils, B and C, in a similar manner.

Next, fasten down the large condenser block, D, and the two smaller condenser blocks, E and S. When this is done, fasten down the resistance, I, by inserting the long 2½-inch brass machine screw up through the base, and by placing a washer and nut at the top end.

Then mount the valve socket, F, first cutting out a small square of heavy cardboard, the same size as the base of the socket, and placing it between the socket and the metal case.

Lastly, attach the four brass brackets, R, to the transformer, A, as shown in Figure 8 and mount it in position, exactly as shown in Figure 1.

This completes the constructional work on the bottom half of the case, Q.

Next, fasten the receptacle, P, to the upper half of the case in the proper holes by means of the two machine screws that come with the unit.

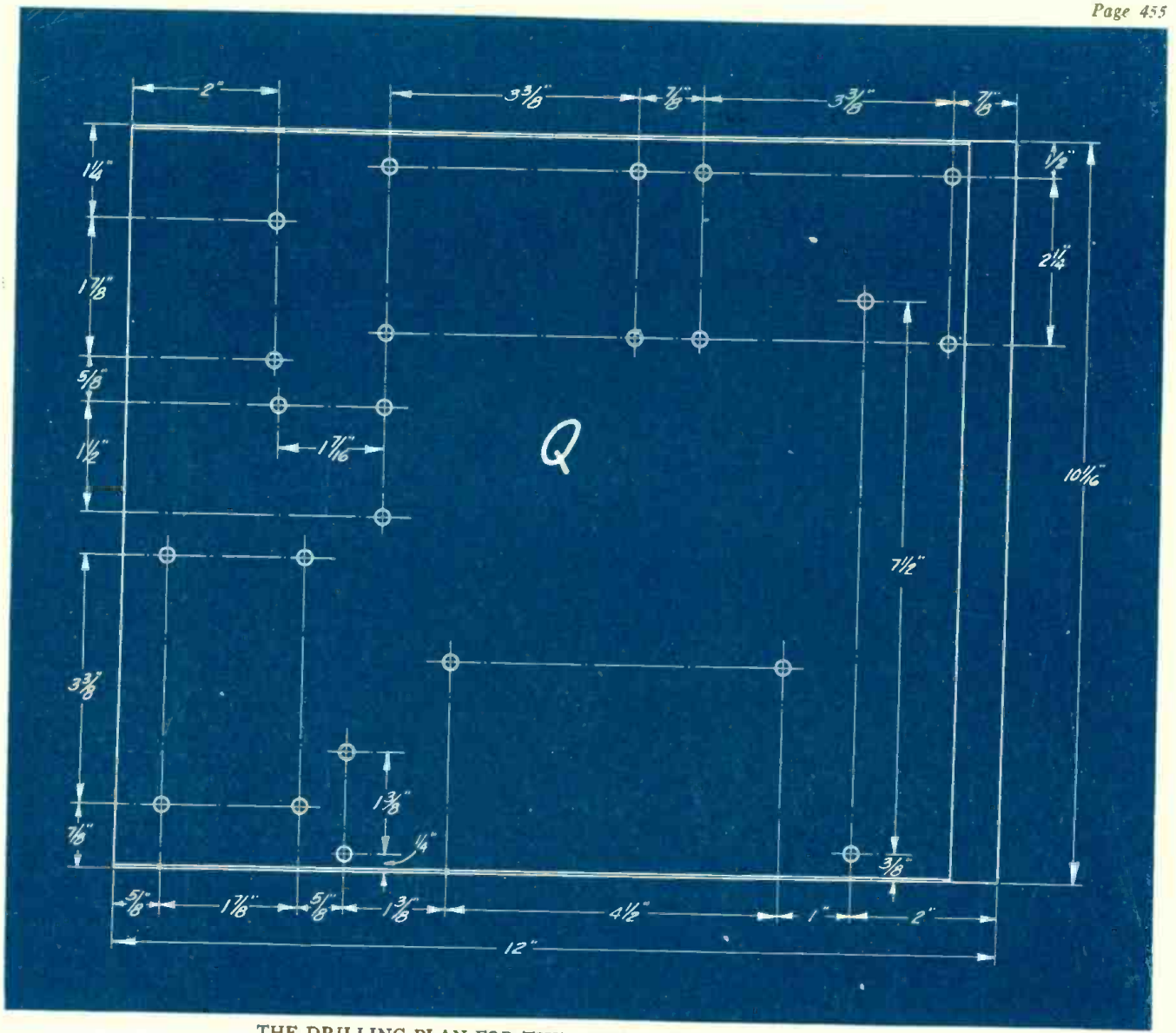
The constructional work is now complete and the unit is ready to be wired.

How to Wire the Power-Pack

If the picture wiring diagram is followed in wiring up this unit, the job will be found to be an easy one. Use a rubber covered hook-up wire or a flexible wire such as Celatsite for this work. Follow the connections shown in the picture wiring diagram in Figure 1 exactly and no difficulty will be experienced.

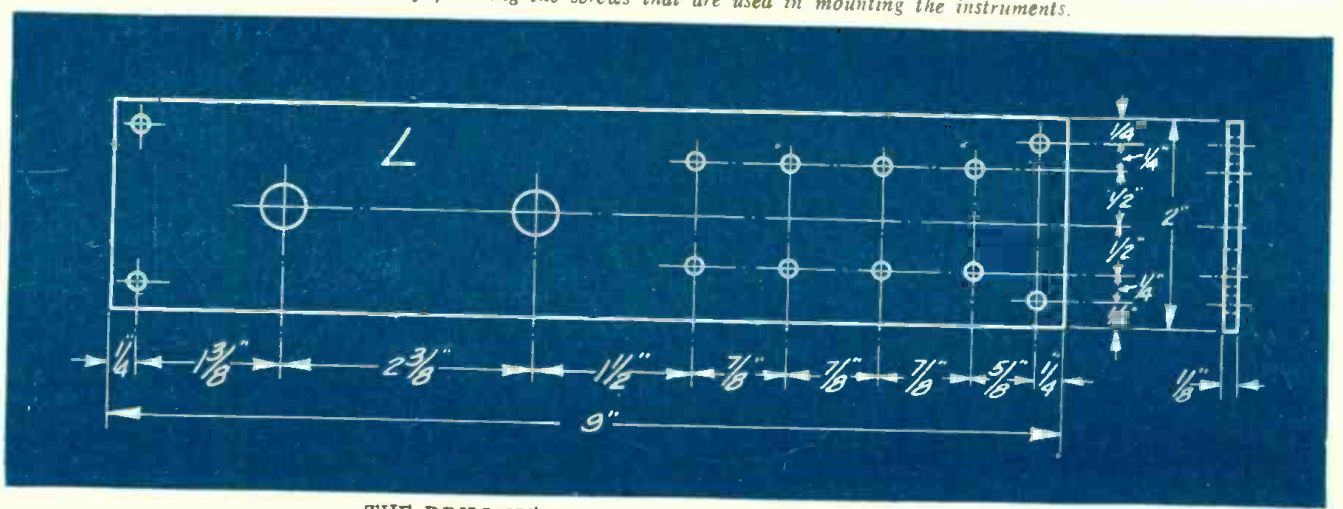
When wiring up the connections to the binding posts, it would be advisable to take out the choke coil nearest the panel while this work is being done,

(*Continued on page 495*)



THE DRILLING PLAN FOR THE BOTTOM HALF OF THE CASE Q

FIGURE 6: *This shows the exact positions of all the holes for mounting the instruments on the bottom half of the metal case. The holes should be drilled with the correct size of drill, for easily fastening the screws that are used in mounting the instruments.*



THE DRILLING PLAN FOR THE SMALL PANEL L

FIGURE 7: *The dimensions and layout for the holes used in mounting the instruments and binding posts are clearly indicated. The sizes of the holes should be determined beforehand by measuring the sizes of the screws on the binding posts and the shafts of the two instruments that are to be mounted on this panel.*

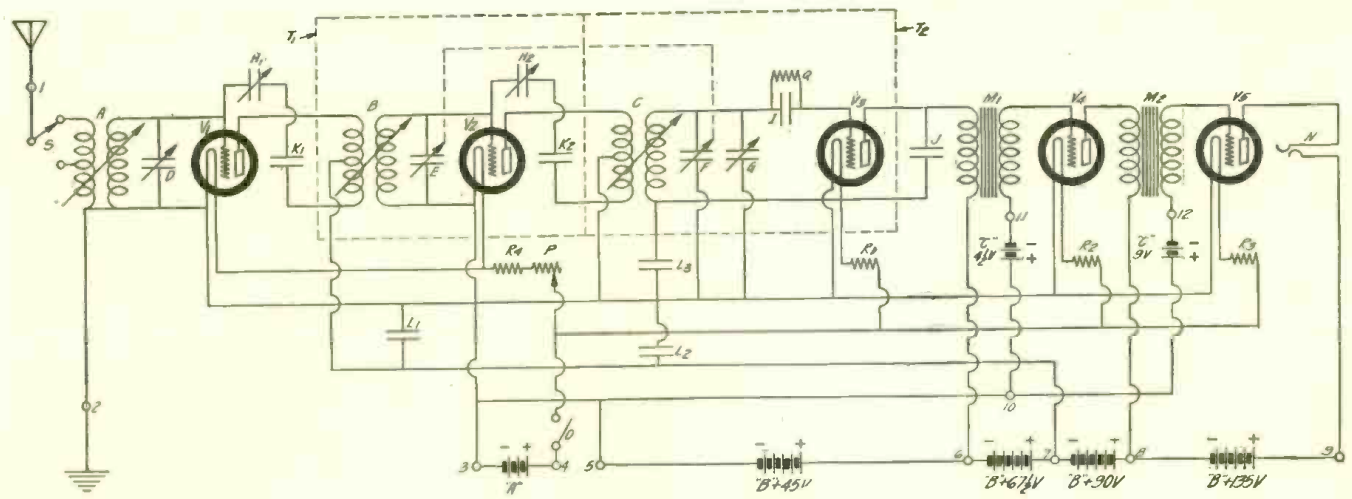


DIAGRAM OF THE ELECTRICAL CIRCUIT

FIGURE 1: *Here is shown the theoretical wiring of the Hi-Q receiver. Notice that the second stage of high-frequency amplification and the detector are shielded with complete stage shields and that the condensers, E and F, mounted on these shields are connected by a single-control tuning knob and shaft.*

HOW TO ASSEMBLE

The Hammarlund-Roberts Hi-Q Receiver

This series of articles on the assembly and operation of popular kits of parts that may be obtained for building really good radio receivers will differ from the "How-to-Build" articles, in that the sets described have been designed outside of POPULAR RADIO Experimental Laboratory by commercial engineers. The sets that will be picked for description, however, will have been carefully tested in the POPULAR RADIO Electrical Testing Laboratory and will be chosen for their outstanding features and all-around efficiency.

By JOSEPH CALCATERRA

COST OF PARTS: *Not more than $63.50*

HERE IS A LIST OF THE PARTS RECOMMENDED FOR THE CONSTRUCTION OF THE RECEIVER—

A, B and C—Set of Hammarlund auto-couple coils;
D, E and F—Hammarlund midline variable condensers, .00035 mfd.;
G—Hammarlund Jr. variable condenser, 32 mmfd.;
H1 and H2—Hammarlund equalizer condensers;*
I—Sangamo grid condenser with grid-leak mounting clips, .00025 mfd.;
J—Sangamo fixed condenser, .001 mfd.;
K1 and K2—Sangamo fixed condensers, .00015 mfd.;
L1, L2 and L3—Sangamo by-pass condensers, ¼ mfd.;
M1 and M2—Samson low-frequency transformers, 3 to 1 ratio, type HW-A3;
N—Carter short jack, No. 1;
OP—Carter combination midget rheostat (10 ohms) with filament switch, No. M-10-S;
Q—Durham metallized resistor, 2 megohms;
R1 and R2—Amperites, No. 1A;
R3—Amperite (No. 1A for UX-201-a type valve; No. 112 for UX-112 or UX-171 type valves);
R4—Fixed resistance, 2 ohms (supplied in foundation unit);*
S—Carter "Imp" antenna switch, No. 12;
T1 and T2—Shields;*
U—Composition panel, drilled and engraved;*
V1, V2 and V3—Benjamin sockets, No. 9040;
V4 and V5—Benjamin sockets without bases, No. 9049;
W—Hardwood baseboard;
X—Composition sub-panel;*
Y1 and Y2—Marco vernier dials, No. 192;
Z—"Ebco" Hi-Q cabinet;
10 binding posts.

* The Hammarlund-Roberts foundation unit includes drilled and engraved panel, U, and sub-panel, X, shields, T1 and T2, equalizers, H1 and H2, extension shaft, resistance unit, R4, screws, nuts, etc.

THE Hammarlund-Roberts Hi-Q circuit is the result of a concerted effort to produce a receiver which would be simple to operate; that would be non-oscillating, selective, give even amplification over the whole wavelength range and be adaptable for use under all ordinary conditions of location, antenna length and skill of the operator.

This receiver is, fundamentally, a five-valve tuned high-frequency receiver taking advantage of the good points usually found in this type of circuit but so designed as to eliminate the bad features that have caused many fans to frown on the ordinary tuned-high-frequency set.

In the first place, the ordinary receiver makes no provision for a variation in the antenna length of the individual installation or for its distance from the broadcasting stations.

In the Hi-Q receiver this is taken care of by using a tapped primary winding permitting an adjustment of the number of turns in the antenna circuit and a consequent variation of coupling and transfer of energy. In this manner it is possible to adjust the receiver for operation on a long antenna by reducing the number of turns of the primary winding or adjust it for operation on a short antenna by increasing the number of turns in the antenna circuit. A two-point antenna switch, S, is used for the switching operation.

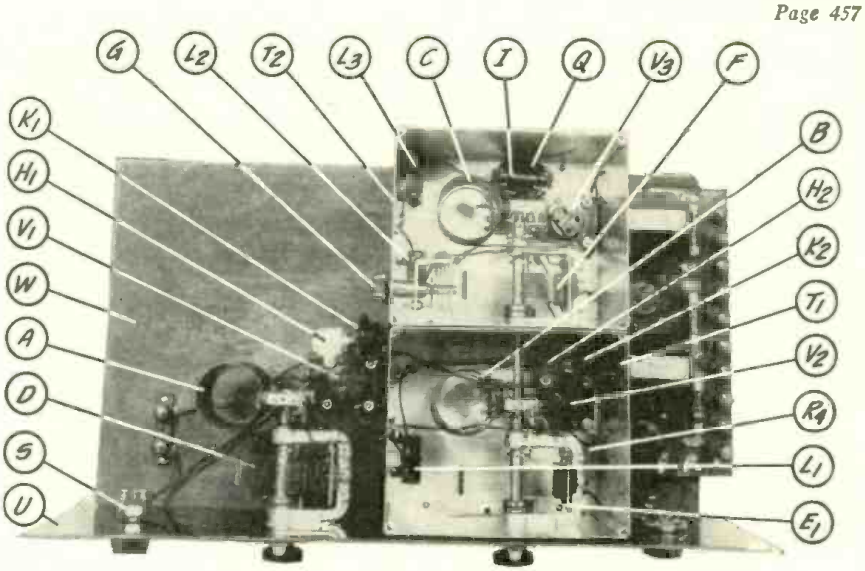
While there are three tuned circuits in the receiver, simplicity of tuning has been accomplished by ganging the second and third variable condensers, E and F, on one shaft. Any slight variation in the two condensers may be balanced up by adjusting the auxiliary tuning condenser, G, which, when once properly adjusted, need never be touched again.

The positions of these parts is shown clearly in Figures 2 and 3.

Up to this stage there is little difference between the Hi-Q and many of the other tuned-high-frequency circuits. The real secret behind the remarkable efficiency of the circuit lies in a novel departure from ordinary practice in the design and operation of the high-frequency transformers in this receiver.

Instead of the usual arrangement of a fixed coupling between primary and secondary windings, these high-frequency transformers employ variable coupling between the two windings. By this means it is possible to overcome the disadvantages growing out of the old system.

With these variable-coupling transformers, it is possible to increase the coupling to the point where maximum efficiency is obtainable at high wavelengths, using a large number of turns and tight coupling, without risking unstable operation and oscillation at the low wavelengths. When the receiver is tuned to lower wavelengths, the coupling is automatically decreased or "loosened"; this reduces energy transfer and prevents unstable operation or chocking of the vacuum valves.

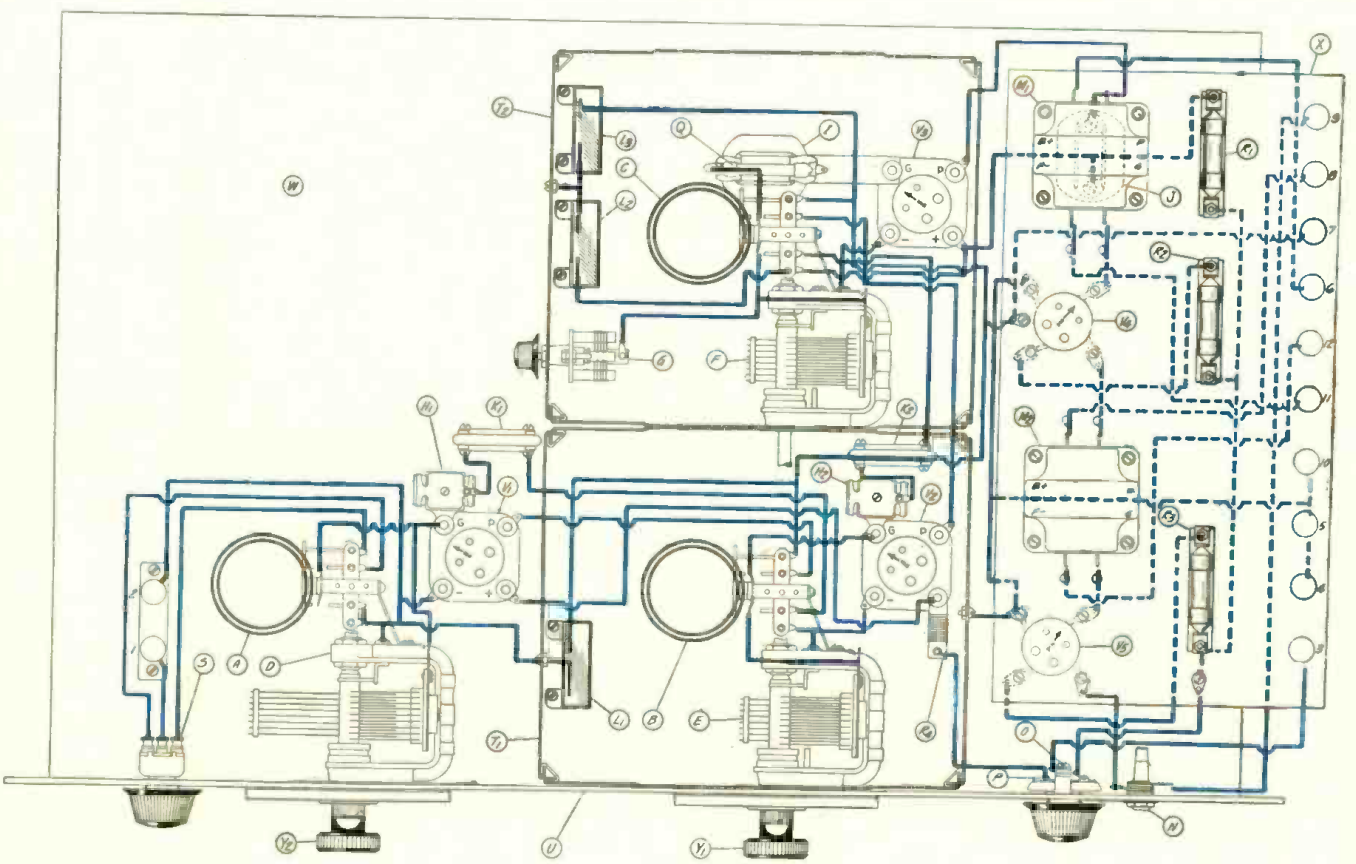


A VIEW OF THE RECEIVER FROM ABOVE

FIGURE 2: *This shows the general arrangement of the complete receiver, with the top portions of the two shields removed so that the parts mounted inside may be seen.*

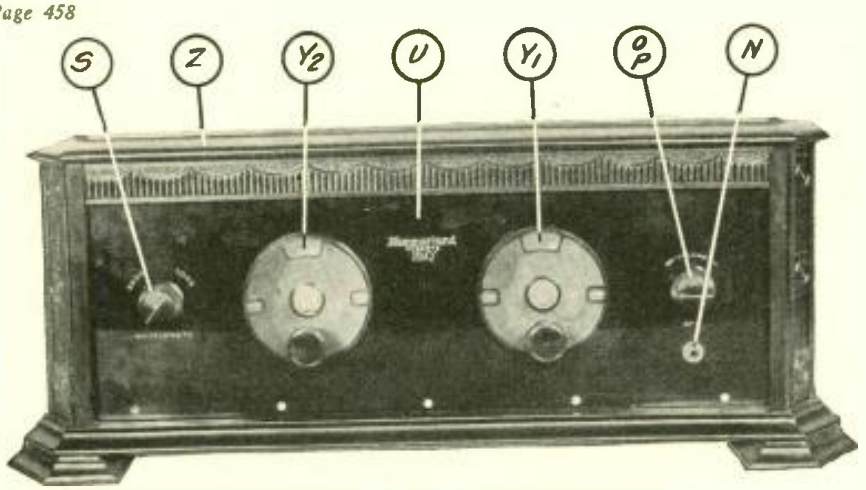
This variation of coupling is accomplished through an ingenious cam arrangement by means of which the primary coil is made to change its relationship to the secondary winding as the variable condenser is adjusted throughout its range. By the scientific design of the cam, the coupling of the coils is adjusted to the best point for each wavelength setting of the variable condenser on which the coil is mounted.

This automatic variation of coupling



THE PICTURE WIRING DIAGRAM

FIGURE 3: *In this drawing all of the parts that are mounted in vision are drawn in* BLACK *lines. The fixed condenser, J, shown in dotted* BLACK *lines at the upper right-hand corner of the diagram, is mounted underneath the first transformer. All of the wiring that is in view is shown in solid, heavy* BLUE *lines and the wiring beneath the low-frequency panel at the right is shown in dotted* BLUE *lines*



A FRONT VIEW OF THE HI-Q

FIGURE 4: *The various controls on the panel of the Hi-Q are marked with letters which correspond with the lists of parts given at the beginning of this article.*

provides a simple but efficient method of obtaining maximum amplification throughout the whole wavelength range.

Another feature that is worthy of mention is the method used to eliminate oscillation because of feedback through the vacuum valves. The primaries of the high-frequency transformers are wound in one direction, but are tapped so that it is possible to connect the circuits to produce neutralization of the vacuum valve capacities in tubes V1 and V2, and prevent the howling and radiation nuisance so common in ordinary tuned-high-frequency receivers. Stabilization is obtained by adjustment of the equalizer condensers, H1 and H2, shown schematically in Figure 1.

The designers were aware of the increased "kick" that could be obtained by the use of a regenerative detector but they knew too the regenerative detector's tendency to produce distortion through sideband cutting, a type of distortion that gives disagreeable results in the quality of tone obtained from the reproducer. The increased gain obtained in the high-frequency stages by the variable coupling more than offsets any loss that might be caused by not using a regenerative detector, without sacrificing quality of reproduction.

Efficient volume control from minimum to maximum without danger of operating the valves at more than their rated voltage, is obtained by the series combination of a 2-ohm fixed resistance, R4, and a 10-ohm rheostat, P. The fixed resistance makes it impossible to put the full 6 volts of the "A" battery across the filament terminals of the high-frequency valves. While a rheostat should not be used as a volume control in the detector or low-frequency stages, it provides an efficient volume control in the high-frequency filament circuits. Figure 1 shows the positions of these units in the circuit.

The high impedances of the primary windings of the low-frequency transformers selected for this circuit insure faithful reproduction of speech and musical tones. The helical winding used in the secondary windings reduces distributed capacity to a minimum and eliminates muffling effects so often obtained with transformers having high distributed capacities.

Complete shielding of the second high-frequency stage and the detector stage prevents intercoupling between the circuits and also reduces external pickup to a minimum; this provides exceptional selectivity. The first high-frequency stage may also be shielded if desired; however, this is not really necessary.

A UX-112 or a UX-171 type valve should be used in the last stage socket, V5, if really good volume and quality is desired, although it is possible to use an ordinary type of amplifier valve in this stage with good results. Either a UX-201-a or a UX-200-a type valve may be used in the detector stage socket, V3, although a UX-200-a type tube is more sensitive and will give better results on distant stations.

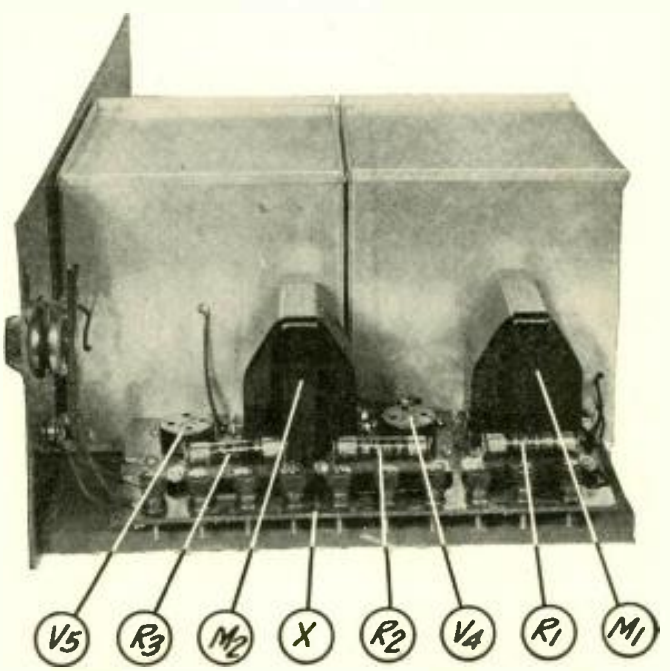
In mounting the parts and wiring the receiver, it is a good plan to mount all the parts and make all possible connections on the detector and low-frequency unit sub-panel before mounting it on the receiver baseboard. In this way the mounting of the parts and wiring will be much simplified.

Then mount the front panel on the edge of the baseboard. Next, mount the Auto-couple coils on the condensers. Mount variable condenser, D. Next, mount the other two variable condensers on a common shaft with the shield walls serving as a support between the two condensers. Place the bottoms of the shields in place on the baseboard and mount the two sockets in place.

Then, mount the other parts in their proper places, as shown in Figure 3, and proceed with the wiring. The sides of the shields should not be put in place until all the preliminary connections to terminals which will be difficult to get at later, are made. Figure 3 also gives the wiring scheme.

Use solder in making your con-

(*Continued on page 479*)



A VIEW OF THE SET FROM THE LOW-FREQUENCY END

FIGURE 5: *Here is shown the low-frequency amplifier in position at the side of the two box shields. The binding posts run along the edge.*

SOME OF THE EXTRAORDINARY

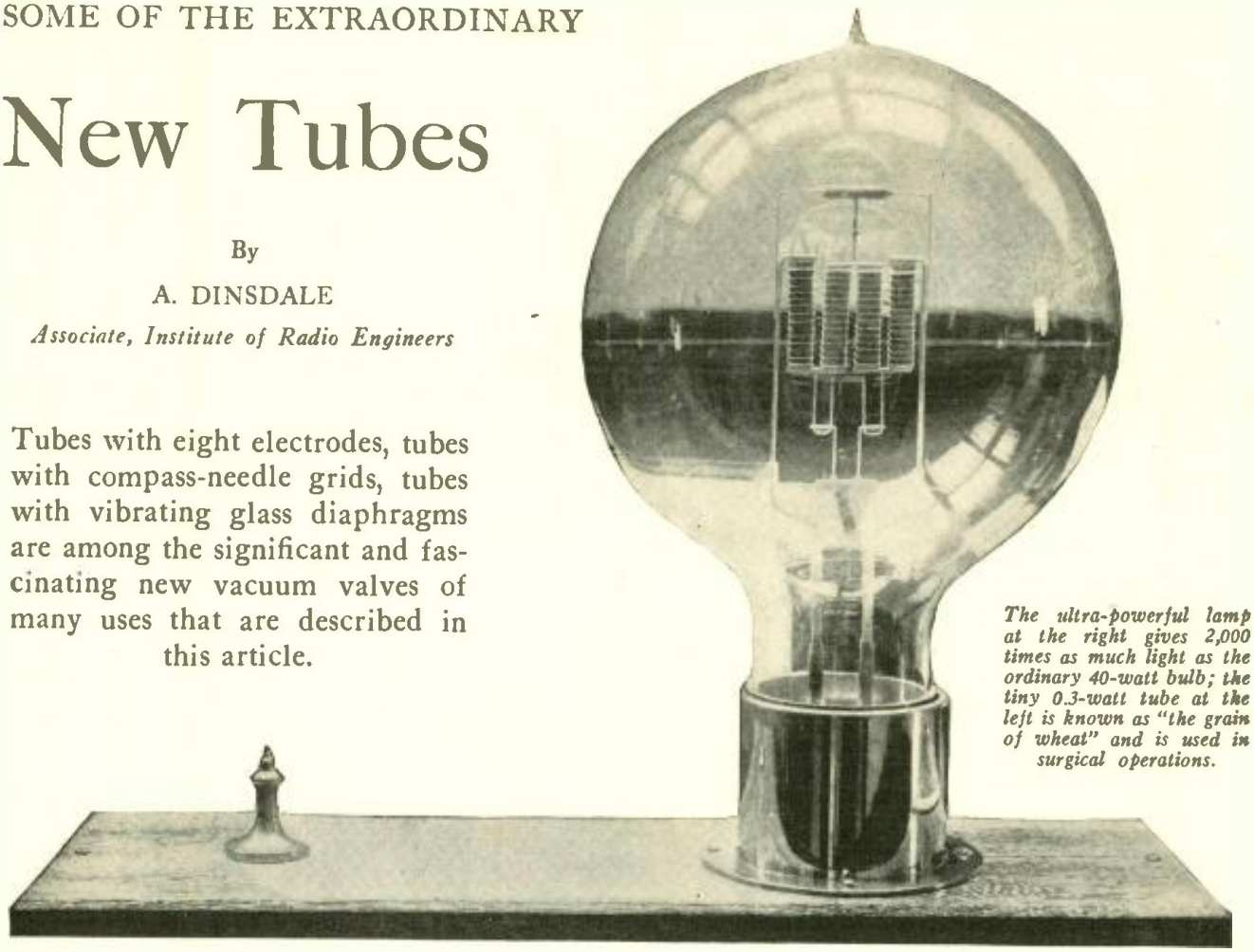
New Tubes

By

A. DINSDALE

Associate, Institute of Radio Engineers

Tubes with eight electrodes, tubes with compass-needle grids, tubes with vibrating glass diaphragms are among the significant and fascinating new vacuum valves of many uses that are described in this article.



The ultra-powerful lamp at the right gives 2,000 times as much light as the ordinary 40-watt bulb; the tiny 0.3-watt tube at the left is known as "the grain of wheat" and is used in surgical operations.

A READING of patent records is usually a dry proceeding—a necessary evil to be done with as quickly as possible.

But occasionally one comes across some novel and interesting invention. During the past few months particularly, some very curious designs of vacuum valves (or "thermionic valves" as they are more properly called) have made their appearance.

It has been said that there is no limit to the possibilities of the thermionic valve. In radio today these valves range from the miniature peanut tube, which amplifies only the most minute amount of electrical energy, up to great water-cooled or oil-cooled leviathans which are capable of handling 1,000 kilowatts each. Such giants, of course, are only used in the very largest transoceanic radiotelegraph stations.

Beyond the realms of radio, however, the thermionic valve is beginning to be used for a rapidly increasing variety of purposes; for many of these the ordinary valves are not suitable. For many special applications in radio, also, the ordinary valve is unfitted; in consequence there is an increasing demand for freaks for all sorts of special purposes.

At the present time there are scores of things that a vacuum valve can do besides making broadcasting audible to listeners in.

It can, for example, be used to control dynamos and similar electrical equipment, to regulate electric power systems, to actuate fire and burglar alarms and, in fact, to replace existing forms of relays of many varieties.

A Tube with Eight Electrodes

A few moments' consideration of some of the ingenious suggestions which have been made for improving the thermionic vacuum valve and extending its sphere of usefulness will indicate the lines upon which future developments may be expected. For instance:

Four-electrode vacuum valves are commonplace nowadays, but in Figure 1 we have a valve that has no less than eight electrodes!

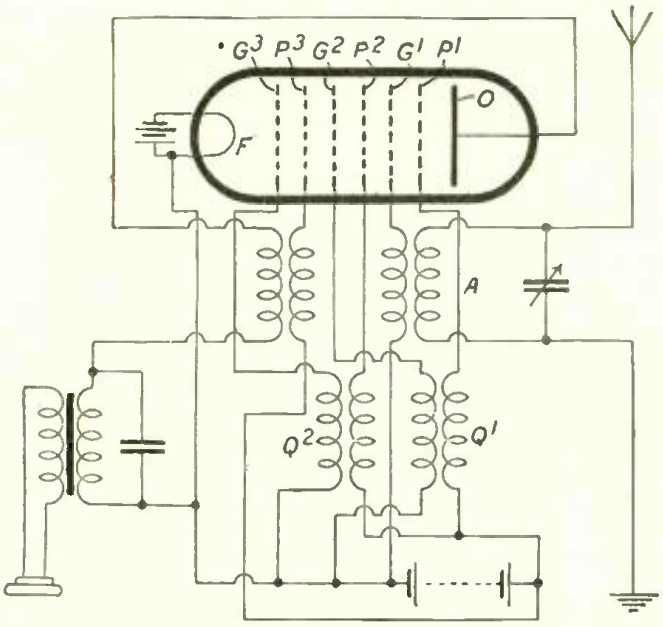
This extraordinary valve is the invention of Captain H. J. Round, the well-known British research engineer. Between the filament and plate of this extraordinary valve are placed six grids, three of which, G1, G2 and G3, are connected to the "B" battery negative as usual, while the other three, P1, P2 and P3, act as auxiliary plates, and are connected to "B" positive.

The input from the antenna is coupled at A to the grid, G1, and the amplified output from P1 is fed back through the transformer Q1 to the second grid, G2. The doubly-amplified output from P2 is then transferred, for a third stage of amplification, through the transformer, Q2, to the grid, G3. If the latter grid is suitably adjusted, by means of a potentiometer or grid-leak, rectification will also be effected, and the final output of P3 will be passed on to the low-frequency amplifying transformer.

As a contrast to this device, Figure 2 shows a form of valve fitted with a large number of separate plates, P. This valve is designed to act as an ultra-rapid interrupter, or switch.

The electron stream from the filament, F, is controlled by means of the two condenser plates, C and C1, which are charged from an oscillatory source of voltage. This oscillatory charging causes the electron stream to be swung rapidly across the series of insulated plates, P, in turn, thus energizing the different circuits to which they are connected.

This particular form of vacuum valve is employed in a method for determining the height of an airplane or the depth be-



A MULTIPLE GRID TUBE

FIGURE 1: *In this circuit, employing a special vacuum valve with six grids, a number of stages of high-frequency amplification are possible.*

low the surface of the ground of a mass of conducting material—such as mineral ores. In this method the time taken by an electromagnetic wave to reach the given object and to be reflected back again is measured, and as the time interval is necessarily extremely brief, some special form of interrupter, such as that shown, must be employed to open and close the transmission and reception circuits alternately at a high rate of speed.

A Tube for Controlling an Airplane

Figures 3 and 4 show apparatus, based on the thermionic vacuum valve principle, designed to automatically control airplanes or ships.

In this invention the basic principle is the use of a magnetic-compass needle as a grid of a special form of vacuum valve, so that any movement of the airplane or ship to one side or other of its appointed course will cause the compass-needle to swing towards either one plate or the other of the valve. This upsets the balance of the two plate currents, for, with the movement of the grid, more electrons will be enabled to reach one of the plates. This increased plate current is used to bring the airplane back automatically to its appointed course.

As shown in end section in Figure 3, the filament is directly above the moving compass-needle grid. Figure 4 shows this perhaps more clearly still. The two plates are mounted one on each side, and below, the swinging grid.

In the normal position, as set before the machine leaves the ground, the electron stream from the filament is shared equally by the two plates, P and P1, and equal currents therefore flow through the two electromagnets, M and M1, in the plate circuits.

If the airplane or ship deviates from her course to even a slight extent, the compass-needle grid, maintaining its fixed position in space, will move closer to one or the other of plates P or P1.

As the grid is given a positive bias by means of the tapping, T, the current through the nearest plate will increase, owing to the attraction on the electron stream exerted by the positive grid; this increased current will consequently flow through the windings of the corresponding electromagnet, M or M1. This is arranged automatically to operate the rudder and thus bring the airplane back on to her course.

A Vacuum Valve as a Microphone

Another somewhat similar application of the moving-grid principle is shown in Figure 5, which illustrates what might be called a "vibrating-grid microphone."

The upper surface of the ordinary glass bulb is flattened out as indicated at S, and it is sufficiently flexible to act as a diaphragm.

The grid, G, is flexibly mounted inside the bulb on a supporting arm, and is rigidly attached by a small pin to the center of the flattened glass diaphragm. This pin passes through a small hole in the center of the plate, P.

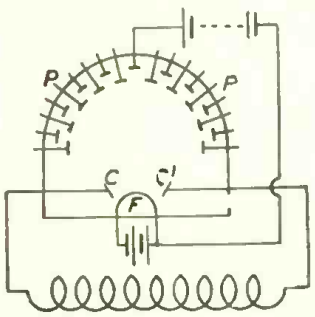
The entire device is supported and enclosed in an outer shield or mounting, M, constructed of cork or some other nonresonant substance, so as to protect the tube from outside mechanical disturbances.

The effect of speaking near the glass surface, S, is to cause the latter to vibrate in sympathy with the low-frequency sound waves in the air, exactly in the same fashion as an ordinary microphone operates.

The vibrations of the glass diaphragm are communicated to the movable grid, G, so that its relative distance from the plate and filament is varied accordingly. In turn this variation of distance varies the intensity of the plate current, causing microphonic variations which correspond to the applied speech waves.

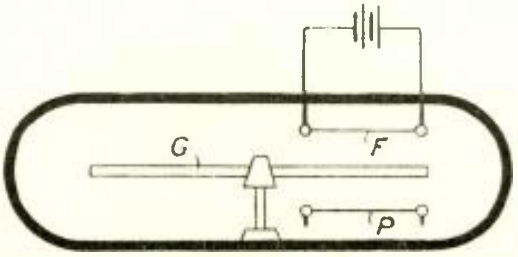
The varying output of this device may then be amplified and applied to a broadcast transmitter in the usual way.

(Continued on page 499)



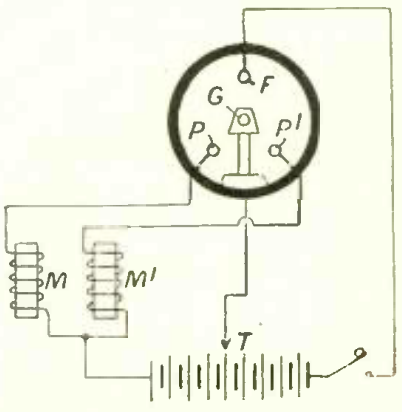
A MULTIPLE PLATE VALVE

FIGURE 2: *Another vacuum valve with multiple electrodes that has many interesting possibilities for experimenters.*



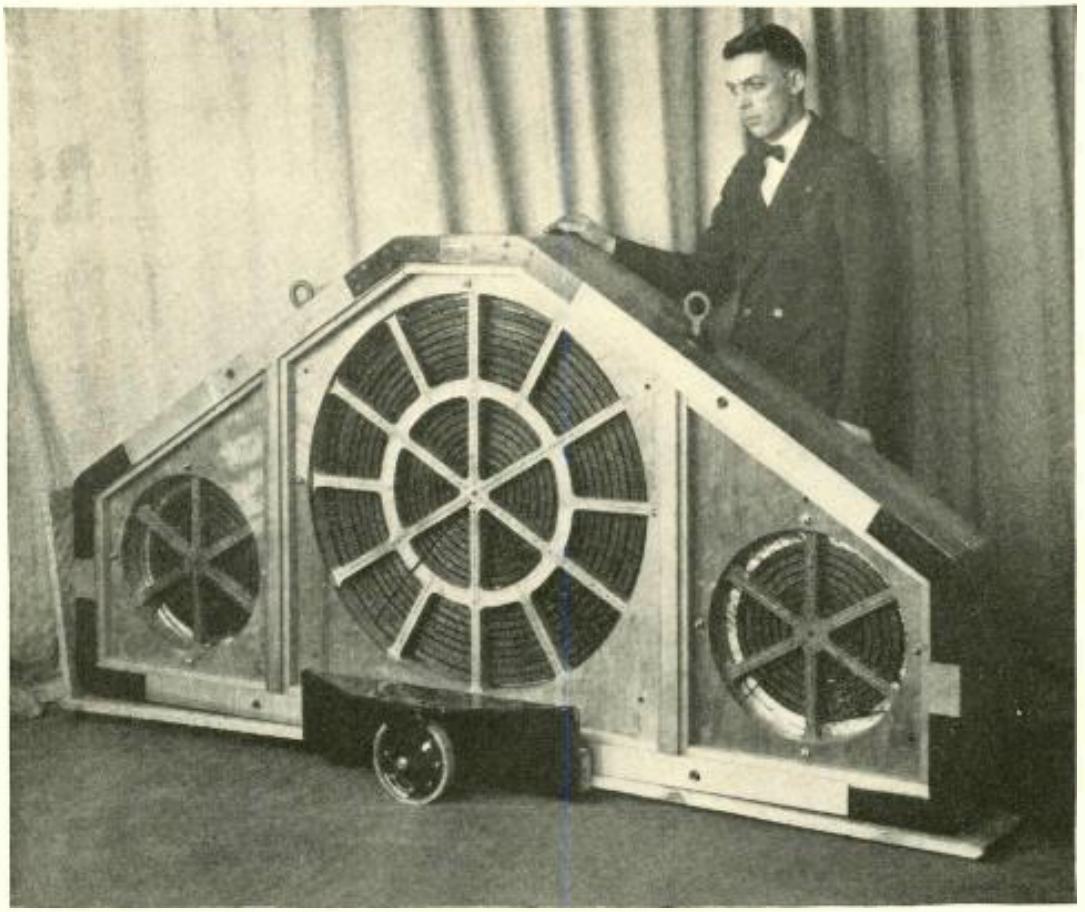
A TUBE FOR CONTROLLING AIRPLANES

FIGURE 3: *A still further development of the vacuum tube that has a movable compass-needle grid and two plates.*



A UNIQUE TUBE IN CIRCUIT

FIGURE 4: *This view of the tube shown in Figure 3 gives a more complete idea of the circuit.*



A NEW AND POWERFUL MULTIPLE LOUDSPEAKER

This new device, built on the Hewitt principle, consists of one large cone and two smaller ones and will cover the whole range of frequencies used in the reproduction of voice and music. It is powerful enough to supply radio programs to buildings as large as the new Madison Square Garden.

What's New *in* Radio

Conducted by

THE TECHNICAL STAFF

Inventors, experimenters, manufacturers and readers generally are invited to keep POPULAR RADIO informed of all new apparatus that is of their own creation or that comes to their attention; if the apparatus passes the tests of the POPULAR RADIO LABORATORY, it will be duly recorded in this Department.

Battery Connections May Be Safely and Simply Made with This Cable Equipment

Name of instrument: Battery cable and connector plug.

Description: This 5-foot cable, which bears the manufacturer's type No. 660, contains seven wires. These wires are coded and each is clearly labeled to indicate the battery terminal to which it is to be connected. The cable sheath terminates approximately two feet from one end of the wires; this provides ample slack to reach all of the battery terminals. The other end of the cable terminates in a bakelite socket. This socket has seven holes in one end, through which the pins of the plug portion of the connector project to make the seven individual contacts required in connecting the two halves of the connector together. The plug serves as a terminal for seven wires, which are to be connected to the various circuits in the receiver. These wires are also coded and labeled to correspond with the wires in the longer portion of the cable.

Usage: For connecting the batteries or power-packs to a receiver.

Outstanding features: All batteries can be instantly disconnected from the receiver by pulling the plug out of the socket. In connecting up batteries to the cable, if the plug is removed from the socket, there is no possibility of short-circuits resulting from loose ends of wires flopping around. The socket end of the cable (which is the "live" end) is completely encased in the socket; this further eliminates the chance of short-circuits. All wires are clearly labeled with stamped metal markers. The over-all length of the cable, when the plug is in the socket, is 6 feet. Each of the wires is well insulated and, except at the ends, all the wires are tightly bound in a cotton sheathing.

Maker: Yaxley Manufacturing Co.

P. & A. Photos

Grandfather Can Tune in With This Receiver

Concealed in this grandfather's clock is a complete five-tube receiving set. Note the two-dial control and the loudspeaker located just under the face of the clock. This clock was one of the displays at a manufacturers' exhibit near London.

An Instrument That Prolongs Tube Life

Name of instrument: Vacuum-valve rejuvenator.

Description: This device contains a step-down transformer and the necessary resistance units. These are completely enclosed in a metal case which is equipped with an extension cord and plug for insertion into an AC lamp socket. Binding posts are provided for making connections to the receiver and there is a switch on the front of the case that controls the voltage applied to the vacuum valves during the rejuvenating process. The tubes to be rejuvenated are left in their sockets in the receiver and are all put through the process at the same time. If they are of the 5-volt type, one pair of binding posts on the case of the rejuvenator is connected to the "A" battery binding post on the receiver, after the "A" battery has been disconnected. If the receiver employs 3-volt valves, connections are made the same way except that there is a separate pair of binding posts on the rejuvenator to provide the proper voltage for these valves.

Usage: To increase the electron emission of vacuum valve filament after it has become depleted, due to long use or the application of excessive filament voltage. This device may be used to rejuvenate only those valves that contain thoriated filaments. These include the UX-201-a, UX-200-a, UX-171 and UX-199 types of valves.

Outstanding features: Several valves may be rejuvenated at one time. Sturdy construction. Well made electrically. Simple to operate. Completely enclosed.

Maker: Jefferson Electric Mfg. Co.

A High-efficiency High-frequency Transformer

Name of instrument: "Duoformer" high-frequency transformer.

Description: The winding of this transformer is of the double-coil, semi-torodial type. Each coil is wound on a ribbed form, with the insulating material between ribs cut out except for a distance of ¼ inch from the top of the form. There the coil form is left in the form of a ring to provide a rigid support for the rib construction. The result of this arrangement is a highly efficient coil, with low losses. The primary winding is on a composition tube which is placed inside of the larger coils. The four terminals of the transformer are located at the bottom of the instrument, right at the ends of the secondary windings. This makes for short leads inside of the coil, and also facilitates the external circuit wiring. The two coils are held rigidly together by a metal connector at the top and by two composition strips at the bottom.

Usage: As the coupling device between the high-frequency amplifier valves in a receiver which makes use of one or more stages of this type of amplification.

Outstanding features: High efficiency. Small size. Well designed. Easy to wire up in a receiver.

Maker: Camfield Radio Mfg. Co.

A Handy Unit for High-Voltage Power-Packs and Power Amplifiers

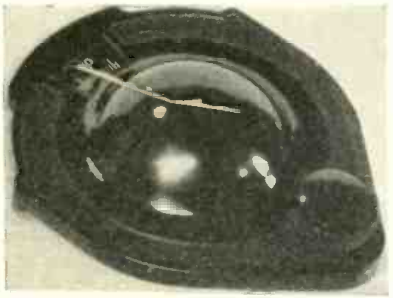
Name of instrument: Power "compact," type R-210.

Description: This instrument contains a power transformer to supply the high voltage and also the filament voltages required for rectifier and power amplifier valves of the UX-216-B and the UX-210 types. It also includes two filter-choke coils and two buffer condensers. All of this apparatus is enclosed in a metal case, which is filled with an insulating compound. Many of the connections ordinarily required in a power-pack are already made inside of this case. The necessary terminals are provided in the form of binding posts on two sides and top of the unit. A 6-foot extension cord and plug is also provided for connection to the 110-volt, 60-cycle supply line. Special units may be obtained from the manufacturer where the line frequency is not the standard 60-cycle supply.

Usage: This unit provides the power foundation unit for a high-voltage "B" power-pack to supply sufficiently high voltage for the operation of a UX-210-type power-amplifier valve and also to supply the filament voltages for this valve and the rectifier valve.

Outstanding features: Takes the place of six of the units ordinarily used in a power-pack which supplies the high voltage as well as the low AC voltage for the filaments of the power-amplifier and rectifier valves. Saves much space and simplifies construction as many of the necessary connections are already within the unit. Neat in appearance. All parts are thoroughly insulated. Terminals are conveniently placed and are plainly marked, thereby eliminating any possibility of making a wrong connection.

Makers: Thordarson Electric Mfg Co.



This Vernier Dial Is Easy to Install

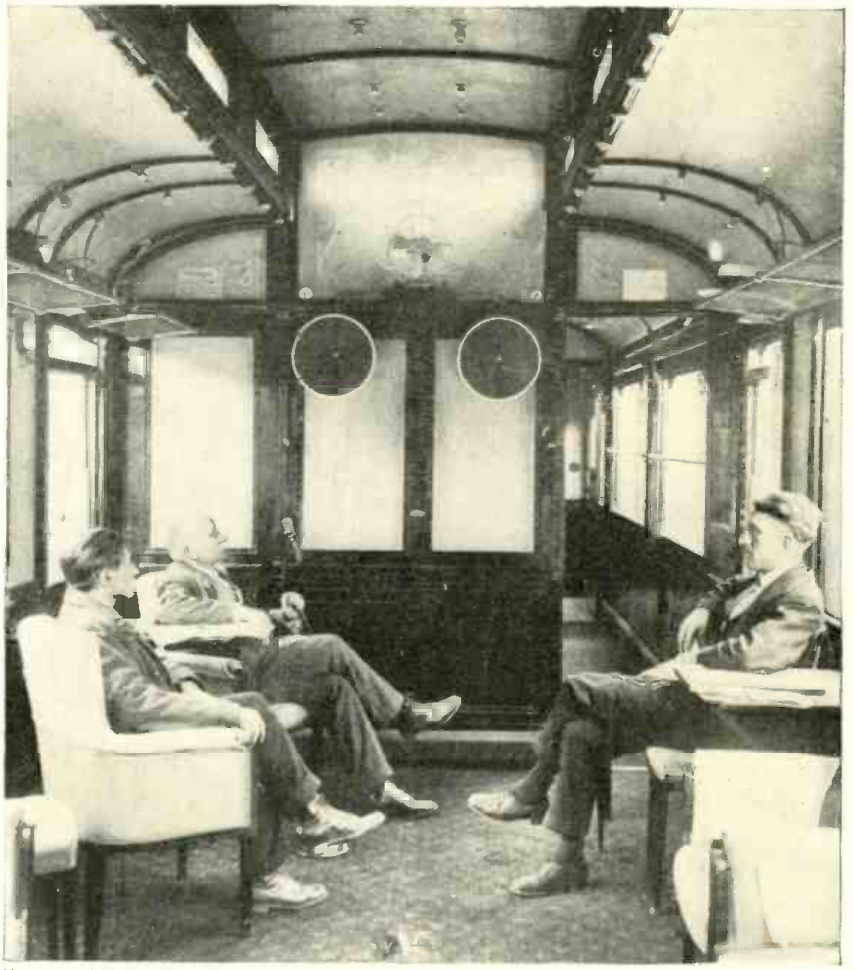
Name of instrument: Vernier dial.

Description: This unit consists of a flat composition dial that may be attached to the shaft of the instrument which it is to control. Over this dial is placed an artistic shield which completely hides the dial, except for a small sector of the calibrated scale which is visible through the indicator window of the composition shield. Mounting of the shield on the panel is accomplished by means of two small holes which must be drilled through the panel to accommodate two screws that are fastened in the back of the shield. The shield is then made fast by nuts placed on these screws from the back of the panel. The control knob is attached to the composition shield and operates a split bushing, which makes contact with the edge of the inner dial and thus provides a mechanical coupling. The coupling has a ratio of approximately 14 to 1.

Usage: As a vernier tuning control for use in conjunction with tuning instruments in a radio receiver.

Outstanding features: Easily installed. Good vernier action. No set-screws used. Neat appearance. Conceals shaft end. May be obtained with several different types of calibration to fit different instruments.

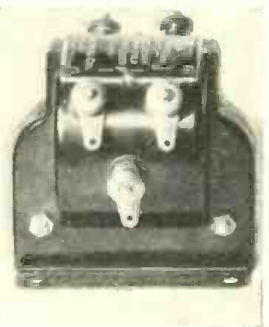
Maker: Kurz-Kasch Co.



Underwood & Underwood

RADIO ENTERTAINMENT FOR PASSENGERS

The latest addition to the list of radio-equipped passenger trains is the Paris-Orleans express in France; the installation of loudspeakers in the smoking room is shown above. The next step presumably will be the installation of individual receiving sets with headphones at each chair, so that each passenger may enjoy privately the program which he likes most.



Transformers That Supply Large Volume Without Overloading Valves

Name of instrument: Power amplifying (push-pull) transformers.

Description: In these transformers the windings and cores are completely enclosed in metal cases with the terminal binding posts mounted on the cases by means of insulating bushings. One winding of each of the transformers is center-tapped to divide the signal voltage between the two vacuum valves used.

Usage: In the last low-frequency amplifying stage of a receiver to prevent overloading by dividing the work to be accomplished in this stage between two valves. Under certain conditions a pair of these transformers in conjunction with two valves may be used as a third transformer-coupled, low-frequency stage to provide great amplification; no more than two stages of this type of amplification can ordinarily be used.

Outstanding features: Neat in appearance. Terminals conveniently located. Helps to prevent overloading in the last low-frequency amplifier stage.

Maker: All-American Mfg. Co.

A New Cabinet for the Home Set Builder

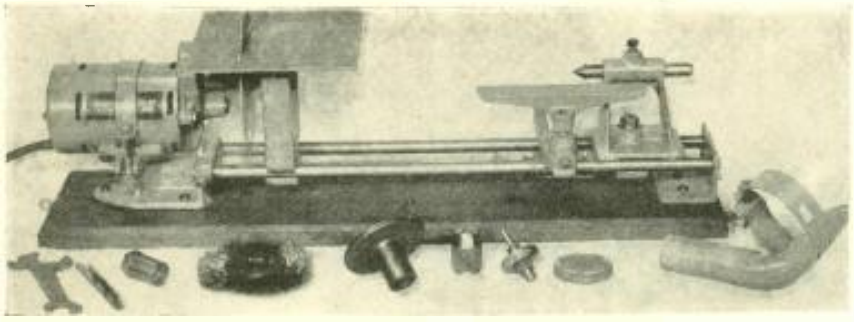
Name of instrument: Radio cabinet.

Description: This cabinet is constructed of solid mahogany in a conservative design; it contains a compartment for the receiving set and a separate compartment at the left end for a reproducer unit. The workmanship is exceptionally good and the finish is all that could be desired.

Usage: As a cabinet for containing radio receiving apparatus.

Outstanding features: Good design. Well finished. Conservative appearance.

Maker: Detroit Woodcraft Corp.



This Machine Tool Will Take the Drudgery Out of Your Radio Construction Work

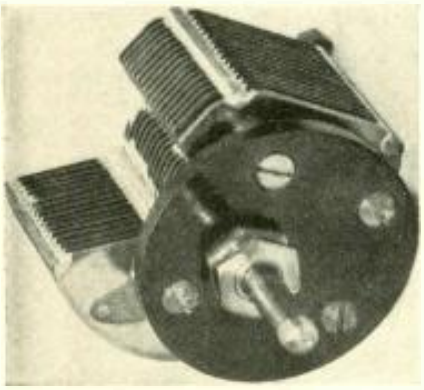
Name of instrument: Combination machine tool.

Description: This tool consists of an electric motor, a wood base, a support for the attachment of various auxiliary parts, and a complete set of machine tools. All of the tools are well made and the combined device is small enough to use in any home workshop. The motor is easily detached from the baseboard and is equipped with a handle for portable use. The outfit is shown above with the circular saw and saw-table attached, ready to be used for cutting wood, hard rubber or bakelite. By simple adjustments the machine may be converted into a lathe, an electric drill, a grinder or a polisher. Numerous other uses will suggest themselves to the experimenter.

Usage: This device provides facilities for cutting and drilling panels, baseboards and cabinets, for cutting and shaping small parts of wood, rubber or composition, and for small lathe-work or grinding and polishing.

Outstanding features: Well constructed of good materials. Good design. Adapted to many uses. Eliminates the tedious manual work involved in radio or other small construction work. Other auxiliary devices are made to go with this foundation unit and motor.

Maker: Electro Magnetic Tool Co.



A Fine Condenser for Use Where Space Is Limited

Name of instrument: Variable condenser.

Description: The stator plates are first assembled in a unit by means of slotted rods and solder, which provide rigid spacing and secure suspension. The rotor plates are also assembled in a similar manner and make use of four slotted rods into which the plates are soldered. The stator section is mounted on a round piece of composition insulating material and the bearing for the rotor is also mounted on this same block. The bearing is sufficiently heavy to eliminate the necessity of a second bearing at the rear end of the rotor shaft. A spring contact is provided to the rotor section.

Usage: For any purpose where a variable capacity is required, particularly in the tuned circuits of receivers.

Outstanding features: Extremely small size. Carefully assembled. Rigidly made. Well insulated. Provides an adjustment whereby the maximum capacity may be slightly altered to exactly match the capacity of other condensers, which may be ganged together.

Maker: Armo Radio Laboratories.

An Instrument That Will Automatically Turn a Radio Receiver "On" or "Off"

Name of instrument: Time switch.

Description: This unit consists of a small 8-day clock and a switching mechanism. Provision is made for mounting the clock directly on the panel of a radio receiver while the switching mechanism is mounted behind the panel and is connected to the clock by means of a shaft provided with the instrument. A warning buzzer is also included. The device will start a receiver at any predetermined hour. This is accomplished by setting the clock in the same way that an alarm clock is set; at the specified time the automatic switch closes the "A" battery circuit of the receiver, and, assuming that the receiver has been tuned in advance to the desired station the program will at once be heard. The receiver will continue in operation for one hour, at the end of which time it will be turned off automatically. Or, during that hour the clock may be set to turn the receiver off at any desired time. Thus, if it is desired to hear the dinner music from a certain station beginning at 6 P. M., the clock may be set for this hour at any time during the day. After the receiver has been turned on at 6 o'clock, the clock may be reset for a later hour, and at this time the control switch will automatically turn off the receiver.

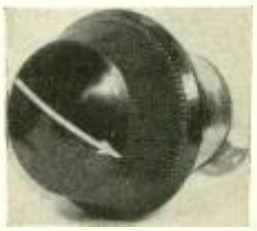
The clock may also be set to ring a warning buzzer at a predetermined hour in case it is desired to tune in some other program at a certain time, or for anything else that requires a reminder at a specified time.

In addition to its use on a radio receiver, the time switch may be used to start a phonograph, to start an electrically controlled furnace and for many other uses, which involve the automatic turning "on" or "off" of electrical current.

Usage: (Covered in the description given above.)

Outstanding features: Makes the operation of a radio receiver semi-automatic. Compact in size (the clock being about the size of an ordinary pocket watch). May be mounted in the receiver or separately. Contains a buzzer warning device.

Maker: Ushichiro Tokumi.



A Switch That Provides a Simple Control of Selectivity

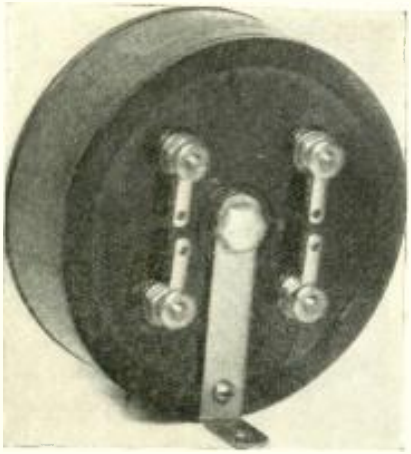
Name of instrument: Antenna switch.

Description: This is a small, single-pole, double-throw switch that may be attached to the panel of a receiver by means of a single-hole mounting. The contact members of the switch are enclosed in a metal shell with a composition back upon which the three terminal connectors are mounted. The space required behind the panel measures 1 inch by ⅞-inch and the unit is equipped with a 1½-inch engraved bakelite knob.

Usage: In a receiver that has two antenna connector terminals (for short and long antennas). This switch may be installed to permit the operator to make an instantaneous change of the antenna from one of these connectors to the other.

Outstanding features: Simple, fool-proof construction. Small size. Positive action. Single-hole mounting.

Maker: Carter Radio Co.



Good Long-Wave Transformers for That New Superheterodyne

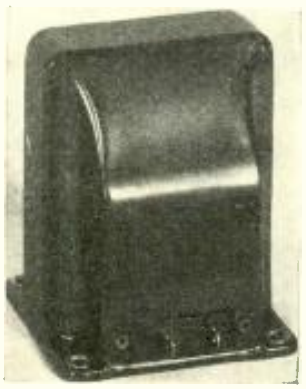
Name of instrument: Victoreen long-wave coupling transformers.

Description: These transformers are of the air-core type and are wound on a 2-inch form. They are of the "fixed tune" type and each transformer is sharply tuned by means of a small semi-variable condenser adjusted and sealed at the factory. The transformers are completely inclosed in round composition cases with the terminals mounted on one side, in a position that makes wiring easy. These terminals are binding posts and are equipped with soldering lugs. Each transformer is supplied with a metal mounting bracket for fastening to the baseboard of a receiver. In addition to the coupling transformers, an antenna coupler and an oscillator coupler are made in the same form to provide a complete kit of couplers for this type of receiver.

Usage: As the coupling units in a superheterodyne receiver.

Outstanding features: Neat in appearance. Sharply tuned and carefully matched. Easy to mount and to wire.

Maker: The George W. Walker Co.



A High-grade, Audio-Frequency Amplifier Coupling Unit

Name of instrument: Dual impedance unit.

Description: This dual impedance is entirely enclosed in a neat metal case with a flanged base, in which are provided the necessary screw holes for mounting the instruments. The four terminals project through the steel case and are mounted on composition insulating strips.

Usage: As a coupling unit in a double-impedance audio-frequency amplifier.

Outstanding features: Rigid construction. Convenient arrangement of terminals. Neat appearance. Compact. Excellent quality of reproduction when used in conjunction with standard vacuum types.

Makers: Samson Electric Co.

A Fixed Condenser That Will Withstand High Voltages

Name of instrument: Filter condenser.

Description: This condenser is hermetically sealed in a metal container to exclude moisture or other elements which might decrease the effectiveness of the unit. The two terminals are brought out at the top of the condenser in the form of soldering lugs. The particular unit pictured herewith has a capacity of 4 microfarads and may be safely used in circuits where the direct-current voltage does not exceed 600 volts or the alternating current, 40 volts.

Usage: As a capacity unit in any circuit where high voltages, either AC or DC are present. Such for instance, as the filter circuit of a power-pack used to supply high voltage for the operation of a UX-210 type tube.

Outstanding features: Compact in size and convenient in form. Carefully assembled. Clearly marked as to capacity and voltage ratings.

Maker: Dubilier Condenser & Radio Corp.

A Device That Makes a Test of Valves

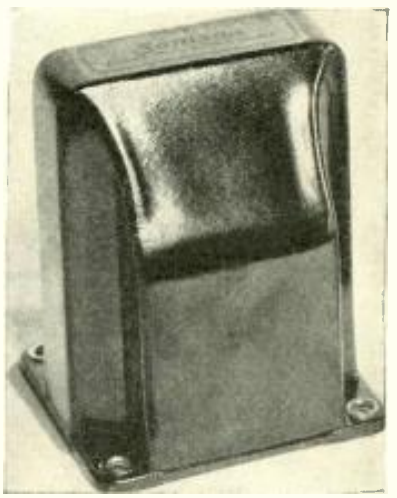
Name of instrument: Tube Tester.

Description: This unit, known as the Sterling R-408 Universal tube tester, is mounted in a metal case, finished in green crackle. The necessary switches, meters and the valve-socket are on the outside of the case. It is equipped with a 2-foot extension cord and a plug. To test a vacuum valve, this plug is inserted in one of the sockets of any receiver which is in operation. The tube which is to be tested is plugged into the socket on the tester. By manipulation of the various switches on the valve tester, in accordance with printed instructions which come with the instrument, the various characteristics of the valve under test may be easily determined. The meters show the filament and plate voltages and also the plate current. One of the most important features of the device is the fact that the plate current reading may be taken with both negative and positive grid biasing. The printed instructions provide all the necessary data to enable the owner of this instrument to properly interpret the readings obtained in the test of any tube.

Usage: To determine the characteristics and quality of any standard three or five-volt vacuum valve.

Outstanding features: Provides all data necessary in determining the characteristics of standard tubes. Operating voltages are obtained by plugging this instrument into a socket of any receiver; thus extra batteries are not required and tests can be made under actual working conditions.

Maker: Sterling Mfg. Co.



An Efficient Unit for the Impedance-Coupled Amplifier

Name of instrument: Low-frequency plate impedance.

Description: This is a well-made unit and is completely inclosed in a black metal case of neat appearance. It has two terminals at one side near the bottom of the instrument. These are in the form of soldering lugs and are mounted on insulated insert in the metal case; mounting holes are provided at the four corners of the flanged base.

Usage: As a plate coupling unit in an impedance-coupled amplifier.

Outstanding features: Adequate inductance. Neat housing. Electrically efficient.

Maker: Samson Electric Co.

A Moderate-Priced Receiver for Power or Battery Operation

Name of instrument: "Scout" Radio Receiver, type No. 60.

Description: This receiver employs five vacuum valves in two stages of high-frequency amplification, a detector stage and two stages of transformer-coupled, low-frequency amplification.

There are two tuning controls on the front panel; these actuate gold pointers that move over scales engraved directly on the panel. The scales are calibrated in wavelengths. One tuning control operates a dual condenser, which tunes the second high-frequency stage and the detector at the same time; for extremely fine tuning an auxiliary condenser, operated by the lower left-hand knob on the panel, is provided to keep these two circuits in exact balance. The second tuning control operates the condenser which tunes the input or antenna circuit. The filament voltage of all valves is controlled by the rheostat located in the lower, right-hand corner of the panel. The receiver is turned "off and on" by means of a toggle switch located in the lower center of the panel.

Provision is made for the use of either a UX-201-a, a UX-112 or a UX-171 type valve in the last low-frequency stage. Any desired "B" voltages up to 200 volts may be applied to this stage without harm to the loudspeaker, as an output transformer has been included in the receiver. Provision is also made for the use of either a UX-201-a or a UX-200-a type valve as the detector. Flexible leads are supplied for connections to the batteries; and compartments are provided in the cabinet to accommodate two 45-volt "B" batteries (or a "B" power-pack) and the necessary "C" battery.

The receiver is inclosed in a two-tone walnut cabinet of pleasing appearance and proportions. The panel is of metal but is also finished in two-tone wood graining to match the cabinet. The entire receiver unit is mounted on this panel and is entirely exposed to view by opening the panel outwards. The latter is binged at the bottom and is provided with a latch at the top to lock it when in the normal closed position.

Usage: For the reception of radio broadcasting.

Outstanding features: Neat appearance. Two-knob control. Easy to operate. Adapted for use of either batteries or power-packs. Equipped for use of power tube. Good volume. Good quality of reproduction.

Maker: Sleeper Radio & Mfg. Corp.

A Valve Tester that Provides a Positive Check on Tube Quality

Name of instrument: Universal valve tester.

Description: This instrument, designated by the manufacturer as "Universal Tube Tester, No. 290," consists of a universal valve socket that will accommodate any valve equipped with a standard base, a milliammeter which serves as a plate-current indicator and a push-button switch. These are mounted in a metal container as illustrated. There is also an extension cord, with a plug on the far end. In checking valves this plug is inserted in the valve socket of the first low-frequency stage of a receiver, thus obtaining the operating voltages direct from the batteries used in operating the receiver and eliminating the necessity for separate batteries and complicated battery connections. To test a valve, the tester is plugged into the receiver socket, as described, and the valve to be tested is inserted in the socket provided in the tester. With the receiver turned on, a reading is taken on the meter which is located on the top surface of the tester. Then another reading is taken with the switch button pushed down. The difference between these two readings indicates the quality of the valve under test. By comparing this difference in readings with the table given in the instructions which accompany the tester, the quality of the valve under test may be determined at once, without any knowledge of radio or mathematics on the part of the user of the instrument.

Usage: To enable the set owner to check his valves to determine their operating qualities.

Outstanding features: Simple to use. Requires no knowledge of vacuum-valve characteristics or theory, on the part of the user. Does not require the use of separate batteries. May be put into operation and a valve may be tested in a fraction of a minute. May be used for testing any valves which employ a standard UX-type base.

Maker: Jefferson Electric Mfg. Co.

This Kit Contains All Accessories for a First-class Outdoor Antenna

Name of instrument: "Gold Label" antenna kit, No. 270.

Description: This kit consists of 100 feet of hard-drawn, enameled-copper antenna wire; 50 feet of No. 14 rubber-and-cotton covered, lead-in wire; 25 feet of No. 18 cotton-covered, flexible wire; one Underwriter-approved lightning arrester; 2 glass antenna insulators; 4 porcelain lead-in insulators; one 8-inch porcelain lead-in tube; 1 insulated lead-in strip; 2 copper ground clamps, and all other necessary hardware, such as screws, nails, screw-eyes and insulated staples.

Usage: For the installation of a complete antenna-ground system for radio reception.

Outstanding features: Complete, nothing additional to buy. All parts are of first-class material.

Maker: Swan-Haverstick, Inc.

A Heavy Rubber Ring that Prevents Microphonic Howling in Vacuum Tubes

Name of instrument: Vibration repressor for vacuum valves.

Description: This repressor is a soft-rubber ring approximately one inch in height and large enough to fit snugly around a standard 5-volt vacuum valve. The rubber has plenty of strength to hold it firmly in position on the valve.

Usage: To be slipped down over the top of any standard UX-201-a type or similar sized vacuum valve, to repress external vibration of the valve and tbus eliminate the howls that frequently result when the reproducer is placed too close to a receiver.

Outstanding features: Neat appearance. Installed in an instant. Provides good repressor action.

Maker: Premier Radio Corp.

This Unit Replaces Jacks and the Battery Switches

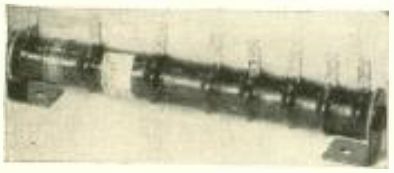
Name of instrument: Multi-stage jack and filament switch.

Description: This unit consists of an insulated case that contains the spring contacts for the switch and jacks with their terminals brought to the outside by means of small binding posts and soldering lugs. It is designed for single-hole, panel mounting and is controlled by a small knob attached to the end of the shaft which projects through the panel. There are three operating positions of this knob. When set at "off" the "A" supply is disconnected from the receiver. When set at position No. 1, the reproducer is automatically connected to the output of the first low-frequency amplifier stage, and the valve filaments of all except the second low-frequency stage are connected to the "A" battery. When set in position No. 2 the reproducer is connected to the output of the second low-frequency stage and the filaments of all valves are lighted. There is a hole through the center of the control knob into which the reproducer or headphones are plugged.

Usage: To combine the battery switch and two filament-control jacks in a single unit in a receiving set.

Outstanding features: Saves panel space. Simplifies wiring of receiver. The reproducer may be connected to either the first or second low-frequency amplifier stages by a single turn of the knob. When the last low-frequency stage is not in use its filament is automatically disconnected from the "A" battery circuit, thus eliminating current waste.

Maker: Rono Manufacturing Co.



This Unit Eliminates the Variable Adjustments in "B" Power-Packs

Name of instrument: "B" and "C" power-pack resistor.

Description: A fixed resistance unit made for the Raytheon type of "B" and "C" power-pack which is tapped at seven points to provide seven different voltage values. The unit is made up of special resistance wire, wound on a tube of material similar to porcelain. The whole unit is covered with a heavy coat of vitreous enamel which is baked on by a heat process. The resistance remains practically constant regardless of the heating effect of heavy currents. The entire resistance unit is mounted on a pair of feet to facilitate attachment to a baseboard, and all terminals are in the form of soldering lugs. The resistance values of the various sections of the unit are clearly stamped on these lugs.

Usage: As the output resistor in any "B" or "C" power-pack where the DC output voltage does not exceed 250 or the current does not exceed 90 milliamperes. The various taps will provide any standard voltages that may be required in the operation of a receiver.

Outstanding features: Excellent materials used. Good, sturdy design. Compact in size. Meets the requirements of any power-pack which uses a gaseous type or a filament type of rectifier valve.

Maker: Ward-Leonard Electric Company.

A Connector That Eliminates Loose Battery Connections

Name of instrument: Battery cable connector.

Description: This connector consists of two parts; one is mounted inside of the receiver by means of a metal bracket that is provided on the instrument. The wires in the receiver that ordinarily lead to the binding posts are then connected to the soldering lug terminals of the connector. The terminals of the other part of the connector are connected to the cable from the batteries. To connect the batteries to the receiver the body of the connector is snapped over the other part. The connections are made within by means of five pairs of spring contacts; these insure good electrical contact. The connector is made of moulded, insulating composition; the contacts are of a metal which provides plenty of "spring" and at the same time makes a good electrical connection.

Usage: For connecting the battery cable to the receiver. It will serve in place of binding posts in the receiver, or it may be installed in a receiver which already is equipped with binding-post terminals.

Outstanding features: Convenient size. Easily mounted and connected. Good insulation. Good contact. Batteries may be instantly disconnected from receiver.

Maker: Beaver Machine & Tool Co., Inc.

Handy Hardware for the Radio Fan

Name of instrument: Radio hardware.

Description: The parts shown in the accompanying illustration should satisfy almost every need for small parts. They consist of metal angles and brackets of numerous shapes and sizes, soldering lugs of various types and UX type valve-prong contacts for use where it is desired to have the valve-prong extend through a sub-panel to make contact underneath. Marker plates are also included. These may be attached to battery wires and terminals and are clearly labeled A—, A+, etc.

Usage: As small hardware for the radio set constructor or experimenter.

Outstanding features: Extensive variety of parts and fittings. Well made. Materials used are admirably adapted to the purpose of the various parts.

Maker: American Radio Hardware Co.

A Compact Condenser Block for Use in Power-Packs

Name of instrument: Power-pack condenser block.

Description: This unit is well constructed and neatly enclosed in a metal container, which is provided with mounting flanges on the bottom and an insulated terminal strip also conveniently located close to the bottom of the instrument. This unit contains five condensers, all that are needed for the filter of a power-pack that makes use of a Raytheon or UX-213 type of rectifier valve. The terminal panel is clearly marked as to the capacity available at the terminals.

Usage: As a complete capacity unit in the filter of a power-pack.

Outstanding features: Easily installed. Compact. Completely enclosed.

Maker: Tobe Deutschmann Co.

LISTENING IN

PRACTICAL *pointers from experimenters and broadcast listeners. What helpful hints can* YOU *offer to your fellow fan? Readers are invited to address their letters to the Editor of this Department.*

CONDUCTED BY DAVID LAY

A DX Fan in Mid-Atlantic

ON my recent trip across the Atlantic, I had a chance that few fans get—to try radio reception from mid-ocean. Here is the story of my try and the stations I heard.

The R. M. S. *Ascania* left Southampton docks on the afternoon of Saturday, November 6th; as soon as she was under way I set up my receiver, a seven-valve superheterodyne (see Figures 1 and 2), in a state-room on one of the lower decks.

This location, however, proved to be useless using only the loop, owing to the excessive blanketing caused by the steel structure of the ship.

In order to overcome this difficulty, a 20-foot length of wire was weighted and thrown out of the porthole; the near end was wrapped loosely around the loop.

An enormous difference was noticed and a number of European stations were received at full loudspeaker strength using only one of the two low-frequency valves. Stations heard included Bournemouth, London, Cardiff, Newcastle, Dublin, Frankfort-on-Main, Hamburg, Berlin (Voxhaus), Prague and numerous other stations which were not identified.

These stations were heard on Sunday and Monday evening with only slightly diminished volume, although on Monday evening the ship was about 600 miles out.

On Tuesday, November 9th, the instrument was moved to the upper deck. Much better results were then obtained, although, in this case, only the loop was used. The stations mentioned above were received at full loudspeaker strength together with the Leeds, Nottingham and Liverpool relay stations which were duly checked by their call letters. The Spanish stations situated at Barcelona, Madrid and San Sebastian came through when the seventh valve was switched in.

At 3.00 GMT on November 10th the first American transmission began to come through. Two stations were heard at moderate loudspeaker strength using seven valves. These stations proved to be WGY, at Schenectady, N. Y., and WGBS, a 500-watt station in New York City. At this time we were about 1,600 miles from England, just over the half distance.

Later in the day the European stations were again received.

At 22.45 GMT 2LO London was still overloading the reproducer, as also were 2ZY and Madrid (Union Radio).

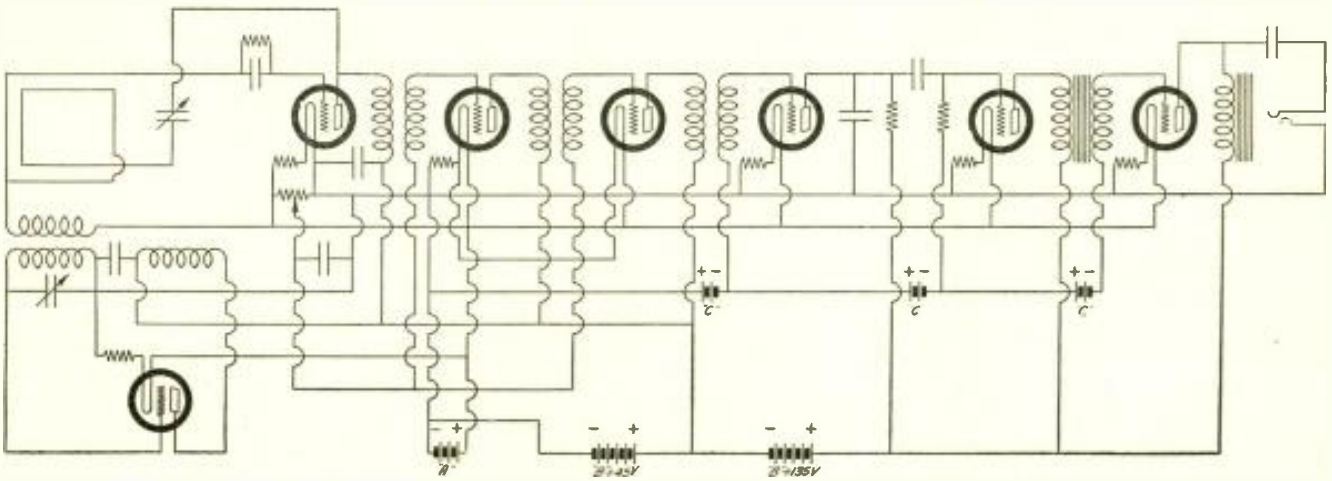
An hour or so later, commencing at 1.10 GMT November 11, the American stations were heard again, but now with enormous volume. WGY, WJZ, WEAF, WBZ and numerous other broadcasters provided the small group of listeners with varied programs.

During the whole day of the 11th transmissions were being received from 2LO (2,000 miles away), 5SC and 2ZY, while the whole of the Peer Gynt Suite was heard from Madrid and a wonderful program was enjoyed from Rome.

On November 12th, 2LO, 6BM, Rome, Madrid and Barcelona were still giving loudspeaker receptions; the usual American transmissions came in later on in the evening together with Canadian stations at Montreal and Moncton, N. B.

The afternoon of November 13th arrived and with it 2LO, 6BM and 2ZY, while later on stations WIOD (Miami Beach, Florida), WBAP (Forth Worth, Texas), CKAC (Montreal), CNRA (Moncton, N. B.) and dozens of stations from New York, Illinois, Georgia, Pennsylvania and Massachusetts.

Came November 14th and we found ourselves off the St. Lawrence Estuary with a 60-mile-an-hour wind and several degrees of frost. On the evening of this day we were able to turn our two dials first to London, then to Madrid, and on to Miami Beach via Rome and Montreal, not by any means an economical



A SENSITIVE SEVEN-TUBE SUPERHETERODYNE CIRCUIT

FIGURE 1: *This is a hook-up of the apparatus used by Mr. Beech for his long distance reception work in Mid-Atlantic.*

route for ordinary travel, but so very different via Radio!

And so on down the St. Lawrence to Quebec. While waiting here stations at Montreal, New York and Pittsburgh were tuned in with the greatest ease.

As a result of the experiment the following facts may be of interest.

London was received in broad daylight at a distance of 2,400 miles.

The first American transmission came through when about 1,500 miles distant.

At one time WGY Schenectady was heterodyning 2ZY Manchester, Eng., and reception was spoilt from either station.

—J. L. Beech, *Montreal, Ontario*

* *

How Ordinary Flour Helps Me in Drilling My Panels

It is sometimes hard to locate the screw holes for condensers and other instruments to be mounted on a panel without the aid of a drilling templet.

Here is a simple way to locate the position for these holes.

Locate and drill the hole for the center shaft of the condenser. Then place the instrument on the panel with the shaft protruding through the hole and rest it in exactly the position you wish it to occupy. Sprinkle a little white powder or flour around the screw bushings and then carefully pick up the condenser without disturbing the panel. The powder will form little circles the centers of which may be marked with a sharp center punch.

—Gilbert D. Preston, *El Centro, Cal.*

* *

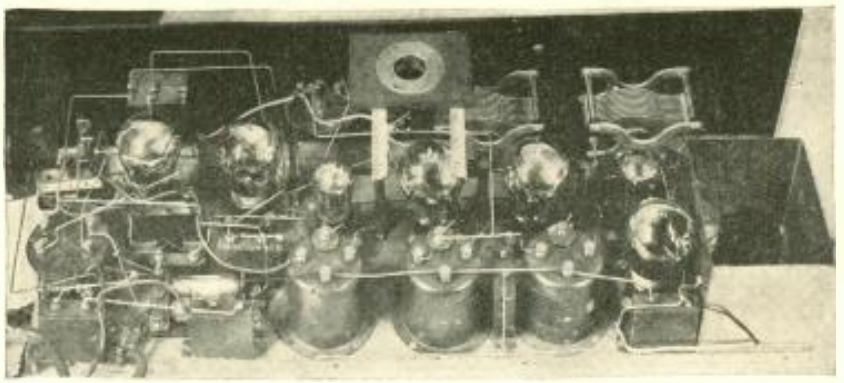
How I Brought My Eight-Tube Cockaday Super Up to Date

I have followed with interest, in some of the recent issues of Popular Radio, descriptions of various changes in the Cockaday superheterodyne reflex receiver.

After nearly two years of satisfactory use of this set I decided that for my use, several changes were necessary. There is no question of the great distance getting abilities of this set, but the reflex principle has a tendency to make it difficult to control at times. Also the resistance coupling did not please me, as it necessitates an extra tube and high "B" voltage. With the Karas transformer and another good transformer in the last stage, just as good results may be secured without these faults.

After considerable thought, I decided that a Tropadyne hookup with transformer-coupled audio would serve my purposes, besides using very few new parts. In fact the only parts needed to make the change were a new oscillator coil (home-made), an .0005 mica condenser, a variable grid-leak, an additional audio transformer and an amperite. The old coil, one socket and the radio transformer in the set were discarded.

It will be noted that this is still the autodyne principle, no separate oscillator being required, and that it reduces the set to seven tubes. On local stations, six tubes provide ample volume. These few changes are all at the extreme left of the set, the right-hand end of the set-up remaining exactly "as is."



REAR VIEW OF THE SET

Figure 2: *This picture shows the layout of the set shown in schematic form in Figure 1. The loop is mounted in the socket at the top center of the receiver.*

The amperite I find desirable on the last audio tube, as otherwise, when changing from 6 to 7 tubes or vice versa, the rheostat must be readjusted each time.

Figure 3 shows the new hook-up.

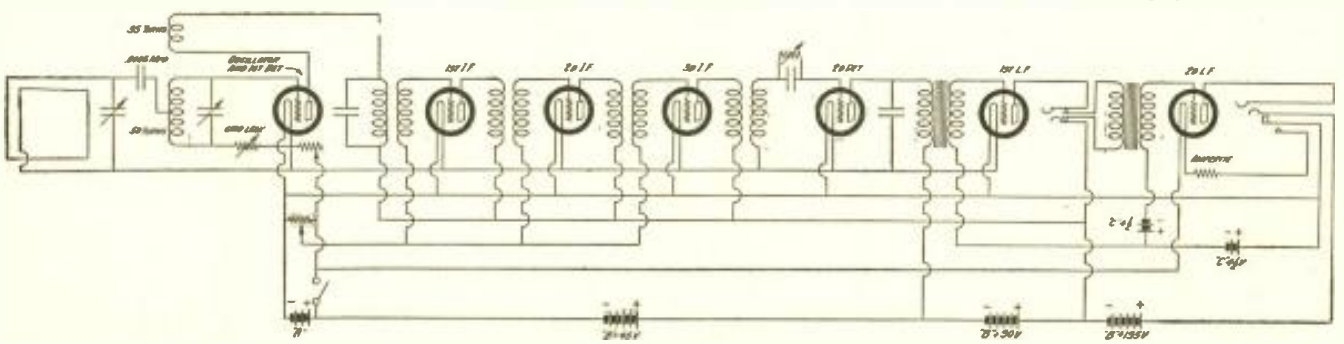
The new oscillator coil is made as follows:

On a 2¾-inch diameter piece of insulating tubing, 3 inches long, wind 50 turns of No. 26 double silk-covered wire, taking a center tap for the grid condenser connection. Leave ¼-inch space; then wind 35 turns more of the same wire for the plate coil. The beginning of the grid coil goes to the grid, and the last turn of the plate coil to the plate of the combined oscillator and first detector tube. The other end of the grid coil goes to the grid-leak (which, by the way, should be set at a very low value), while the other end of the plate coil goes to the plate post on the first intermediate transformer, which is still tuned as before by the small condenser (semi-variable).

The grid condenser (.0005 mfd.) is connected between the center tap and one side of the loop; the two ends of the grid coil are also connected, of course, to the oscillator tuning condenser.

Using this coil, the oscillator con-

(*Continued on page 481*)



A SEVEN-TUBE SUPERHETERODYNE CIRCUIT

Figure 3: *This wiring diagram shows how Mr. Bergenstein changed over his eight-tube superheterodyne into a seven-tube affair, eliminating two stages of resistance-coupled amplification and a reflex stage.*

IN THE WORLD'S LABORATORIES

CONDUCTED BY DR. E. E. FREE

Are Men Made of Ether Waves?

UNDER the teaching of modern physical theories we have grown accustomed to regard the universe as composed of two essentially different kinds of things. On one side are the electron and the proton, the tiniest particles of matter as well as the ultimate units of electricity. Men and stones, planets and stars, are made, we have been told, out of various assemblages of these two fundamental particles.

On the other side we have what is called radiation or ether waves, from the longest waves of radio down to the shorter waves of light and finally to the shortest waves of all, those of the gamma rays from radium and of the newly-discovered cosmic rays studied by Professor Millikan. Of these two kinds of things—matter and radiation—the modern physicist has been accustomed to build up his picture of the world.

There have been, it is true, some dim spots in this picture. Readers of this Department are already familiar with the puzzles of what is called the "quantum theory"—the theory which considers light and other forms of ether waves as consisting, in some unknown fashion, of small, individual particles and not of waves at all.

For four years theoretical physicists the world over have been seeking for some way of reconciling this theory of ether-wave particles with the more familiar theory of ordinary waves.

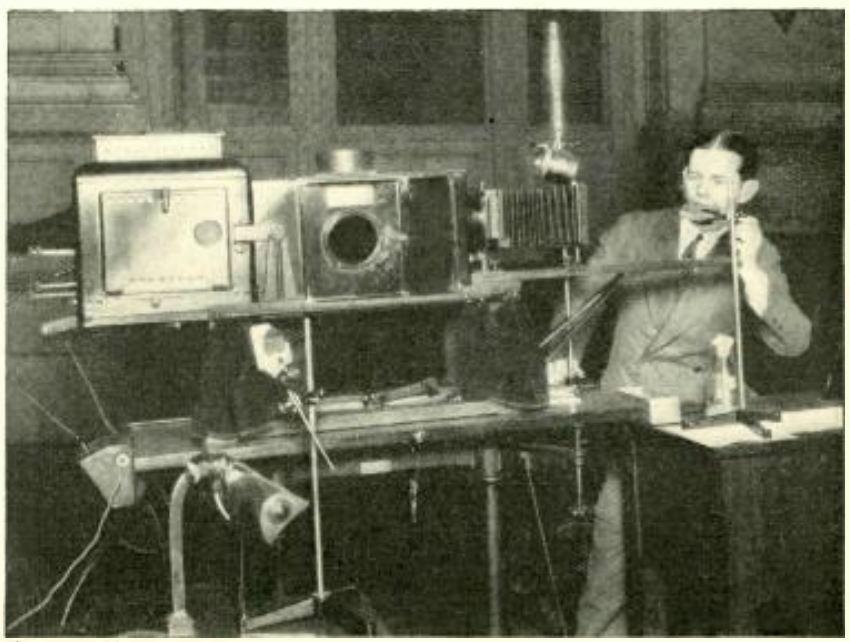
Out of this attempt there have emerged in recent months two new ideas concerning the nature of matter and of ether waves; which means two new ideas about the ultimate nature of the universe and of ourselves. It is probably not too much to say that these new ideas are quite as important as the mechanics of Sir Isaac Newton or as the relativity theory of Dr. Einstein. They give us for the first time a rational viewpoint toward the famous Bohr theory of atoms, a theory which we have found it necessary to accept because it fits so many facts, but which the majority of physicists have been frank to say escaped their real understanding.

One of the new viewpoints which the past few months have brought us indicates a still more remarkable conclusion. So far as it can be interpreted in ordinary physical terms at all, it means that everything in the universe, including the bodies with which we study it and the brains with which we attempt to understand it, are composed, not of electrons and of protons, but of ether waves.

The electron (which we have been thanking for the operation of our vacuum tubes) and the proton (which we have been assuming as the stabilizing influence which keeps our atoms from flying apart) are both viewed by this new theory as merely appearances. They are no more than ether waves in a peculiar state, as a whirling dervish in the desert appears to be no longer a man but a revolving dust cloud.

It is perhaps too soon in the development of the new theories to assert dogmatically that this is their physical meaning. Both are essentially mathematical. Their conclusions appear in the form of equations, not as physical pictures. In the explanation of the puzzles of atomic theory, especially of the relations of atoms to light rays, the mathematical findings of the new theories have been reduced to physical terms and tested. They fit perfectly. Further conclusions and applications are being obtained rapidly. For the past two decades the science of physics has been moving so speedily that it seemed impossible to continue at such velocity. Nevertheless, the speed of advance has not only continued but has accelerated.

It is one of the greatest recommendations of the two new theories of waves and electrons that they are entirely different in approach but agree in coming out at much the same conclusions. The first of the two can be dismissed in a



New York Electrical Society

DISPLAYING ONE MYSTERY OF ETHER WAVES

Dr. Norman Hilberry, of New York University, recently illustrated to the New York Electrical Society the beautiful rings and patterns of color produced by reflecting a powerful light beam from a single thickness of the film of a soap-bubble. The existence of these colors is usually believed to be a proof of the wave theory of light; the colors, it is thought, are caused by the interference of two sets of light waves, one reflected from the front surface of the soap film, the other from its rear surface.

New York Electrical Society

A VISIBLE PROOF OF THE EXISTENCE OF ATOMS

Inside the small, upright apparatus in the center of the picture it is possible to produce visible atom tracks, caused by the atoms which are shot out at enormous velocities from a small bit of radium or other radioactive material. The flying atoms are made to pass through air which is supersaturated with moisture. The passage of each atom causes tiny droplets of this moisture to condense along the path the atom has taken, thus making the track visible.

few words. It is really little more than a new kind of mathematics.

The Bohr theory of the atom, many times described in POPULAR RADIO, assumes that the electrons in atoms have a certain definite number of orbits which they can occupy, and no more than this number. When an electron moves inside an atom it must move from one specified orbit to another specified one. This makes what we call an electron "jump" and this emits light.

Seeking a more suitable mathematical expression for these facts than is supplied by the conventional equations, a German mathematician, Dr. W. Heisenberg, made use of an old but neglected algebraic device, the mathematics of what are called "matrices." Thus he devised what is now called the "matrix mechanics" of atoms and which constitutes the first of the new theories.

Readers who shrink from the no small mental labor which the handling of the matrix mathematics requires must merely take on faith the statement of the experts that the theory fits the facts of atoms better than did the previous, more conventional mathematics.*

The other theory, converging on the same ultimate results as the matrix mechanics of Heisenberg, is the product of Professor E. Schrödinger of the University of Zürich, and is called the "undulatory dynamics" or "wave mechanics."

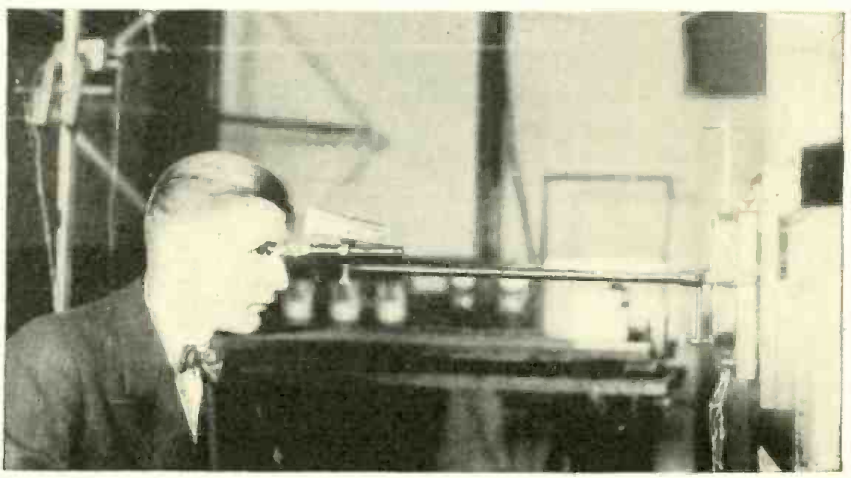
Like the matrix theory it begins with a new mathematical statement of the puzzling facts about ether waves and atoms. The mathematics is, however, very different. It is essentially a mathematical statement suited to the description of waves. Using this on the problems of atoms, which were not supposed to be waves at all, Professor Schrödinger finds that the new wave equations fit quite well; indeed, they fit better than anything else so far. They have been accepted by the majority of mathematical physicists as resolving the most annoying of our former difficulties about waves, atoms and quanta.§

So far as it is now possible to translate the Schrödinger wave mechanics into ordinary physical terms, the meaning seems to be that what we call protons and electrons are merely more or less permanent configurations of waves or wave trains. If you take a stick and touch the surface of the water in a tub you will start a wave across this surface. The wave will be reflected back again when it strikes against the solid side of the tub and by touching the water repeatedly and at the proper intervals you can set up on the surface of the water a reasonably permanent system of waves called "standing waves." Similarly, by shaking one end of a rope such as children use for skipping, the other end being fixed, you can set up a similar system of standing waves on the rope.

(*Continued on page 486*)

*The original papers are: W. Heisenberg, *Zeitschrift für Physik* (Berlin), volume 33, pages 879-893 (1925); M. Born and P. Jordan, *the same*, volume 34, pages 858-888 (1925); Born, Heisenberg and Jordan, *the same*, volume 35, pages 557-615 (1926). None is easy reading and so far as the Editor of this Department is aware the theory has not been "translated" into a language understandable to the average person.

§The original papers, all by Professor Schrödinger, are in the *Annalen der Physik* (Leipzig), volume 79, pages 361-376 (March, 1926); *the same*, volume 79, pages 489-527 (April, 1926); *the same*, volume 80, pages 437-490 (July, 1926). Professor Schrödinger has summarized the chief points of his theory in "An Undulatory Theory of the Mechanics of Atoms and Molecules," *Physical Review* (Minneapolis), volume 28, pages 1049-1070 (December, 1926). There is a brief but clear review of the main implications of both the Schrödinger wave dynamics and the Heisenberg-Born matrix mechanics entitled "Matrix and Wave Mechanics," by R. H. Fowler, in *Nature* (London), volume 119, pages 239-241 (February 12, 1927).



From a photograph made especially for POPULAR RADIO

TESTING THE RESISTANCE OF OXIDIZED COPPER WIRE

Dr. Wesley M. Roberds, of the University of Kansas, has proved that the resistance of a piece of copper wire to high-frequency electric current is not increased materially when the surface of the copper wire is slightly oxidized. Dr. Roberds is shown observing the deflection of a sensitive galvanometer, from the readings of which can be calculated the resistance of the wire.

★ PROGRAM FEATURES *for* THE MONTH

Here is POPULAR RADIO'S *selection of the "star" broadcast features that are scheduled as regular weekly events for the month beginning April 18—program numbers of outstanding merit that are selected on the basis of intrinsic worth, as well as upon their importance as determined by the large audiences reached by powerful single stations and by the chain stations that now cover the country. Every radio fan has—or should have—a receiver good enough to tune in on most of the features that are listed.*

(EASTERN STANDARD TIME)

Mondays

ROXY AND HIS GANG; 7.00 P. M.; *110-piece symphony orchestra, with soloists;* WJZ, WBZ, WBZA, KDKA, KYW, WRC, WSB, WHAS, WSM.

Roxy became radio's greatest impresario when, over three years ago, he organized the famous "Capitol Theater Gang," now the Bowes Family. This was the first major musical event to be listed as a regular weekly feature. Roxy began his theatrical career back in 1909 in a small Pennsylvania town, where his brother-in-law operated a saloon. On three evenings of the week Roxy, aided by chairs from the local undertaking establishment, put on moving picture shows in the "back room" of the place. He now manages the largest theater in the world—a theater which embodies dreams he has entertained ever since those Pennsylvania days. Roxy is 43 years old.

RECORD BOYS; 8.00 P. M.; *songs and humor;* WJZ, WBZ.

The Record Boys, who specialize in humorous selections of their own composition, and who have a strong leaning toward humorous negro songs, had a great listening audience long before they came to the air. They made phonograph records for over five years. They have also appeared in vaudeville in the East and Middle West.

HIRE'S HARVESTERS; 8.00 P. M.; *instrumentalists;* WEAF, WEEI, WGR, WLIT, WRC, WCAE, WTAM, KSD, WCCO.
Here the listener will reap a rich harvest of music covering a wide range of interpretation and no monkey business.

WILLYS-OVERLAND SYMPHONY; 8.30 P. M.; *symphonic music and soloists;* WJZ.
Henry Hadley with a miniature symphony made up from the membership of the New York Philharmonic Orchestra.

A. AND P. GYPSIES; 9.00 P. M.; *classical and semi-classical music;* WEAF, WEEI, WJAR, WDAF, WRC, WCSH, WTAM, WLIT, WWJ, WCAE, WSAI.
Chain-store music popular enough to hold the attention and merit the applause from one of the biggest chains of stations used in the business. The regular soloist is John Barnes Wells, one of the best of the lyric tenors—who is also a composer.

WBAL ENSEMBLE; 9.00 P. M.; *chamber music;* WBAL.

RUUD LIGHT OPERA; 9.30 P. M.; *orchestra and soloists;* WJZ, KDKA, WBZ.
Light opera molded into proper shape for air use.

LIDO VENICE DANCE ORCHESTRA; 10.00 P. M.; *jazz music;* WEEI.
New England's finest source of dance music.

B. A. ROLFE'S DANCE ORCHESTRA; 11.00 P. M.; *jazz numbers;* WEAF.

B. A. Rolfe is one of the very few men who is able to reach and carry melody in the super-treble scale of the cornet. He has had three cornets stolen by musicians who have thought that he employed some trick or device to obtain this effect!

WBAL DANCE ORCHESTRA; 11.00 P. M.; *dance music;* WBAL.
Smart music from Baltimore's best.

CORNADA ORCHESTRA; 1.00 A. M.; *dance music;* KMOX.
St. Louis' 99 per cent. contribution to the jazz industry.

Tuesdays

DINNER CONCERT; 6.30 P. M.; *classical and semi-classical music;* WGY.
Direct from the Hotel Ten Eyck at Albany for those who cannot tap the early music of the New York stations.

WBAL DINNER MUSIC; 6.30 P. M.; *chamber music;* WBAL.
Easily available to those New Yorkers who cast about for good dinner music and cannot find it.

GEORGE OLSEN'S STROMBERG-CARLSON ORCHESTRA; 8.00 P. M.; *dance music;* WJZ, WBZ, KDKA, KYW.

George Olsen tries hard to set the standard for American dance music and he comes within the deuce of spades of doing it. He used to broadcast from the grill room of the Pennsylvania Hotel in New York, but now he holds forth in the WJZ studio for the Stromberg-Carlson Company.

EDISON ENSEMBLE; 8.00 P. M.; *classic and popular music;* WRNY.
What the New York Edison Company is doing for broadcasting. This hour is carefully planned and well managed by Charles Isaacson. The Edison company states that radio has increased its business over $1,000,000 a year.

CHAMPION SPARKERS; 8.30 P. M.; *popular music;* WJZ, KDKA, KYW, WBZ.
Sparkling music with a strong appeal to those with a temperament not attuned to the heavy stuff.

GRAND OPERA PROGRAM; 9.00 P. M.; *soloists and instrumentalists;* WJZ, KDKA, KYW.
Grand opera by a special company. Excerpts from the more popular operas are usually played.

EVEREADY HOUR; 9.00 P. M.; *varied program;* WEAF, WEEI, WFI, WCAE, WGR, WWJ, WOC, KSD, WJAR, WCCO, WTAM, WGN, WSAI, WTAG, WRC, WGY, WHAS, WSM, WSB, WMC.

This feature, which takes its place among the best ten, has its own company of regular performers, which is usually augmented by the appearance of star attractions, ranging from Pablo Casals to Irvin Cobb. Virginia Rea is the coloratura soprano of the club; she is one of the few of the regular sopranos who has had the advantage of European voice training.

EDUCATIONAL PROGRAM; 9.00 P. M.; *lectures;* WLWL.
An educational program involving a wide range of subjects and delivered by men who know them well. WLWL's program is something in the nature of a forum for the discussion of the country's social, political and economical problems of the day. It is run by the Paulist Fathers.

JUBILEE SINGERS; 9.00 P. M.; *female quartet;* WBAL.
Female quartets are hard to find, and usually, when found, hard to listen to. Here's a good one to try on your radio.

MUNICIPAL BAND; 10.00 P. M.; *Baltimore City Band;* WBAL.
The pride of Baltimore in an hour of real band music.

Power tubes in every socket

—*and without re-wiring*

Think of getting power-volume on every setting of the dial.

That, precisely, is the almost magic result that follows an installation of the new Zetka Process ZP 201 A type power tubes... designed for every socket of your radio, *without changing a single wire.*

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The *ZP 201 A power tubes are acknowledged by authoritative critics as the foremost tube advance in the history of radio. Keep that in mind when you are buying your next set of tubes. Drop in to your nearest dealer and ask for a demonstration. You'd never believe that a set of tubes could make such a *profound difference* in reception.

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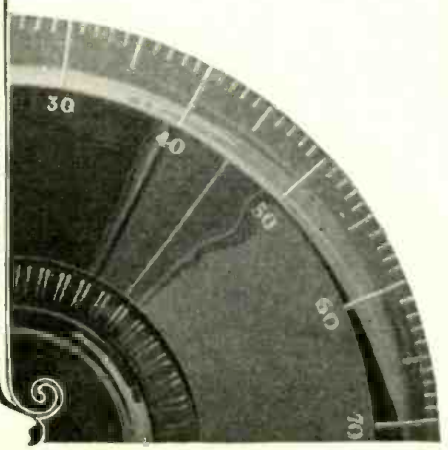
ZETKA Process tubes perform with "NEW TUBE" efficiency throughout their entire life. *Insist upon the clear glass tube in the Blue and Orange Box.



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NEWARK, NEW JERSEY

SAM 'N' HENRY; 9.00 P. M.; *negro comedy;* WGN.
Negro stories and songs by a couple of funny men who have made many records for the large phonograph manufacturers. If you are a phonograph fan, you know 'em.

BRIDGE INSTRUCTION; 10.00 P. M.; WEAF, WEEI, WCSH, WTAG, WJAR, WGR, WCAE, WTAM, WFI, WWJ, WSAI, WGN, WOC, WCCO, KSD, WRC, WGY.
Don't cross your bridge instruction until you tune in for this one—providing you are a bridge player. And who isn't?

DON AMAIZO; 10.00 P. M.; *violinist;* WJZ, KDKA, KYW.

Godfrey Ludlow, the Australian violinist, and the romantic "Don Amaizo," were found and established at WJZ by David Sarnoff, the Vice-President and General Manager of the Radio Corporation of America. Mr. Sarnoff happened to hear Ludlow play at a private concert. Mr. Ludlow now participates in many programs at WJZ'S "Armchair Hour"—a feature he originated.

ARROWHEAD INN ORCHESTRA; 10.30 P. M.; *dance music;* WGBS, WIP.
Snappy music from a snappy road house at the gateway to New York's "Great White Way."

Wednesdays

DINNER CONCERT; 6.45 P. M.; *chamber music;* WSM.
A delightful hour of Southern melodies and chamber music from Nashville's "bestest" hotel.

RADIO NATURE LEAGUE; 7.30 P. M.; *nature talks;* WBZ.

Thornton Burgess, the director of the Radio Nature League, conducts this edifying hour of nature talks. "To do everything possible to preserve and conserve all desirable American wild-life, including birds, animals, flowers, trees and other living things," is the way in which Mr. Burgess phrases the reason for the existence of the league, which has been organized since January 27, 1925. Mr. Burgess' cordial "Good evening, neighbors." is anticipated by every nature lover within the range of WBZ's waves.

KATZ AND HIS KITTENS; 8.00 P. M.; *dance orchestra;* WQJ.
Katz and His Kittens play through WQJ after having completed a year's contract with the management of the Million Dollar Pier of Atlantic City. This is one of the ten best orchestras in the United States.

IODENT'S NO. 1 AND NO. 2; 8.30 P. M.; *the Mitchel Brothers, banjo and piano;* WJZ, WBZ, KDKA, KYW.

The Mitchel Brothers, crooning banjoists and songsters of the Iodent half-hour, hail from the homeland of their craft, Tennessee. Last year these chaps, who are barely out of their teens, were quite unknown. Radio found them and exposed their musical wares to what later proved to be a very appreciative audience. Naturally, Tennessee banjoists sing plenty of darky songs.

DAVIS SAXOPHONE OCTETTE; 8.30 P. M.; *popular and classic music;* WEAF, WEEI, WJAR, WLIT, WRC, WCAE, WTAM, WSAI, WCSH.
This group is perhaps the only musical organization in the United States that uses only saxophones, all in different keys. Although the saxophone has never been admitted to the circle of formal music, this octette offers unique and particularly entertaining popular selections.

STEINDAL STRING QUARTET; 8.30 P. M.; *semi-classical music;* KMOX.
Good music from a quartet that has held its own place on the KMOX program for the past year.

REMINGTON BAND; 8.30 P. M.; *typical band selections;* WGY.

Edwin L. Daniels, conductor of the Remington Band, has recruited his players from the employees of the Remington Arms Co., of Olean, N. Y. This program is made possible by remote control pick-up direct from the Remington factory. The response from the WGY audience has been so favorable that this band concert feature is being continued indefinitely.

IPANA TROUBADOURS; 9.00 P. M.; *dance music;* WEAF, WEEI, WGR, WRC, WCAE, WWJ, WLIB, KSD, WCCO, WDAF, WGY.

The Ipana Troubadours became instantly popular with those who really appreciated good dance music at their first appearance. Most of the members of this orchestra played in big-time vaudeville before going into the toothpaste business.

MAXWELL HOUR; 9.00 P. M.; *orchestra and soloists;* WJZ, WBZ, KDKA, KYW, WHAS, WSB, WMC, WSM.
That this feature is "good to the last note" is testified to by the large number of stations. Well worth tuning in on.

RCA RADIOTRONS; 10.00 P. M.; *songs and comedy;* WJZ, WBZ, KDKA, WEBH.
A variety hour with occasional surprises, largely vocal. But its audience has grown accustomed to novelties of all sorts! A good variety program supplied by animated vacuum tubes with the proper grid bias and plate voltage.

FISHER'S DANCE ORCHESTRA; 10.00 P. M.; *dance music;* KFI.
Dance music with Harry Fisher, one of California's greatest orchestra leaders, wielding the baton.

SMITH BROTHERS; 10.00 P. M.; *humorous songs;* WEAF, WTAG, WGR, WRC, WCAE, WWJ, WSAI, KSD, WOC, WCCO, WDAF.

The famous "Mark" and "Trade" of cough-drop fame are represented by two young men who formerly led the musical activities at Rutgers College. They fill this period with humorous songs and instrumental numbers.

HAGAN'S DANCE ORCHESTRA; 11.00 P. M.; *dance program;* WOR.
Cass Hagan is the young owner and leader of this orchestra; he is a newcomer to the air. Mr. Hagan is the son of a New York politician.

JADE ROOM DANCE ORCHESTRA; 11.00 P. M.; *dance music;* WTAM.
Good dance music from a green room. (This, incidentally, is Cleveland's one dependable source of one-steps.)

KFI MIDNIGHT FROLIC; 3.00 A. M.; *varied program;* KFI.
This is not only a remarkably good musical event, but it also stands as a target for the long-distance radio shooters of the East.

Thursdays

PALAIS ROYAL ORCHESTRA; 6.00 P. M.; *dance music;* WEEI.
Like a Boston edition of Rolfe's famous Palais d'Or orchestra.

MEYER DAVIS ORCHESTRA; 7.00 P. M.; *dance music;* WGBS.

ORGAN RECITAL (Fred Weaver); 7.30 P. M.; *classical and semi-classical selections;* WBAL.
Fred Weaver is a graduate of the famous Peabody Conservatory of Music, where he now plays the organ for the WBAL audience. Mr. Weaver rarely plays light numbers, but holds rather to the selections that have been written for the organ.

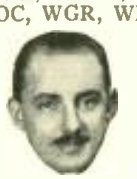
CONCERT ENSEMBLE; 7.35 P. M.; *chamber music;* WGN.
One of a precious few really good chamber-music hours from a town noted for its radio jazz.

CHATEAU SOURIER CONCERT; 7.45 P. M.; *chamber music;* CNRM.
This concert comes from the famous Chateau Sourier Hotel in Montreal. The ensemble is one of the most-listened-to musical organizations on the Canadian air.

WBAL ENSEMBLE; 7.45 P. M.; *chamber music;* WBAL.

Here is a quiet, dignified ensemble that is deservedly popular with the listeners. It is made up of strings and wood-winds. Robert Jula is the young conductor of this ensemble; here is his portrait.

CLICQUOT CLUB ESKIMOS; 9.00 P. M.; *banjo ensemble;* WEAF, WEEI, WCCO, WGN, WCAE, WGY, WJAR, WTAG, KSD, WOC, WGR, WFI, WWJ.



The Eskimos play all of the light music worth playing—and they play mighty well. They have a tremendous following. Harry Resor, the "chief Eskimo," is pictured here at the left.

FULLER ORCHESTRA; 9.30 P. M.; *popular music;* WGHP.
Something more than "just another dance orchestra."

GOODRICH SILVERTONE QUARTET AND ORCHESTRA; 10.00 P. M.; *popular music;* WEAF, WEEI, WCCO, WGN, WCAE, WJAR, WTAG, KSD, WOC, WGR, WFI, WWJ, WSAI, WCSH, WADC, WHAS, WSB, WSM, WMC.
Smart dance music on the threshold of the dance period. This orchestra has been popular with the WEAF audience for nearly two years. Vocal soloists are usually used.

MUSIC BOX HOUR; 11.00 P. M.; *varied program;* KFI.

Virginia Fhahri, one of KFI's standard features, is both a mandolin player and also one of the best sopranos in the West. Her constant companion is a trained parrot, who sits at the end of the mandolin while she entertains the KFI audience.

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Fridays

HOTEL BRETTON HALL ORCHESTRA; 6.30 P. M.; *chamber music;* WOR.
This ensemble from WOR offers a dignified and well-chosen program of classics and semi-classics. It is a seven-piece organization made up of strings and wood-winds.

KING EDWARD HOTEL ORCHESTRA; 6.35 P. M.; *chamber music;* CNRT Hotel.
This orchestra, playing in the main dining-room of Toronto's smartest hotel, is under the direction of the well-known Canadian director, Luigni Romanelli. The concert is immediately followed by the Apollo Male Quartet—another popular CNRT feature.

MIXED QUARTET; 7.30 P. M.; *male voices;* WBAL.
Male voices singing old ballads. This is really an old-fashioned quartet in its ideas, but its execution is good.

HAPPINESS BOYS; 7.30 P. M.; *songs and jokes;* WEAF.


An old vaudeville team bursting with new songs and new jokes. This is one of the best light features on the air. Billy Jones, the tenor, and Ernest Hare, the baritone, write many of their own numbers. One reason why they give such enjoyment is because they get so much fun themselves.

GOLDMAN BAND; 8.00 P. M.; *wide range of selections;* WEAF, WEEI, WGR, WLIT, WRC, WCAE, WTAM, WWJ, WSAI, WOC, WCCO, WGY, KVOO, WFAA, WOAF, WLIB.

Edwin Franko Goldman, leader of the now famous Goldman Band, has been called the greatest bandmaster of the day; he is also a composer of standing. For ten years he was connected with the Metropolitan Opera House, and while there he wrote several selections. "Chimes of Liberty," "Sagamore" and "On the Farm" are among his best efforts. While playing on the campus of the New York University two summers ago, Mr. Goldman was inspired to write two band selections, one entitled "On the Campus" and another "On the Air."

MARKEL'S SOCIETY ORCHESTRA; 8.00 P. M.; *dance music;* WJZ, WBZ, KDKA, KYW.
Markel's Society Orchestra means just that; it plays for a great many of New York society's smartest functions.

ROYAL HOUR; 8.30 P. M.; *orchestra and soloists;* WJZ, WBZ, KDKA, KYW.
This invariably features well-known soloists and instrumentalists. The orchestra confines its interpretations to the standard classical works.

TRAYMORE CONCERT ORCHESTRA; 9.00 P. M.; *chamber music;* WPG.
The same music used by a great Atlantic City hotel to entertain its guests.

FRANCE ORCHESTRA; 9.30 P. M.; *popular orchestral music;* WEAF, WGR, WLIT, WOC, WCAE, WTAM, WWJ, KSD, WDAF, WMAG.

This orchestra is under the direction of a woman, Miss Anne C. Byrne, who has been engaged in orchestral work for the last ten years. Many of the arrangements she plays are strikingly delightful and the La France Orchestra has been a favorite with real music-lovers for several years. The leader herself uses the piano.

ARMCHAIR HOUR; 10.00 P. M.; *vocal and instrumental music;* WJZ, WBZ.

Milton Cross has become part and parcel of WJZ's environment, for he is not only announcer, but a tenor soloist. Mr. Cross joined WJZ's staff in 1922 and is one of the most popular announcers in the country, due to his splendid announcing for operas and the most formal of the musical features presented by WJZ. Cross has been known to have spent twenty hours in research at the New York Public Library that he might have a complete story of an opera to give to the radio audience. This man is responsible for the dissemination of more musical knowledge by radio than any other announcer on the air.

WHITTAL ANGLO-PERSIANS ORCHESTRA; 10.00 P. M.; *classical and semi-classical music;* WEAF, WEEI, WJAR, WTAG, WGR, WLIT, WTAM, WCAE, WWJ, WCCO, WDAF, KSD, WOC, WGN, WGY.

Variety is the keynote of the Whittal Anglo-Persians' musical program for Friday evenings. From "The Call of the Desert" to the parting melody, each number is so entertainingly different from the others that, no matter what your taste in music may be, you will find somewhere in this program a number which will strike your fancy and mood. A romantic Oriental melody, a familiar waltz, a musical comedy, an intermezzo, and a Gypsy air, all are offered. It is easy, therefore, to see that Director Louis Katzman's offerings are delighting listeners wherever radio is enjoyed.

DANCE ORCHESTRA; 11.00 P. M.; *dance music;* KDKA.

Saturdays

JACQUES RENARD'S ORCHESTRA; 6.45 P. M.; *dance music;* WEEI.
This and the orchestra at the Palais Royal supply Boston with practically all of its really good dance music.

ARCADIA BALL ROOM ORCHESTRA; 7.45 P. M.; *dance music;* WGBS.
One of the good New York dance orchestras in what is always a corking fine hour of dance music.

BENJAMIN FRANKLIN ORCHESTRA; 9.30 P. M.; *chamber music;* WIP.
A famous Philadelphia hotel permits the whole radio world to listen to music supplied to its diners.

HOTEL CHELSEA CONCERT; 9.30 P. M.; WPG.
All strings and wood-winds, with a leader who knows how to choose a good program.

"OUR GOVERNMENT"; 10.00 P. M.; *talk by David Lawrence;* WEAF, WTAG, WGR, WFI, WRC, WCSH, WGY.
David Lawrence is a widely read observer of political and economical conditions, both national and international. His contributions to war literature made him famous.

ARCADIA DANCE ORCHESTRA; 12.00 P. M.; *dance music;* KMOX.
If the Middle West should put in a bid for the dance music championship, this orchestra would be one of the entries.

COLORADO ORCHESTRA; 12.30 P. M.; *dance music;* KOA.
Sparkling jazz from the "mile-high" broadcaster of the wide open spaces.

Sundays

BEDFORD Y.M.C.A. MEN'S CONFERENCE; 4.00 P. M.; *Dr. S. Parkes Cadman;* WEAF, WEEI, WCSH, WTAG, WCAE, WSAI.

Dr. Cadman is perhaps better known to the public than any churchman in America—and his fame began with the broadcasting of his sermons, which led directly to the syndicating of writings to the newspapers at an income said to be considerably more than President Coolidge's.

CROSLEY RADIO FEATURE (alternate weeks); 5.30 P. M.; *varied program;* WEAF, WEEI, WJAR, WTAG, WGN, WFI, WRC, WCSH, WCAE, WTAM, WWJ, WSAI, KSD, WDAF, WHAS, WSM, WSB, WMC, WGY.
A newcomer with plenty of snap and good musical novelties.

PARK V. HOGAN ORGAN RECITAL; 7.00 P. M.; *organ and vocal;* WJZ.
This recital is given on an Estey organ by an organist who has been entertaining the New York audience with organ music for the past four years.

THE CAPITOL GRAND ORCHESTRA (and Major Bowes' family); 7.20 P. M.; *symphonic music and soloists;* WEAF, WEEI, KSD, WRC, WWJ, WJAR, WCAE, WTAG, WHAS, WSB, WSM, WMC.

Since she was ten years old, Caroline Andrews, often called the "lark" of Major Bowes' family, has been singing before audiences. Her mother was an opera singer, and Caroline, at the age of five, used to use her mother's trunk for a stage in singing operatic selections that she had memorized through the effort of her parent. Miss Andrews sung with the De Koven Opera Company, the Philadelphia Opera Company, the St. Louis Opera Company and lately in "The Student Prince."

DELLA ROBBIA CONCERT; 7.45 P. M.; *chamber music and solos;* WOR.
Great relief on a day filled with hymns and sermons.

COOK'S TOURS; 8.30 P. M.; *travelogue with music;* WJZ.
Travelogues with musical garnish in the form of folk numbers from the countries visited.

AMBASSADOR CONCERT; 9.10 P. M.; *chamber music;* WPG.
Pleasant chamber music out of Atlantic City's salt air.

ATWATER KENT HOUR; 9.15 P. M.; *star soloists;* WEAF, WEEI, WFI, WCCO, WTAM, WGN, WCAE, WGR, WOC, WTAG, WWJ, KSD, WRC, WSAI, WGY, WHAS, WSB, WMC.

This "highest-priced radio program in the world" features so many great vocal and instrumental stars that few listeners stop to give a thought to the leader of the orchestra that supplies such perfect accompaniment. This important work is done by a very young man in the musical world; his name is Niccolai Berezowsky, and he is not only a capable orchestra director, but he takes his position among a small group of "very-near-great" violinists. He was educated musically in Russia and Germany. Paul Althouse, the Metropolitan tenor, is the guest artist April 24th.

COLLIER HOUR; 9.30 P. M.; *variety program;* WJZ, KYW, WBZ, KDKA.
This is a new idea in broadcasting; it is usually attended by famous writers of fiction and fact and some good music worked into a splendid scheme for continuity.

Bradleyunit-A
PERFECT FIXED RESISTOR

CIRCUITS for B-eliminators, radio receivers, and other radio units usually require the use of one or more reliable fixed resistance units. In fact, fixed resistors are being used more extensively than ever, and the demand for high-grade units is growing, daily.

Bradleyunit-A is a solid molded fixed resistor, calibrated with great accuracy and fitted with silver-plated terminal caps which can be soldered without affecting the calibration of the unit. Bradleyunits are made in 20 different ratings for every purpose.

Ask your dealer for Bradleyunits, not "resistance units." They are sold in the distinctive Allen-Bradley checkered carton.

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Please send me data on Bradleyunits and your folder on B-eliminator hook-ups.

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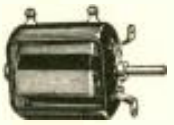
RADIO RECEPTION
depends primarily upon two things—an efficient circuit and use of GOOD PARTS


Type 269 Variometer
Price $5


Type 265 Trans.
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Type 349 Socket
Price 50c.


Type 410 Rheostat
Price $1.25

Always remember this fact in set-building—and remember that General Radio parts have long been recognized by radio editors, test laboratories, and experimenters as the universal standards of radio.

They have a laboratory background of over a decade.

The same outstanding craftsmanship and materials are embodied in General Radio parts for use in broadcast receivers as in General Radio apparatus used as precision standards in the leading radio and electrical laboratories of the world.

Whenever you find a popular circuit, you will invariably find General Radio parts—they are adapted to use in practically all of the better circuits.

If you are unable to obtain our products in your particular locality they will be delivered to you postpaid direct from the factory upon receipt of list price.

Write for Catalog 926-P

General Radio Co., Cambridge, Mass.


Type 268 Variocoupler
Price $2.75


Type 277-D Coil
Price $1.50


Type 247-F Condenser
Price $4.00


Type 368 Micro-Cond.
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ELKAY
TUBE EQUALIZOR SYSTEM

Use Any Combination Of Tubes

No rewiring. Just insert Equalizors to match the different voltages. Self-adjusting. Made for every tube. 50c; mounted, 75c.

Elkay Suppressors choke squealing. 75c; mounted, $1.

Langbein-Kaufman Radio Co. (Dept. R)
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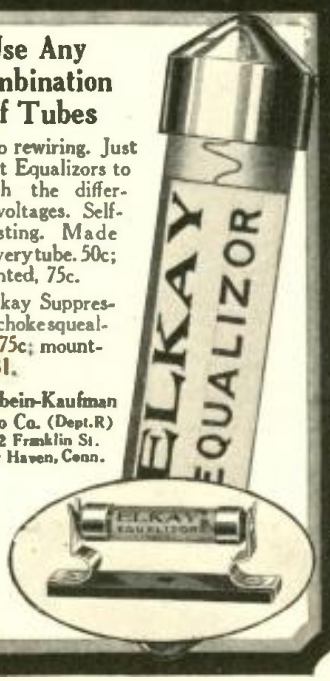
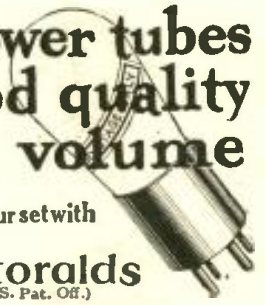


A good name
NA-ALD
in radio

Use Power tubes for good quality at full volume



Simply adapt to your set with

Connectoralds
(Reg. U. S. Pat. Off.)

The use of a Power Tube in the last audio will very greatly improve your tone quality. No change in set wiring is necessary when Connectoralds are used.

For UX 171 and UX 112 Tubes, Na-Ald 112 Connectoralds are recommended for maximum volume with storage battery sets. These tubes will deliver without distortion several times the volume of the regular 201A. Price $1.50.

For UX 120 Tubes in UV 201A sockets, the Na-Ald No. 120 Connectorald should be used. To convert a storage battery set to dry batteries with ample loud speaker volume, use a UX 120 tube in the last audio stage with the 120 Connectorald and UX 199 tubes with 419X Adapters in the other sockets. Price $1.25.

For the UX 120 Tube in UV 199 sockets, ample loud speaker volume without distortion is obtainable from any set equipped for UV 199 tubes by means of the UX 120 or equivalent tube, with the Na-Ald No. 920 Connectorald. The tube is raised slightly, but provides for its use in most sets with limited headroom. Price $1.25.

For UX 120 tubes in the UV 199 sockets of the Radiola Superheterodyne Semi-Portable and Radiola Super VIII. These excellent Superheterodynes will deliver ample volume for loud speaker operation when equipped with the UX 120 used with the Na-Ald No. 420 Connectorald. Price $1.25.

ALDEN MANUFACTURING CO.
Dept. 322-C Springfield, Mass.

Schedules of Dinner-Hour and Dance Programs of Special Note

★ Programs of Dinner-Hour Music

(Eastern Standard Time)

FEATURE	STATION	TIME
Palmer House Victorians	WEBH	7:15 P. M.; *daily except Sundays.*
Hotel Andrew Jackson Concert	WSM	7:15 P. M.; *Tuesdays;* 6:45 P. M.; *Wednesdays and Thursdays.*
Neopolitans	WTAM	6:00 P. M.; *Wednesdays and Thursdays.*
Austin Wylie's Orchestra	WTAM	6:00 P. M.; *Fridays.*
Bem's Little Symphony	KGO	9:00 P. M.; *daily except Saturdays.*
Katz and His Kittens	WQJ	8:00 P. M.; *daily except Sundays and Mondays.*
Hotel Tuller Concert	WGHP	7:00 P. M.; *daily except Sundays.*
WBAL Dinner Concert	WBAL	6:30 P. M.; *Mondays, Tuesdays, Thursdays and Fridays.*
Joe Rine's Orchestra	WEEI	6:05 P. M.; *Mondays, Wednesdays and Thursdays.*
Jack Renard's Orchestra	WEEI	6:45 P. M.; *Saturdays.*
Mack's Collegians	KFI	9:30 P. M.; *Saturdays.*
Ray Fisher's Orchestra	KFI	10:00 P. M.; *Wednesdays.*
Concerts from Atlantic City Hotels	WPG	7:25 P. M.; *daily except Sundays.*
Special Dinner Programs	WBZ	7:00 P. M.; *daily.*
KDKA Little Symphony	KDKA	6:00 P. M.; *Tuesdays, Thursdays.*
Coronado Orchestra	KMOX	7:00 P. M.; *Sundays.*
Organ Recital	KMOX	7:00 P. M.; *daily except Sundays.*
Drake Concert	WLIB	8:00 P. M.; *Tuesdays, Thursdays and Saturdays.*
Drake Concert	WGN	7:35 P. M.; *daily except Sundays.*
Brown Palace Orchestra	KOA	8:30 P. M.; *daily except Thursdays.*
Benjamin Franklin Orchestra	WIP	6:10 P. M.; *Tuesdays, Wednesdays, Thursdays and Saturdays.*
McDonald's Orchestra	WIP	6:10 P. M.; *Mondays and Fridays.*
Bretton Hall String Quartet	WDR	6:30 P. M.; *Tuesdays and Fridays.*
Dinner Concert	WWJ	6:00 P. M.; *except Saturdays and Sundays.*
Jack Jacobs Orchestra	WOR	6:15 P. M.; *Mondays, Wednesdays, Thursdays and Saturdays.*
Twilight Musical	WAIU	7:00 P. M.; *Mondays, Tuesdays and Wednesdays.*

★ Programs of Dance Music

(Eastern Standard Time)

FEATURE	STATION	TIME
Colorado Orchestra	KOA	12:15 P. M.; *Saturdays.*
Packard Six Orchestra	KFI	1:00 A. M.; *Monday mornings.*
Coronado Orchestra	KMOX	1:00 A. M.; *Mondays, Tuesdays, Wednesdays, Fridays, Saturdays.*
Arrowhead Inn Dance Orchestra	WGBS, WIP	10:30 P. M.; *Tuesdays and Saturdays.*
McDonald Recording Orchestra	WGBS, WIP	10:50 P. M.; *Thursdays.*
Van Horn Dance Hour	WPG	10:30 P. M.; *Fridays.*
Casino Dance Orchestra	WPG	11:30 P. M.; *Saturdays and Mondays.*
Silver Slipper Orchestra	WPG	11:30 P. M.; *Tuesdays.*
Golden Pheasant Orchestra	WTAM	10:15 P. M.; *Sundays.*
Emerson Gill Orchestra	WTAM	10:00 P. M.; *Mondays and Wednesdays.*
Far East Orchestra	WTAM	11:00 P. M.; *Thursdays.*
Jade Room Orchestra	WTAM	11:30 P. M.; *Fridays.*
Simovar Orchestra	WENR	1:00 A. M.; *Thursday, Friday and Saturday mornings.*
Midshipmen Orchestra	KGO	12:30 P. M.; *Thursdays.*
Katz and His Kittens	WQJ	11:00 P. M.; *Saturdays. Tuesdays, Wednesdays, Thursdays and Fridays.*
WBAL Dance Orchestra	WBAL	11:00 P. M.; *Mondays, Tuesdays, Thursdays and Fridays.*
Renard's Orchestra	WEEI	10:10 P. M.; *Mondays.*
Joe Rine's Orchestra	WEEI	10:05 P. M.; *Wednesdays.*
Nighthawks	WBBM	1:00 A. M.; *Mondays;* 12:00 P. M.; *Tuesdays and Thursdays.*
Vincent Carr Orchestra	WIP	10:05 P. M.; *Saturdays.*
Vanderbilt Dance Orchestra	WOR	11:35 P. M.; *Tuesday.*
Cass Hogan's Orchestra	WOR	11:00 P. M.; *Wednesdays and Saturdays.*
Fletcher Henderson's Orchestra	WOR	11:00 P. M.; *Fridays.*
Kentucky Serenaders	KYW	11:30 P. M.; *Saturdays.*
George Olsen's Orchestra	WJZ	10:30 P. M.; *Tuesdays.*
B. A. Rolfe's Orchestra	WEAF	11:00 P. M.; *Mondays.*
Goodrich Zippers	WEAF	10:00 P. M.; *Thursdays.*
Johnny Johnstone's Orchestra	WJZ	10:30 P. M.; *Thursdays;* 10:50 P. M.; *Saturdays.*

Henry Miller

A PIN FOR EVERY BROADCASTING STATION

On this wall map, which hangs in the office of the radio division of the U. S. Department of Commerce, each of the 733 broadcasting stations in the country is indicated by a colored pin. Note the congestion in the New York, Illinois and the Pacific coast areas—and the "great open spaces" in the central and, particularly, the south-central sections. W. D. Terrell, chief of the radio division, is seen at the left.

How to Assemble the Hammarlund-Roberts Hi-Q Receiver

(*Continued from page 458*)

nections; but be sure that you are using a good type of rosin-flux and follow instructions regarding the correct way to solder. Do not use any more solder than is absolutely necessary to make a good joint. Big gobs of solder will not hold the joint any more firmly, but may tend to weaken it.

It is an easy matter to make the necessary antenna, ground and battery connections to get the set in operating condition. The antenna wire may be connected direct with the switch arm terminal of the antenna switch, S. The ground connection may be made to the negative "A" battery terminal of the set, but it is preferable to make it direct to the negative terminal of the "A" battery itself.

The other battery connections are clearly shown and require no further explanation. For a standard UX-201-a type amplifier valve in the first low-frequency stage, V4, a negative "C" battery bias of 4½ volts should be used. If a UX-201-a type valve is used in the last stage, the negative "C" battery bias should also be 4½ volts, and it is best to use only 90 volts of "B" battery instead of the 135 volts indicated. If you use a UX-112 type tube, it is best to use 135 volts of "B" battery and 9 volts of "C" battery for the second low-frequency stage. If you use a UX-171 type valve you can still use 135 volts for the "B" battery, but you should use a negative "C" bias of approximately 27 volts, obtainable by adding a small 22½-volt "B" in series with the 4½-volt "C" battery.

You may now proceed with the job of balancing up the gang condensers and the adjustment of the midget condenser. Adjust the cams so that the coupling coils move in step and equalize the valve capacities of the high-frequency stages.

Once these adjustments are made, the tuning of the set is reduced to the simple operation of adjusting the two tuning dials and regulating the volume by means of the rheostat control.

A good antenna installation is necessary for efficient operation. This does not mean that your antenna should be stretched out over two city blocks. An aerial between 80 to 100 feet in length, including lead-in, will usually give the best results. Erect it free and clear of surrounding objects, and be sure that it is properly insulated at every point.

Fisherman's Luck

THE FISHERMAN (*who has taken up radio*)—I got Honolulu last night and you should have heard the stations that got away!

—LIFE

The obverse of the medal; the original is two-and-one-half inches in diameter.

The reverse; the name of each recipient will be engraved in the space provided.

The Popular Radio Medal *for* Conspicuous Service

TO every radio amateur, to every amateur experimenter and broadcast listener, who is instrumental in alleviating human suffering or saving human life, directly through the medium of radio, recognition will hereafter be extended in the form of a medal that shall be known as "The Popular Radio Medal for Conspicuous Service." This medal is unique within the realms of radio, in that it shall be awarded not for scientific achievement or invention, but for service to humanity.

To insure a fair and unbiased consideration of all claims, a Committee of Awards has been appointed that includes five distinguished citizens of international fame. To assist this Committee of Awards, an Advisory Committee has been appointed that numbers among its members some of the most eminent citizens of the United States, including representatives of many of our most distinguished institutions.

The conditions under which the medal will be awarded are here specified:

1. The medal shall be known as the Popular Radio Medal for Conspicuous Service.
2. The medal shall be awarded, without discrimination as to sex, age, race, nationality, color or creed, to those radio amateurs, radio experimenters, broadcast listeners and other non-professionals through whose prompt and efficient action radio is utilized to perform an essential part in the alleviation of human suffering or in the saving of human life within the territorial confines of the United States and its possessions, or in the waters thereof.
3. The medal shall be awarded by a Committee of Awards that shall not exceed five in number. No member of this Committee shall be an employee, officer or stockholder of POPULAR RADIO, INC., nor shall any such employee, officer or stockholder have a vote in the deliberations of the Committee.
4. An Advisory Committee, which shall co-operate with the Committee of Awards and which shall be particularly charged with the responsibility of making recommendations for awards of this medal, shall be made up of men and women who, because of their interest in the public welfare or because of their connection with institutions that are consecrated to public service, are in positions to bring to the attention of the Committee of Awards the exploits of candidates who are within their own special fields of activity.
5. The medal will be awarded for services rendered since Armistice Day, November 11, 1918.
6. Recommendations for awards may be submitted to the Committee of Awards at any time and by any person. Every recommendation must contain the full name and address of the candidate, together with a detailed account of the accomplishment on which the proposed award is based, and must be accompanied by corroboratory evidence from persons who have first-hand knowledge of the circumstances and whose statements may be verified to the satisfaction of the Committee of Awards.
7. The medal will be awarded to as many individuals as qualify for it and at such times as the Committee of Awards may authorize.
8. All considerations not specified herein shall be left to the discretion of the Committee of Awards.

All communications to the Committee of Awards may be addressed to—

The Secretary of the Committee of Awards, POPULAR RADIO Medal for Conspicuous Service, 627 West 43rd Street, New York.

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JOHN R. MOSS, *President, Kiwanis International.*
W. D. TERRELL, *Chief Supervisor of Radio, Department of Commerce, Washington, D. C.*

Listening In

(*Continued from page 469*)

denser will be found too large, bunching the stations at the lower end of the scale. This is a .001 mfd. condenser, and is large because the original design was so-called "second harmonic." The new arrangement being a fundamental heterodyne, a smaller condenser will be necessary, approximately .0005 mfd. But the old one may be used if it is carefully taken apart and 9 plates removed from the rotor, putting in an extra washer to take their place. The stations will then be found spaced evenly over the dial. The other dial can be adjusted as before by using the proper tap on the Korach loop.

Use 45 volts on the plate of the second detector and 90 on all the other tubes.

A set of the new type vernier dials, of which there are many on the market, will improve the appearance of the set, but are not necessary.

I find that these changes make this set much easier to handle, give as much volume and good quality as before, and while a certain amount of distance will be lost, it will still bring in all the distance that any but the most rabid DX hound will require.

—A. C. BERGENSTEIN, *Brooklyn, N. Y.*

* *

How to Construct a Simple Antenna Substitute

To construct this simple antenna substitute, cut two pieces of heavy cardboard to the dimensions given in Figure 4. Then paste a piece of heavy lead foil or tin foil, ¼-inch smaller all around than the cardboard, between the two pieces of cardboard. A length of flexible insulated wire should be connected between a binding post, put through the projecting end of the cardboard and lead foil and the antenna terminal on the receiver. The set should be grounded in the usual manner.

The unit may then be placed under a stand telephone; in this way, it really makes use of the telephone lines as an antenna by capacity; but it does not interfere with the operation of the telephone in any way. It may be used with the electric lighting lines in a similar manner by placing it under the flat surface of an electric percolator, toaster, or similar electric appliance. The appliance must be plugged in, but it is not necessary that the switch on the appliance be turned on.

While the unit may not in all cases give quite as good results as an outside antenna, it is portable and usually more selective.

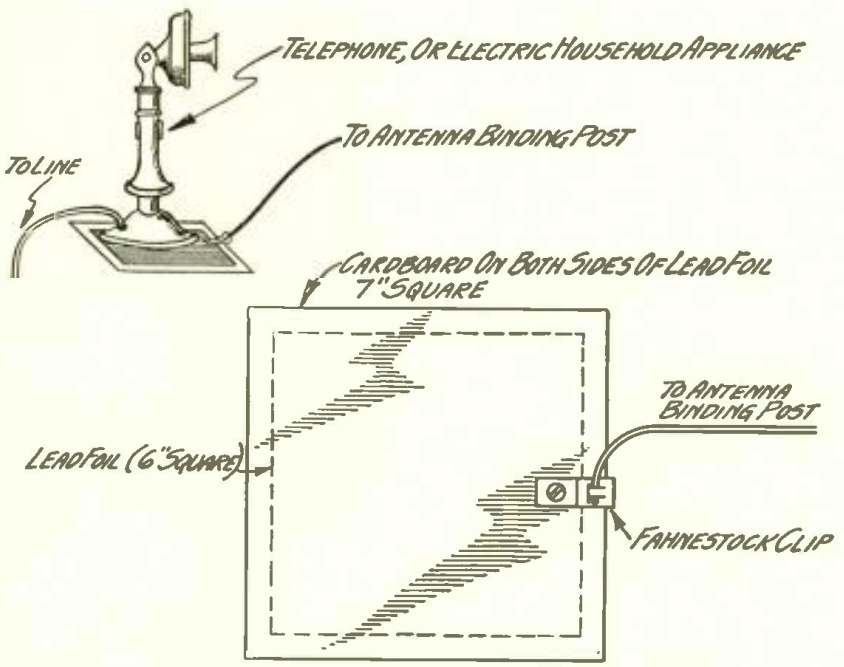
—CHARLES F. FELSTEAD (6CU), *Los Angeles, Cal.*

* *

How to Place a Single-cone Reproducer

WHEN using a single-cone type reproducer it will be found that greater volume occurs directly in front of the cone when the point of the cone is pointed at a wall opposite to the listeners. It has much more volume than when it is placed with the point of the cone directly towards the listeners.

—G. D. PRESTON, *El Centro, Cal.*



A SIMPLE ANTENNA SUBSTITUTE

FIGURE 4: *This diagram shows clearly a method for using the telephone line as an aerial where it is found impossible, on account of local conditions, to erect an outdoor antenna.*

How to Care for Trickle Chargers

IN the use of a low-capacity, storage battery and a trickle charger the only attention required is the inspection of the battery. This should be done about once every month. The water should be kept above the plates of the battery. There are several types of trickle chargers on the market, and in the use of any of them care should be observed in the rate of charging. The rate should be sufficient to keep the battery at full charge at all times. When the charger is new and has just been put into use frequent readings should be taken to determine the condition of the battery. If the battery gradually runs low the rate should be increased and if it gases to a great extent it shows that the battery is full, and the rate should be reduced, to prevent excess charging.

—G. D. PRESTON, *El Centro, Cal.*

* *

A Light Globe to Protect Radio Tubes

Too frequently one hears the story, "I burned out five tubes, and it happened all at once."

Such experiences are costly; they are also unnecessary. By exercising a little care they may be prevented. I have found that a simple method to eliminate one of the big wastes of radio consists in using an ordinary electric lamp as a safety guard.

All that is needed for protection against such an accident is a 40-watt, 110-volt lamp—the kind found in most homes. The lamp is used when one is installing the set or is working on it to repair damages or to improve its reception efficiency. No matter what is being done to the receiver, there is no occasion for burning out the tubes. Without a safety device, however, this may happen because of an inherent defect in the set, because of an internal short in one of the tubes between the grid or plate and the filament, or because of carelessness in installing the receiver and connecting the battery wires.

Connect your lamp in series with the plus 90 "B" battery lead, and you cannot possibly burn out your tubes. Even if there is a defect of any nature in either the receiver or the connections, the 40-watt lamp safety protection will permit the tube filament to glow just dimly, and only when the filament control switch is still on the "off" position. If the tubes really light up with the switch in the off position, this circumstance is an indication of trouble somewhere, and the receiver should be disconnected at once and examined for the defect causing the disturbance.

When you have completely hooked up the set and made it function properly, you can safely remove the lamp, because the receiver is then in perfect shape.

—CHARLES OLIVE, Willmor, Minn.

High-Resistance Connections

ONE of the most common sources of trouble in a receiving set, and one which may easily be taken for something else, is the indifferent action of the set caused by a high-resistance connection. This is sometimes difficult to locate. It will cause the set to operate in an unsatisfactory manner, and is often mistaken for "location" trouble. A high-resistance connection may occur at any connection in the receiver, and one of the most frequent causes is the use of solder in which a corrosive flux has been used. Weak springs in jacks and switches are also common causes of high-resistance connections.

—G. D. PRESTON, *El Centro, Cal.*

* *

How Worn Parts May Make Receiver Noises

MECHANICAL parts, which have become worn, often cause noises in receiving sets that are attributed to loose connections in the wiring. In practically all sets the wiring is fixed and should not cause much trouble from loose connections ordinarily.

However, the vernier drive shafts of condensers often become worn; sometimes this also happens to the bearings of the vernier plates. When this occurs the contact between the shaft and the condenser may seem to be in perfect shape, yet the set, when critical tuning is necessary on distant stations, will not respond properly. There is a scraping noise or scratching sound heard that is often wrongly blamed on a loose connection in the wiring.

—G. D. PRESTON, *El Centro, Cal.*

A REAL DE-LUXE SET

FIGURE 5: *All the parts are gold plated and mounted on plate glass in this set and cabinet, built by J. W. Lake, of Dallas, Texas. It contains three stages of high-frequency amplification and two stages of low-frequency amplification. The design on the front panel is chipped and inlaid with gold leaf.*

How to Make a Multiple Phone Connector

To make one of the multiple phone connectors shown in Figure 6, cut two pieces of thin brass strip to the dimensions given in the figure. The six small holes around the central hole are for the phone tips, and should fit them snugly. A ¾-inch piece of rubber cut from an inner tube is put between the two similar pieces of metal.

The whole assembly is held together by a small machine screw put through the central hole with a nut on the other side. The six outside holes are punched through the rubber, but are made smaller than the holes in the metal so the rubber will keep the phone tips from slipping out.

For a set that has binding posts, two of the phone connectors shown in Figure 6 at A should be made and one fastened on each binding post. This will allow the connection of as many as six pairs of head phones in parallel on the two binding posts.

For use with phone plugs, such as the Weston plug, multiple phone connectors like the one shown at Figure 6 at B should be made. The projecting end of the connector is rolled to the same size as the end of a phone tip, and is plugged in where the phone tip usually goes in a Weston or similar phone plug.
—CHARLES F. FELSTEAD (6CU), *Los Angeles, Cal.*

* *

What I Got on a Crystal

A FRIEND of mine gave me a home-made crystal set some time ago, saying that he couldn't get much on it. I hooked it up with a 100-foot antenna and received the station at Fort Worth, Texas, the first thing.

In time I logged 42 stations in all. Stations in New York City (1,500 miles away), Pittsburgh, Pa., and Denver, Col., were the farthest away on my list.

Even though we have a better receiver now, I still prize my crystal set. I am 15 years old.

—JIM CULLIPHER, *Hope, Ark.*

* *

How to Connect Old and New Dry Cells

IT is poor economy to connect new and old dry cells in parallel. This tends to ruin the good ones and will do the old ones no good. Little harm may be done if the two cells are connected in series, however. In a parallel connection the positive terminals are connected to positive and negative terminals to negative. In connecting in series, positive terminals are connected to negative and the end positive and negative terminals are connected to the output device that is being supplied with current.
—G. D. PRESTON, *El Centro, Cal.*

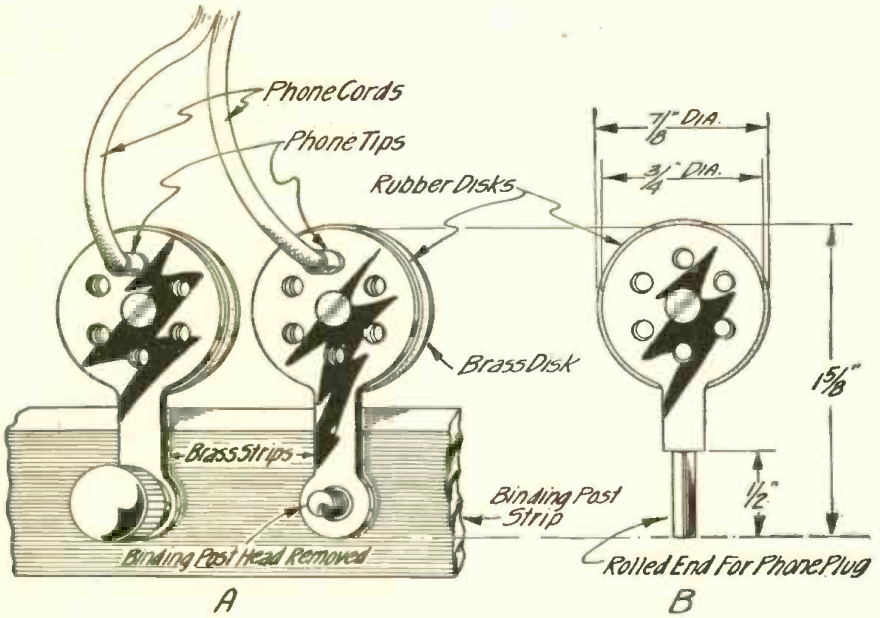
* *

How to Prevent Interference from a Swinging Antenna

How many listeners in realize that a swinging antenna with unsoldered joints will cause a vibration which may not only cause a noise in their own loud-speaker but in their neighbor's as well. The swinging may be so violent as to cause the antenna to come into contact with nails in the roof, rain gutters or other metal objects, thus causing untold trouble.

Have the antenna away from all obstructions, solder all joints, and pull tight enough to prevent excess swinging; this will eliminate interference from this source.

—G. D. PRESTON, *El Centro, Cal.*



CONNECTORS FOR SEVERAL HEADPHONES

FIGURE 6: *These drawings show how two simple connectors for use with a number of headphones are made; they also give all the necessary dimensions.*

The "Lowest-Down" Radio Reception on Earth

IMPERIAL Valley, California, has the unique distinction of being the "lowest down" radio receiving area in the world. The one receiver there is located on the shore of Salton Sea, the largest inland body of salt water in this country; this set is owned by "Captain" Davis, a character of the western desert. The surface of the water of this great inland ocean is 249 feet below sea level.

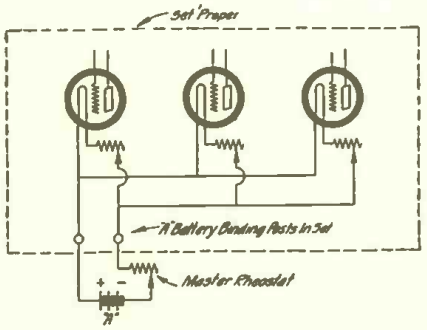
—G. D. PRESTON, *El Centro, Cal.*

* *

How to Connect a Master Rheostat in Your Receiver

No matter whether all the vaccum valves (or tubes) in a receiving set are of the same type or not, the rheostats in the filament leads of each of the valves will be found to give best results when adjusted to a certain value; and the proper value for each different one will be found to vary considerably. This is especially noticeable in a set using the old-style, gas-filled valves. When a separate filament rheostat is used for each valve—and to get the very best results out of the valves this is advisable—as the battery that supplies the filaments becomes weaker, all the rheostats have to be constantly readjusted if maximum results are desired. All this constant readjusting may be eliminated by connecting a master rheostat in one of the "A" battery leads to the set, as shown in the diagram. The master rheostat should have a current-carrying capacity a little greater than the total current taken by all the valves in the set. For a set using three C-301-a type valves, for instance, a six-ohm, one and one-half-ampere, master rheostat is of sufficient size. After the individual rheostats have each been adjusted to the correct value for the tube which they control, they may be left adjusted and the dropping of the "A" battery voltage as the battery becomes discharged may be compensated for by the master rheostat.

—CHARLES F. FELSTEAD (6CU), *Los Angeles, Cal.*



A MASTER RHEOSTAT

FIGURE 7: *This drawing shows how the rheostat should be connected in a receiver.*

Connection Loops Should Follow Screw Threads

WHEN wiring a receiver, care must be taken that the "loop" end of wire that goes round a binding post follows the screw thread. With few exceptions, all binding posts are threaded with a right-hand thread. Therefore the nuts are tightened to the left or clockwise. It is a good idea, when making a loop in the end of a wire which is to be placed on a binding post or a screw, to bend the loop in a clockwise direction or to the left so that the wire will not be twisted out from under the nut when it is tightened. Always make the loop in the same direction that the nut tightens in.

—G. D. PRESTON, *El Centro, Cal.*

* *

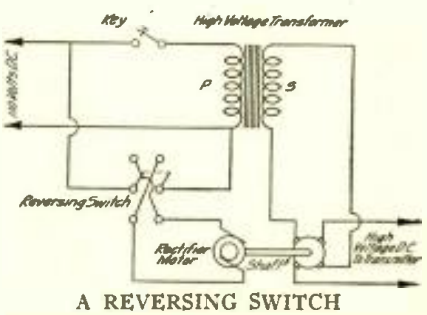
A Handy Reversing Switch for a Synchronous Rectifier

HERE is an idea for amateurs who use transformers and synchronous rectifiers to convert the alternating current in the house-lighting lines into high-voltage, direct current to supply to their tube transmitters.

If the synchronous rectifier is started on the wrong half of an alternation, the current from the rectifier will be of the wrong polarity. This will put the negative side of the line on the plate of the transmitting valve; and the set will not oscillate. Usually, when this happens, the amateur opens and closes the switch that connects the rectifier motor to the line until the rectifier comes up with the right polarity.

This method is not only extremely hard on the motor and the transmitting set, but it is also too slow and awkward for rapid transmission. By connecting a double-pole, double-throw (DPDT) switch in the primary circuit of the power transformer, as shown in Figure 8, the polarity of the high-voltage, direct current may be reversed without stopping the rectifier motor. When the polarity comes up wrong (the antenna ammeter and the plate milliammeter will not read when this happens), just throw the DPDT switch to the other side, and the polarity will immediately be righted.

—CHARLES F. FELSTEAD (6CU), *Los Angeles, Cal.*



A REVERSING SWITCH

FIGURE 8: *How the reversing switch should be installed for use with a synchronous rectifier on a transmitting set.*

Stations I Have Heard with My LC-26 Receiver

IN looking through my file of POPULAR RADIO I came across an item on page 554 of the October, 1926, issue, by a Mr. Tracy stating that he had logged 205 stations with his LC-26 receiver.

He wonders if this is an extraordinary result to be expected from an LC-26.

I don't think it is, as the following list of stations will indicate; all of these stations were received on the loudspeaker.

KDKA, KFAB, KFAE, KFBA, KFBD, KFDM, KFDX, KFEQ, KFH, KFLD, KFI, KFJF, KFJX, KFKU, KFKX, KFMQ, KFMX, KFNF, KFQB, KFRU, KFUL, KFUO, KFVE, KFVN, KFXF, KGO, KGW, KHJ, KFNG, KLDS, KMA, KMMJ, KMOX, KMTR, KNKV, KNX, KOA, KOCW, KOIL, KPO, KPRC, KSAC, KRLD, KWKH, KSBA, KSD, KSO, KSOE, KTHS, KTNT, KVOO, WAAD, KWWG, KWSC, KYW, WAAF, WAAW, WABC, WADC, WAHG, WAIU, WAMD, WAPI, WBAL, WBAP, WBBM, WBBZ, WBCN, WBZ, WCAD, WCAE, WCAP, WCBD, WCCO, WCEE, WCLS, WCX, WDAF, WCBS, WCRW, WCFL, WCK, WCBO, WDBE, WAED, WDBY, WDOD, WDZ, WEAF, WEAR, WEBC, WEBH, WEBK, WEBX, WEEI, WEMC, WENR, WEW, WFAA, WFAM, WFAV, WFBB, WFBM, WFBZ, WGES, WGBS, WGHB, WGHP, WGN, WGR, WGY, WHA, WHAD, WHAM, WHAS, WHAZ, WHB, WHBF, WHBM, WHK, WHN, WHO, WHT, WHST, WIBJ, WIBM, WIBO, WIBQ, WIBR, WIL, WIOD, WJAD, WJAN, WJAS, WJAX, WJAZ, WJBA, WKAN, WKAA, WJBB, WJBC, WJBL, WJBO, WJJD, WJR, WJY, WJZ, WKRC, WKVW, WLBL, WLIB, WLS, WLST, WLW, WLWL, WMAQ, WMCE, WMBB, WMBF, WMC, WMCE, WMXL, WKAQ, WOC, WOAI, WOAN, WOAW, WOI, WOK, WOO, WOQ, WOR, WORD, WOS, WOWO, WPG, WQJ, WRC, WRHM, WRLD, WRVA, WREO, WRM, WRR, WSAI, WSB, WSBC, WSKC, WSM, WSMB, WSL, WSWS, WSMK, WSOE, WSUI, WTAD, WTAM, WTAW, WTAX, WREC, WIBA, WJAM, CKY, CRNT, PWX, YBZ.

The above list totals up 208 stations which I think is sufficient to convince anyone that the LC-26 can secure the results.

I think two of the stations need mentioning in particular. KFUL, a ten-watt station at Galveston, and WREC, a ten-watt station at Coldwater, Miss., were brought in with no trouble at all. KFUL has since increased its power.

I think this will convince almost anyone that Mr. Tracy's record is nothing out of the ordinary and that anyone building a set of this type can expect the same results.

—W. R. BATTEN, *Peoria, Ill.*

* *

How to Care for Jacks and Switches

JACKS and switches are important and should be looked after occasionally. Try a plug in the jack and see that there is not too much play. A poor contact will cause a lot of trouble after the set has been in operation for some time. The springs should be tested in the same manner as a socket. There are several makes of jacks on the market, many of them good, but in a short jack special care should be paid to the springs. In switches made in the form of jacks the spring should be rather heavy to get a good contact. In the closed types, dependence will have to be placed on the name of the maker.

—G. D. PRESTON, *El Centro, Cal.*

In the World's Laboratories

(*Continued from page 471*)

In both cases, certain points on the water or on the rope will seem to be still. The motion of the wave passes through them, but the points themselves are not moved.

In an extremely crude manner, this gives some idea of the Schrödinger viewpoint of electrons. The real material of the universe is seen as ether waves, although the idea of the ether is not necessary. A mere universe of waves is enough. At certain places or under certain circumstances these waves create what seem to us persistent entities, like the apparently motionless points on the water-surface or along the rope. These are the electrons and protons. And these are also, it must not be forgotten, ourselves; for whatever theory we assume as to the nature of the proton and electron, we shall not escape the fact that it is of these mysterious entities that every human body and every particle of the material world are made.

Oxide Coatings Do Not Alter Wire Resistance

ANOTHER familiar radio delusion has been exploded. For years it has been imagined that the coating of oxide and other corrosion products which forms on wires of copper or brass when they are exposed to the air had a considerable effect in increasing the resistance of such tarnished wire to high-frequency electric currents. By the well-known "skin effect" it has been assumed that the electric current would tend to seek the outside layers of the metal in such wires. As these outside layers were converted more or less completely into the low-conductivity oxide or sulphide of copper, it was imagined that the passage of the current would be impeded notably. The use of silver wire in radio, prominently suggested a year or two ago, rested on the theory that the corrosion products of silver are conducting instead of non-conducting and that they would not so greatly impede the flow of current.

All this was a plausible theory. The only detail the matter with it is that it turns out to be untrue. It is so proved by the best test in the world.

Someone has tried it!

The someone is Dr. Wesley M. Roberds of the Blake Physical Laboratory, at the University of Kansas. It has been reported many times recently that the resistance of copper wires to currents in the neighborhood of 10,000 kilocycles (30 meters) does not correspond, when measured, to the values predicted by the theoretical formulas for high-frequency resistance and given in the tables in the textbooks. Dr. Roberds set out to test this discrepency. Working at 8600 kilocycles

and at 15,000 kilocyles, he tested number 16 copper wire and number 16 silver wire for the exact values of electric resistance. When precautions were taken to equalize the distribution of the current in all parts of the loop of wire that was being measured, the values found were sufficiently close to those predicted by the theory to constitute an adequate vindication of the latter.

The interesting observation on the lack of effect from oxide coatings Dr. Roberds made incidentally to his other investigation.* Resistance curves run on bright copper wire were found to coincide with curves run on the same wire after it had acquired a heavy coating of oxide. "If the acquisition of oxide by copper wire causes any change in resistance," Dr. Roberds reports, "it is very small."

* "The Resistance of Copper Wires at Very High Frequencies," by W. M. Roberds. *Physical Review* (Minneapolis), volume 29, pages 165-173 (January, 1927).

How Listeners Affect the Broadcast Wave

IT HAS long been a theoretical conclusion in radio that the presence near a broadcasting station of a large number of receiving antennas tuned to that station will affect the intensity of the broadcast wave. Each antenna abstracts, of course, a small fraction of the wave energy, and theory indicates that the antenna will withdraw this energy from a portion of space somewhat larger than the space which the antenna actually covers. A forest of tuned antennas, such as now decorates the housetops of virtually every city, ought to have a substantial effect in depleting the wave; an even greater effect than would be registered by an equal amount of metal in the form of such untuned objects as the frames of buildings or the like.

That this is actually the case is suggested by the recent interesting measurements made by the well-known British radio expert, Mr. R. H. Barfield, of the Radio Research Board of the Department of Scientific and Industrial Research.† Mr. Barfield's measurements were made on the wave from station 2LO, in London. Setting up his portable receiving apparatus in different locations on the outskirts of the city, Mr. Barfield discovered that when his receiving location was one characterized by the presence of many antennas in a line between it and 2LO's transmitter, the wave strength received fell off substantially. On the contrary, when the location was such that only a few receiving antennas were located between the transmitter and the receiver,

† "Effect of a Large Number of Receiving Aerials on the Propagation of Wireless Waves," by R. H. Barfield. *Nature* (London), volume 119, pages 195-196 (February 5, 1927).

the diminution of the wave strength was much less noticeable. It is assumed, probably correctly, that virtually all of the antennas in the city would be tuned to the one station, 2LO, as London possesses no other broadcasting station in ordinary use. It is probable that all of the Londoners are occupied with 2LO if their receivers are in use at all.

Obviously, these measurements are open to a certain criticism, through the possibility that some of the absorption may have been produced by buildings or other objects which may possess an exceptional absorbing capacity in one direction or another around 2LO. However, since London is built of rather uniform construction in all portions of the city, this conceivable error is probably much less important than would be the case were similar measurements attempted in an American city, where the steel frame construction (probably the largest seat of absorption) is commonly localized in certain definite areas.

Radio engineers have long hoped for some device by which the operating engineers of a broadcasting station could determine their moment-by-moment "load"; some device by which the number of listeners tuned in on that wave would be perceptible to the transmitting engineer. For example, if there went on the air some feature notably popular, that fact would be indicated immediately by a sudden increase of the "load." On the other hand, when a popular feature was succeeded by one less admired, the reaction of the audience would be obvious instantly by a fall in the number of listeners.

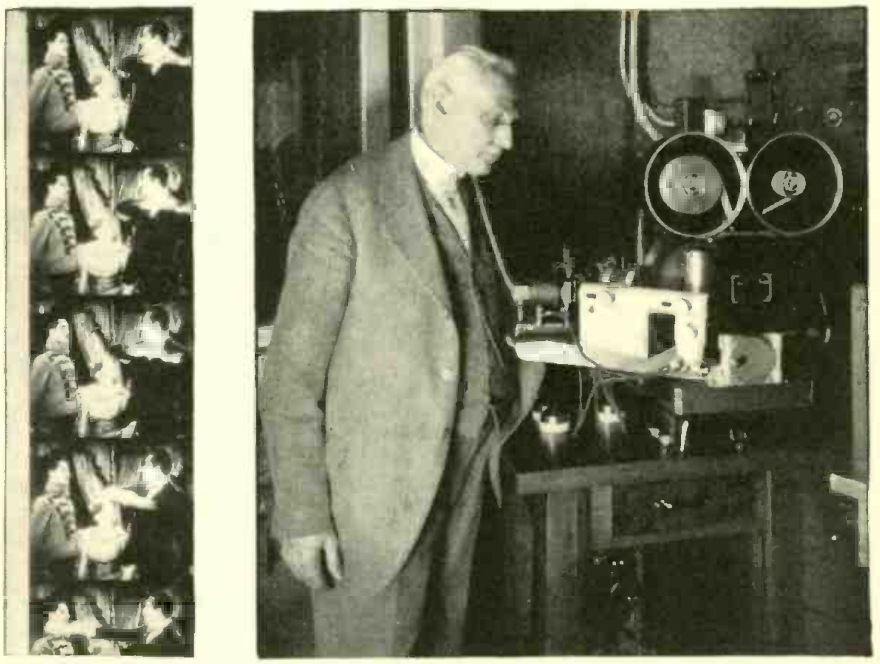
Although Mr. Barfield's results may be considered by optimists a step in this direction, they unfortunately do not indicate, for the moment at least, any method of devising this most desirable indicator for the attitude of the broadcaster's audience.

Two New Talking Movies

ON January 29th, at Schenectady, New York, the General Electric Company demonstrated a new system for the production and presentation of a talking motion picture. Less than a month later, on February 28, the Fox-Case Laboratory presented in New York City a similar demonstration of their new speaking motion picture system, the so-called "Movietone."* Thus there are added to the Vitaphone two new competitors providing the addicts to motion pictures with three separate and distinct systems by which it is expected to be possible to synchronize sight and sound.

The Vitaphone system (demonstrated some months ago and already described in this department) employs a sound record constructed on the basis of the phonograph. Wax discs are prepared exactly as in phonograph technique and

* Information from press releases distributed by the General Electric Company, Schenectady, N. Y., and the Fox-Case Studios, New York City, respectively.



General Electric

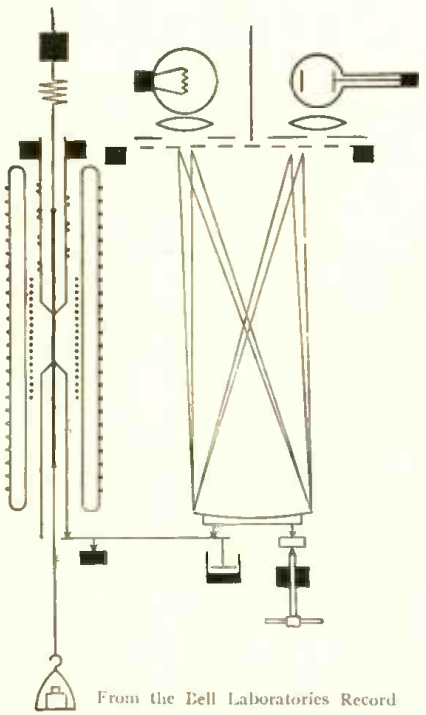
THE NEWEST "TALKING MOVIE" AND ITS INVENTOR

At the left is a reproduction of a strip of the new General Electric "talking motion picture," in which the record of the sound is photographed on the same strip of film with the moving picture itself. The sound record is represented by a number of very fine horizontal lines (too fine to be visible in this reproduction) forming a ladder-like strip at the left of the strip of motion picture. In front of Dr. Hoxie is the apparatus with which the sound record is photographed. The original photographic negatives, recording the sound and the motion picture, may be photographed separately and the records put together, later on, on the finished film.

are run off simultaneously with the picture, the proper synchronism of sight and sound being provided by the automatic control of speeds for the film projector and the phonographic device which turns the wax record.

The Vitaphone's two new competitors operate differently. In both instances the sound record is carried on the same film which carries the motion picture, a procedure used in the original phonofilm of Dr. Lee de Forest, first presented several years ago. In the system of the General Electric Company, the sound record is made on the film by means of a vibrating mirror, the motion of which responds to the vibrations of sound. By a combination of lenses and slits this vibrating mirror is made to photograph on the motion picture film a succession of dark and light lines. The number of these lines on each inch of film corresponds to the pitch of the tone being sounded. At the same time the light or dark intensity of the lines corresponds to the loudness of the sound.

Essentially the same result is obtained by the "Movietone" method, but the variation in the intensity and spacing of the light and dark lines, instead of being provided by the vibration of a mirror, is arranged for through the variation in the intensity of the light emitted by a special lamp, christened the "Aeo" lamp. In both instances the original sound vibrations which it is desired to record are converted into electric vibrations by means of microphones and amplifiers, in the usual fashion. These electric vibrations are then impressed either upon the vibrating mirror or upon the "Aeo" lamp, thus creating the variable images which are photographed. The system reproducing the sound record is essentially the same in the two instances, the variation of light from a lamp shining through the film being transmuted by a photoelectric cell into electric vibrations which are then amplified and reproduced by loudspeakers according to substantially standard technique.



From the Bell Laboratories Record

A PHOTOELECTRIC FOOT RULE

The arrangement of the apparatus used by Mr. P. P. Cioffi to measure changes of length to one part in four billion; at the lower right-hand side of the diagram is the mirror, which is tilted slightly by the expansion of the metal specimen held down by the weight at the left. The light ray from the lamp at the middle of the top of the diagram is thus reflected into the photoelectric cell at the upper right-hand corner, or to one side of it.

The new systems which photograph the sound record upon the same film with the motion picture record possess, it is obvious, the advantage of simplicity over the Vitaphone, which is compelled to use a combination of phonograph record with a separate motion picture film.

It is announced that the "Movietone" has been developed and will be operated in collaboration with the Vitaphone, with the Case Laboratories of Auburn, New York, and with the Bell Telephone Laboratories.

It is probably too soon to predict with any assurance just what rôle the talking motion picture is apt to play in the life of the world or just which of the various systems developed or proposed is likely to come out on top after the inevitable period of competition is finished. Judging by the demonstrations which have been given recently, and by the period of experience, now substantial in the case of the Vitaphone, any one of the three systems above described will probably be satisfactory for the needs of the theatrical industry and of the public. Many additional systems have been claimed or demonstrated, both here and abroad. It is probable that some of them will prove equally satisfactory with the three above described.

Thanks to the development of the radio art and its related arts and sciences, there is now no doubt that the great motion picture public of the world will be permitted to enjoy whatever combination of sight and sound their hearts may lead them to desire.

The World's Finest Foot Rule

THE newest of physical devices, the photoelectric cell, has been put to use recently in a new direction—as the essential element in a measuring device far more sensitive than any yet developed.

With this apparatus, the invention of Mr. P. P. Cioffi, of the Bell Telephone Laboratories, it is possible to measure the length of a specimen of metal within four parts in a billion, more than two

thousand times as accurate a measurement as has been possible by previous devices.*

The need of this accurate foot rule arose in connection with some investigations of what is called "magnetostriction"—a property of certain magnetic metals to expand or contract slightly when subjected to powerful magnetic forces.

These changes in length or volume are very minute. It is not apparent, for example, that a steel needle actually contracts or expands when its magnetism is altered. Nevertheless, careful scientific tests have shown this to be the case and the effect has come to have great scientific importance in connection with several modern theories dealing with magnetism.

In studying these effects accurately, Mr. Cioffi found it impossible to measure the changes in which he was interested by ordinary means. Accordingly, he devised an apparatus in which the very minute expansion or contraction of the metal bar produces a tilt in a small mirror mounted on a flexible support. The tilting of this mirror slightly alters the direction of a light ray reflected from its surface. This alteration in the ray is detected, in turn, by a sensitive photoelectric cell upon which the light ray falls. By an ingenious combination of narrow slits, lenses and other optical apparatus, Mr. Cioffi is able to convert the alteration of direction thus measured into a measure of the change of length of the metal specimens which he is examining.

It has been predicted frequently in this Department that the photoelectric cell, possessing the unusual property of being able to convert light rays into electricity, is apt to be as important an instrument in scientific investigation and in practical engineering as the vacuum tube itself has proved to be. Readers of this Department will remember the ingenious apparatus constructed under the direction of General Ferrié for the purpose of recording starlight. Mr. Cioffi's accomplishment is another document in this same direction.

* "Measuring to Four Parts in a Billion," by P. P. Cioffi. *Bell Laboratories Record* (the magazine printed for circulation to the staff of the Laboratories), volume 3, pages 201-204 (February, 1927).

Electrical Prospecting

THE many scientific devices which have recently come to the aid of the business of prospecting for mineral deposits cannot help but possess the greatest interest for everybody. There is no business more romantic than that of trying to find precious metals in the earth. While the lovers of the picturesque may regret the passing of the older prospector and his burro, the world will undoubtedly be better off when he has been superseded by the radio engineer with his transmitters and telephones and other machines for peering into the interior of the earth's crust.

Undoubtedly, the most successful method devised to date of accomplishing electrical prospecting is that worked out in Sweden for the examination of the earth to determine whether or not iron deposits are present.

Underwood & Underwood

LISTENING FOR BURIED TREASURE IN THE GROUND

In this picture Mr. Hans Lundberg (at the center) is prospecting for ore deposits in a Swedish mineral district, using modern electric methods. Electric currents similar to the audio-frequency currents of radio are fed into the rock strata suspected of containing mineral deposits. The directions in which these currents pass through the rocks are then detected by radio-telephonic methods, thus indicating where mineral deposits may be expected.

YOUR RADIO PROBLEMS SOLVED

POPULAR RADIO maintains for the benefit of its readers a Technical Service Bureau and Laboratory, which will, without charge, answer by personal letter any question or problem submitted by a subscriber. **This service is, however, also available to readers, other than subscribers, at the very nominal rate of $1.00 the inquiry.**

In writing please confine your questions to one general subject, writing on one side of the paper only, and enclose a self-addressed and stamped envelope.

It is possible that your individual problem has been covered in an issue of POPULAR RADIO, and so as an aid to you we endeavor to keep a supply of back numbers in stock. The condensed index below gives a few of the subjects that have appeared recently: look this list over and if the information you want is covered, we will be pleased to supply back numbers at 35c. a copy.

May, 1926
—How to Draw Up Your Own "Tuning Graphs."
—How to Build the Improved Raytheon Power-pack.
—How to Build an Antenna Mast for $15.00.
—Fifteen Ways to Reduce Static.
—Do Your Coils Broadcast?

June, 1926
—How to Build the New Home Receiver.
—How to Put Up a Good Outdoor Antenna.
—How to Get the Most Out of Your Ready-made Receiver.
—Audio-frequency Amplification. How to Get it Without Distortion.
—Four New Combinations of Units for Assembling the Raytheon Power-pack.

July, 1926
—How to Get the Best Reception in Summer.
—The Best Crystal Set for $13.00.
—How to Build the Newest Portable "Town and Country" Receiver.
—Four New Combinations of Units for Assembling the Raytheon Power-pack.
—How to Get the Most Out of Your S-C Receiver.

August, 1926
—A New Method of Using Harmonics for Determining Frequencies.
—POPULAR RADIO Circuits.
—How to Build the Improved Browning-Drake Receiver.
—How to Pick Out a Loudspeaker.
—How to Get the Most Out of Your "Town and Country" Receiver.
—Three Vacuum Tubes in One.

September, 1926
—Foretelling Radio Reception from the Weather Map.
—How to Build an Impedance-coupled Amplifier.
—A Radiant Crystal Pilot.
—POPULAR RADIO Circuits.
—How to Simplify Your Set with Automatic Filament Controls.
—Inside Information on New Radio Receivers.
—How to Wire Your House for Radio.

October, 1926
—How to Build the New LC-27 Receiver.
—The Radio Road Hog.
—POPULAR RADIO Circuits.
—Sets That Earn Incomes.
—Inside Information on New Radio Receivers.
—Why Signals Fade.

November, 1926
—How to Build the LC-Senior Power-pack.
—Waves and Wavelengths.
—POPULAR RADIO Circuits.
—How to Select Your Radio Parts.
—How to Patent Your Radio Inventions.
—How to Solder.

December, 1926
—Uncle Sam's New Short-Wave Net.
—How Circuit Resistance Affects Selectivity.
—POPULAR RADIO Circuits.
—How to Build the LC-Intermediate Power-pack.
—Inside Information on New Radio Receivers.

January, 1927
—How to Build the New KH-27 Receiver.
—To Start and Stop Your Set Automatically.
—POPULAR RADIO Circuits.
—The Quack Doctors of Radio.
—How to Build the LC-Junior Power-pack.

February, 1927
—The Coming of the "RADIO UNIVERSITY."
—How to Get Quality Amplification.
—How to Build and Use a Portable Test-Board.
—How to Assemble the All-Amax Senior Three-tube Reflex Receiver.
—What's New in Radio.

March, 1927
—How to Build the Univalve Receiver.
—POPULAR RADIO Circuits.
—How to Increase the Range of Ammeters and Voltmeters.
—How to Build Your Own 36-inch Cone Loudspeaker.
—What's New in Radio.

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Model S-25 Table only **32.50**
Model S-20-25 Combination **60.00**

Made of high quality, figured walnut plywood. Takes 8" x 26" panel. 25 degree slope. Drop front, and piano hinged top. Baseboard included with each cabinet.

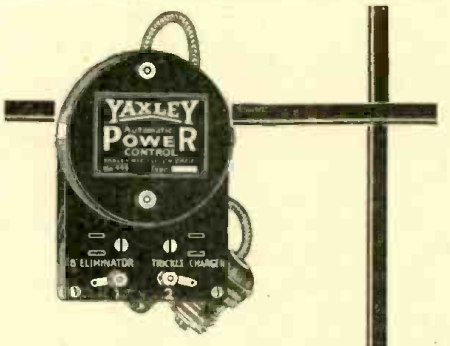
The model S-25 table has 16" x 31" figured walnut top, and is very desirable for use with any table cabinet.

WALNUT INFRADYNE CABINETS .. **$26.00**
for 7" x 30" panel and 10" x 34" baseboard.

WALNUT HAMMARLUND-ROBERTS HI-Q CABINETS **$17.50**
for 7" x 21" panel, 12" deep. Chest type, given beautiful high-light finish.

Write for folder showing complete line of consoles, tables and cabinets, and dealers' prices.

CORBETT CABINET MFG. COMPANY
St. Marys, Pa.



Automatic Power Control

Here is the way to control the switching of your B eliminator and trickle charger or either automatically.

When you turn the switch on your set, the Automatic Power Control switches on the B eliminator and cuts out the trickle charger or does either. When you turn the set off, the Power Control is working automatically, surely and without fail turning off the B eliminator and the trickle charger on.

No. 444 Automatic Power Control, Series Type—for use with sets having tubes with a current draw equal to or greater than 6 U. V.-199 type of tubes. Each..... **$5.00**

At your dealer's. If he cannot supply you, send his name with your order to

YAXLEY MFG. CO.
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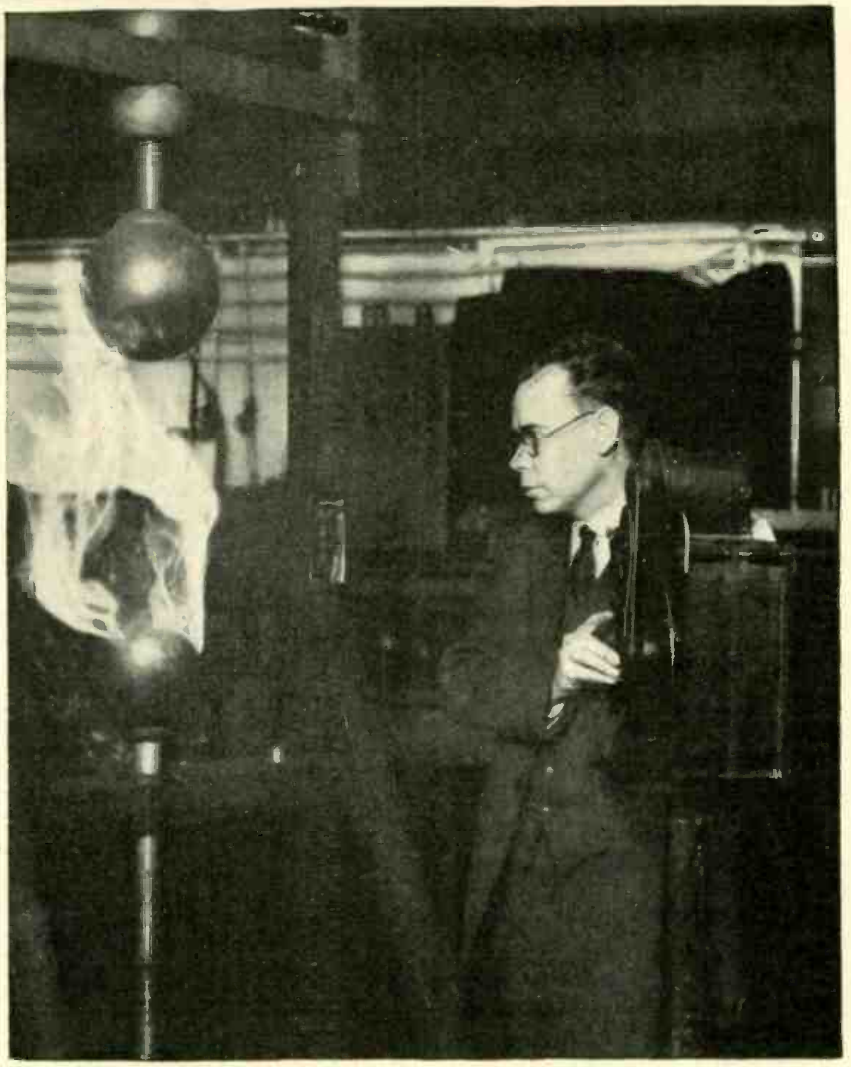
APPROVED RADIO PRODUCTS



Westinghouse

HE TAKES THE PORTRAIT OF ARTIFICIAL LIGHTNING

Mr. J. W. Legg is shown with his new high-speed photographic camera, which will make twenty-two separate photographs of a lightning flash, each in less than one two-thousandth of a second. In the picture the arc passing between the large high-voltage terminals at the left is being photographed by Mr. Legg's camera. Eleven pairs of lenses are used, being opened in succession by a high-speed shutter. The resulting photograph is like that shown in a sample plate reproduced on the following page.

The essential of the method is the use of alternating electric currents, of audio-frequency, which are fed into the ground at selected points and then detected by one method or another at points a short distance away. These currents tend, of course, to follow paths in the ground, which paths have higher conductivity than the general rocks of the earth.

Thus the currents will follow along veins or ore masses which are charged with conducting materials, including the minerals of iron. The details of recent results and methods in this direction were described by Mr. Hans Lundberg, of New York City, before a recent meeting of the American Institute of Mining and Metallurgical Engineers, and have now been published by that Institute.* Mr. Lundberg's paper is an informative description of the subject.

*"Electrical and Electromagnetic Prospecting," by Hans Lundberg. *Transactions of the American Institute of Mining and Metallurgical Engineers* (New York City), volume 74, pages 3-28 (1926).

"Corkscrew" Lightning

ALTHOUGH lightning is probably the oldest natural phenomenon observed by man (for who can doubt that even the cavemen watched it and feared it?) it is surprisingly ill understood. That it consists of vast electric discharges from cloud to cloud or between the clouds and the earth there can be no doubt. The accompaniment of static, all too familiar to radio fans, is a sufficient proof of that.

But concerning the exact nature of the flash, its causes, its habits as to paths through the air, its preferred landing places, and similar matters, we remain in ignorance too dense to be enjoyed with equanimity.

That is what gives such great interest to the recent discovery of Mr. J. W. Legg, of the Westinghouse Electric and Manufacturing Company, who has made a new high-speed photographic camera and has used it to prove that flashes of artificial lightning, produced

from the high-voltage transformers in the Westinghouse laboratories, proceed through the air in spirals even more twisted than a corkscrew, and not in straight lines.*

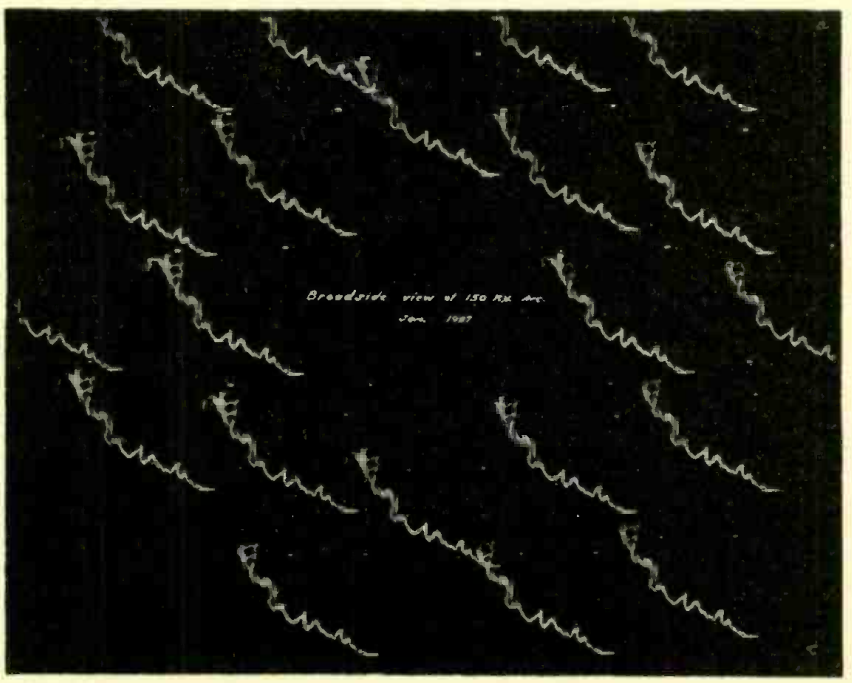
Mr. Legg's camera has twenty-two lenses, set in the front of a box which contains the sensitive photographic plate. In front of these lenses rotates a high-speed shutter which exposes each of the lenses in turn and for intervals which can be made as short as one twenty-six-hundredth of a second. Twenty-two separate pictures of a lightning flash or other object are made on the same plate, but eleven of these are in pairs, the two exposures of each pair being made simultaneously and on opposite sides of the plate. This makes each of these pairs stereoscopic. By cutting out the corresponding halves of each stereogram from the opposite sides of a print and mounting these in a special stereoscope Mr. Legg obtains a view of the flash which shows all three dimensions, looking "solid" instead of flat. This is how it was determined that the lightning moves in spirals, not in straight lines.

The camera was originally developed, not for tests of lightning, either artificial or natural, but for the study of arcs and sparks about electric machinery. When an arc forms across the terminals of a dynamo or motor, or in any other place around such machines, serious damage is apt to result. It is difficult to determine by mere inspection what actually happens in such instances of breakdown. The sparks occur far too quickly to be seen by the eye. After the arc is over essential parts of the machine or apparatus are likely to have been melted and to be indistinguishable. Purposeful breakdowns, artificially produced and photographed by some very high-speed camera, like that devised by Mr. Legg, are expected to yield much information of value in designing machines of this type.

Although the device does not appear to have been so used as yet, it is probable that it would be of similar service in studying the formation of arcs around radio apparatus or in the examination of sudden glows in radio tubes and of other radio phenomena the time-scale of which is extremely short. Especially in transmitters, such a high-speed photographic record of puzzling things that happen ought to be interesting and possibly important.

So far as lightning is concerned, the most interesting fact which emerges from Mr. Legg's proof of its corkscrew nature is the fact that it does not move in direct paths, determined by mere difference of potential or self-ionized by the spreading light wave which is emitted by the beginning of the spark and which undoubtedly precedes the spark. The real path, as disclosed by

* The camera and the spiral lightning flashes are described in a press release of the Westinghouse Electric and Manufacturing Company, of February 3, 1927; there is a more complete description by Waldemar Kaempfert in the *New York Times*, February 27, 1927, page 5 of the Special Features Section. POPULAR RADIO is indebted to the Westinghouse Electric and Manufacturing Company and to Mr. Legg for some further information.



Westinghouse

WHAT PORTRAITS OF ARTIFICIAL LIGHTNING ARE LIKE

Here is a sample set of photographs of an electric arc, produced by a voltage of 150,000 volts. Each of the images on the plates represents one instantaneous photograph made by Mr. Legg's high-speed camera. Eleven of these images are in pairs, exposed at the same instant, but on opposite sides of the camera; these paired images are, therefore, stereoscopic.

Westinghouse

EXAMINING A "SOLIDIFIED" LIGHTNING FLASH

The new high-speed camera perfected by Mr. J. W. Legg permits the making of stereoscopic photographs of an electric arc or of a flash of lightning. By mounting two such stereoscopic photographs in front of the lenses of a stereoscope, it is possible to view the portrait of the lightning flash as though it were solid. This is how Mr. Legg has discovered that the flashes of artificial lightning move in corkscrew fashion rather than in straight lines or in the zigzag lines by which lightning is conventionally represented.

Mr. Legg's stereograms, is perhaps determined by variable ionization of the air, making the true path of least electric resistance a winding corkscrew instead of some more regular curve. But all this is uncertain. What is needed, quite obviously, is some additional observation; including, if possible, the photography in the same fashion of flashes of real lightning in real storms. The Westinghouse Company promises that as much of this additional work as possible will be carried out.

The possible effects of ionization of the air on lightning, and the general desirability of investigating the whole matter further make it a good time to recall the interesting suggestion made some months ago by the veteran English physicist, Dr. C. V. Boys. Dr. Boys suggests that we should tempt lightning to come down when and where we want it to by shooting at it with a rocket.*

The hot gases escaping from the rear of the rocket would consist, Dr. Boys points out, of highly ionized materials. If it is really the ionization of the air which controls the path of lightning, the discharge of a good-sized rocket upward into a highly-charged thundercloud should be followed promptly by a stroke of lightning downward along the rocket's flight. Naturally, the experimenter would not care to touch off the rocket with a match. The danger of the cloud retaliating too quickly for successful flight away from the point of peril would be too great. But it would be possible, Dr. Boys suggests, to lie down on the ground at some distance and pull a string which would ignite the rocket.

The lightning season is approaching. It is to be hoped that some adventurous experimenter will put the matter to the test. If anyone does, both Dr. Boys and the Editor of this Department will be glad to hear of the results.

There is one precaution; the experiment should be tried at a distance from any buildings or inflammable materials. The fire department has enough trouble with natural lightning, without anyone going to the trouble of bringing some down on purpose to plague it.

* "Progressive Lightning," by C. V. Boys. *Nature* (London), volume 118, pages 749-750 (November 20, 1926).

How to Build the Varion Power-Pack

(Continued from page 454)

and when it is finished the choke coil itself can be replaced and wired into the circuit.

In wiring up the transformer, A, be sure that the tagged leads are connected to the proper numbers, as shown in the picture wiring diagram in Figure 1.

A re-check of the wiring may be made by comparing the connections made on the unit with the connections shown in the schematic diagram in Figure 3.

When the wiring on the unit itself has been done, the extension leads to the switch, N, and attachment plug, M, and the receptacle, P, should be completed.

The wiring work is then complete and the top part of the metal case, Q, may be placed over and fastened with screws to the lower part of the case so that all of the parts are protected.

The power-pack may be used on 110-volts, 50 to 60 cycles. The valves to be used in the socket, F, are of the full-wave gaseous type, as mentioned earlier in the article. The rectifier valve should be inserted in the socket, F, and the plug, M, attached to the lighting lines, first being sure that the switch, N, is turned off before the unit is connected to a receiver.

The connections to the receiver should be made with a battery cable and will depend on the type of receiver that the unit is used with. As the binding posts are all marked with the voltages that will be obtained, this should be a simple job to do.

The detector-plate voltage may be varied by rotating the knob on the potentiometer, J2, and the "C" bias to the last tube in the set may be varied by rotating the knob on the potentiometer, J1. No other controls or adjustments are necessary. The unit should work satisfactorily with any receiver, provided the proper connections are made so that the voltages designated by the manufacturer of the set are obtained.

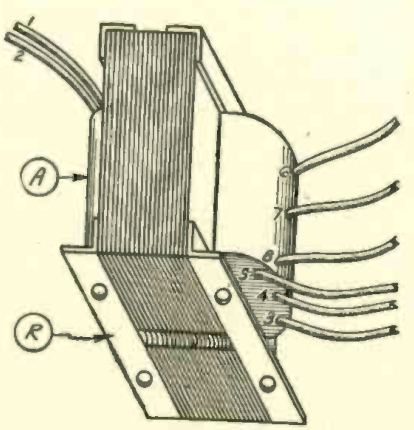


FIGURE 8: *This drawing shows how the transformer leads are numbered and indicates the proper way to fasten the brass brackets to the core.*

How to Eliminate Interference With the Pre-Selector

(Continued from page 443)

is connected direct to the receiver and the Pre-selector is cut out of the circuit.

Operation of the Pre-selector

After the Pre-selector has been connected to the receiver, batteries and antenna it is ready to be put into operation. First see that the rotors of the two plug-in coils are turned so that their windings are parallel with those of the stators. Also see that the midget condenser on the panel is set with its plates half-meshed.

Now set the tuning dials of the receiver to some wavelength *above* the broadcasting band. The tuned circuits of the receiver will function as fixed tuned circuits after the Pre-selector is put into operation. It is important that these circuits be tuned to exact resonance with one another. Probably the best way to accomplish this is to set them at the highest wavelength at which the receiver has been logged, say the wavelength of KYW if this station has been logged on the receiver. After the Pre-selector is functioning, this setting may be changed to a higher wavelength, following the directions given below.

Next, turn the receiver "on" and turn the rheostat of the Pre-selector up (¼ way if the filament supply is 6 volts, or about ¾ way if the "A" supply is 4½ volts). Then, tune in a station on the two dials of the Pre-selector.

Wave-length	*Left-hand Dial*	*Right-hand Dial*
235	26.5	27
244	28	28
263	32	30
273	34	33
300	40	42.5
309	42	45
330	46	51
360	52.5	60.5
391	58.5	69.5
431	64.5	79
447	66	80
475	70	87.5
492	71.5	92
526	74.5	96

The dial settings shown in the tabulation above will give an approximate idea of how the settings run, but will not necessarily be accurate for all Pre-selectors because the setting of the left-hand dial of the Pre-selector will vary with the wavelength to which the receiver is tuned.

When a station is heard, it should be tuned in as loud as possible on the two dials of the Pre-selector. Then turn back to the receiver and readjust its dials for maximum reception. The receiver circuits will then be in resonance.

The receiver may now be adjusted for a higher wavelength. Turn the left-hand dial of the Pre-selector a fraction of a degree higher until the station can just barely be heard. Then again readjust the receiver dials for maximum response. Continue this manipulation until the receiver is adjusted for the highest wavelength to which it is capable of tuning. Thereafter the tuning controls of the receiver require no further attention. A little experimentation will be needed to determine the best settings of the rotors of the coils, the rheostat, and the midget condenser in the Pre-selector. Usually the best setting of the rotors of the coils will be that with the rotor windings at an angle of about 45 degrees from the stator windings. The rheostat should be set at the lowest point at which maximum volume can be obtained. This will be at about ¼ turn of the knob from the "off" position.

The adjustment of the midget condenser is only important in tuning in distant stations. For all ordinary reception it may be set at one place and left there. In experimenting with the setting of the midget condenser it is important to remember that any considerable adjustment here will require a readjustment of the right-hand tuning dial of the Pre-selector.

If the receiver has two or more antenna terminals, it is advisable to try connecting the Pre-selector to each of them in turn. Usually results will be best if the output wire from the Pre-selector is connected to the "short antenna" binding post of the receiver. In making these tests it will probably be found necessary to readjust slightly the dial which tunes the antenna circuit of the receiver.

In putting the Pre-selector into operation it is well to remember that it is an extremely sharp tuning device, particularly on the left-hand dial. Even the most powerful local stations may be tuned out by a slight movement of this dial. The right-hand dial is also quite critical in tuning (although this varies somewhat with the position of the rotor of the right-hand coil), so that a station will not be heard unless both dials are quite accurately adjusted to the proper setting for the station tuned in. To locate stations for the first time it is advisable to proceed by setting the right-hand dial at 40 and then slowly rotating the left-hand dial between 20 and 60. If nothing is heard, move the right-hand dial to 45 and rotate the left-hand dial between 25 and 65, etc.

If the frequency changer tube of the Pre-selector oscillates (this condition is indicated by numerous whistles as the right-hand dial is turned) to such a degree that the midget condenser does not offer sufficient control, the remedy will be found in replacing fixed condenser C5 with one of higher capacity, say .00015 or .0002 mfd. The use of

TO THE RADIO INDUSTRY

An announcement of interest

THE Ward Leonard Electric Company has built nothing but resistance apparatus for more than 35 years.

Today it offers the Vitrohm Resistor as the solution to your radio resistor problem.

Ward Leonard wants the business of manufacturers who are giving to the public good apparatus that will work and keep on working.

The Vitrohm Resistor is a wire-wound, vitreous enamelled unit that will not alter in value during service nor disintegrate under constant use and heavy loads.

Ward Leonard has made this type of Vitrohm Unit for more than 35 years, and as is usually the case, skill and methods have improved with practice.

Ward Leonard maintains a staff of trained engineers and technicians with all of the resources of well equipped laboratories to aid them in their work. For more than 35 years they have endeavored to find something "good enough" to replace the vitreous enamelled wire-wound Vitrohm Unit. And after 35 years they are still trying, but no equivalent for Vitrohm has been found.

The Radio Industry has become a large, though youthful, factor in the Electrical Industry. It is finding that this is an industry which ever demands the best. In the Electrical Industry "best" in resistors means Vitrohm.

To the radio manufacturer who wants the best, to the man who insists that everything he buys be dependable in quality and sure in production, we say, "Come to our plant. See us work. See our facilities and learn why only Ward Leonard can give you the Vitrohm Resistor".

The prices of Vitrohm Resistors for radio are not high. While they cannot enter into price competition with molded "mud" or makeshift units, they are cheaper on a dollar basis than any other unit which even approximates their performance. And they are Vitrohm *dependable* Resistors.

"RESISTOR SPECIALISTS FOR MORE THAN 35 YEARS"

Ward Leonard Electric Company

37-41 South Street Mount Vernon, N. Y.

7235-2

.00025 mfd. capacity here will usually prevent oscillation entirely and for that reason may be preferred by some builders for the set-up.

Operation of the Pre-selector with a Loop Antenna

A receiver that employs two stages of tuned-radio-frequency amplification will give good results when operated with a loop, in conjunction with the Pre-selector. With the experimental model of the Pre-selector a loop antenna has brought in stations up to 400 miles distant, when used in a poor location, with a number of different standard makes of 5-tube receivers.

To connect the loop, disconnect the antenna from the Pre-selector and remove the right-hand coil (looking from the front) from its socket. One end of the loop is then connected to terminal No. 3 of this coil socket. The other end of the loop is connected to terminal No. 6 and the center tap of the loop is connected to terminal No. 4 or No. 5 (these are connected together in the wiring of the Pre-selector).

If the loop does not have a center tap, it is a simple matter to scrape the insulation off a spot at about the middle of the loop winding and to attach the connecting wire from the Pre-selector at this point. It is advisable to keep the three leads from the loop to the Pre-selector as short as possible, and to bring them out at the rear of the Pre-selector unit so as to keep them well away from the body of the operator. The tuning process is accomplished in the same manner as when an antenna is employed.

The Latest Experiments with Television and "Black Light"

(*Continued from page 451*)

and had a bad effect on the eyes of the sitters. So I went to the other end of the spectrum and tried infra-red rays. By means of these latter rays I was able ultimately to dispense altogether with visible light, with the somewhat remarkable result that it was possible to *see in total darkness!*

This is perhaps the most spectacular development of all in connection with television, and it has an uncanny and impressive effect upon visitors to a demonstration. The sitter goes into the transmitting studio and is immediately enveloped in complete darkness. Literally, he cannot see his hand in front of his face, but his friends at the receiving end are able to see him put his hand up in an effort to see it.

On December 30th, 1926, a demonstration was given to members of the Royal Institution and a description of what was shown appeared in *Nature* on February 5th, 1927; the account was written by a witness, Dr. Alexander Russell, F. R. S., Principal of Faraday House, London.

It is unwise to prophesy what may be the full extent of the importance of this development in warfare. It may even render it possible to follow the movements of an enemy when he believes himself to be under cover of darkness.

Darkness, the great cloak for military operations, will no longer give so much security. The attacking party creeping forward for a surprise attack on a pitch-black night may be swept by an invisible searchlight, and watched on the television receiving screen of the defenders. Allowed to come well within range and in spite of the apparent protection of darkness and the absence of visible searchlights, they may find themselves overwhelmed and decimated by well-directed gunfire.

It is to be hoped, however, that other uses may be found in peace time for this latest development of television. The fact that infra-red rays possess great fog-penetrating powers opens up possibilities for their use in connection with naval warfare and commercial navigation.

The power of light to penetrate fog varies roughly as the fourth power of the wavelength, so that red light penetrates some 16 times better than blue light, and infra-red light some 16 to 20 times better still.

Red light has already come widely into use in aerodromes, and for other purposes where fog penetrating properties are of importance. This new application of television renders possible the use of infra-red rays with their great penetrative powers.

These invisible rays are employed in exactly the same way as ordinary visible light. That is to say, the rays are allowed to shine on the sitter, and the "light" reflected from his face is passed on to the infra-red "televisor."

As to the distance over which television impulses may be transmitted, any circuit which will transmit clear speech, either by wire or by wireless, is suitable. Given any such circuit, however long, it is possible to send television impulses over it.

That being so, and as we now have direct telephonic communication between London and New York by a combined wire and wireless link, we may, perhaps, look forward with confidence to the day when New Yorkers will be able to see what is going on over 3,000 miles away in the great British metropolis, just as they are now able to hear.

The enormous possibilities of television stir the imagination, and open up long vistas crowded with marvelous speculative visions and achievements surpassing even those which the fabled Magic Carpet made possible.

Some of the Extraordinary New Tubes

(*Continued from page 460*)

or, if the valve is arranged to oscillate in its normal condition, the applied speech will automatically modulate the CW output and act as a radio telephone transmitter.

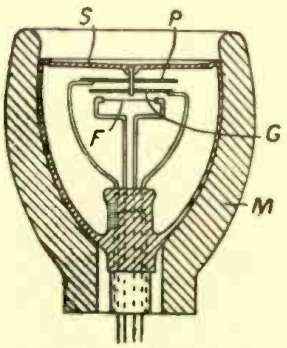
A Tube That Contains a Resistance-Capacity Coupling

Another outstanding development in unusual thermionic vacuum value design is credited to Dr. S. Loewe of Berlin, whose devices have already been described in these pages. He has succeeded in designing a resistance-capacity coupling of such minute dimensions that instead of applying it to the circuit externally, he is able to incorporate it within the bulb of his valve. This valve, also, has two sets of electrodes, so that the complete device acts as a two-stage low-frequency amplifier, and is all included within a single small bulb.

Such a tube will give the same degree of amplification as two ordinary resistance-capacity-coupled low-frequency amplifier stages, externally coupled in the usual manner; and, owing to the elimination of parasitic capacities and long external leads, it is particularly suitable for use as a high-frequency amplifier, particularly on short waves, although the high-frequency amplification obtainable by means of resistance-capacity coupling is not as great as in a tuned amplifier.

From the few examples of unusual tube design here mentioned it is apparent that we have by no means exhausted the possibilities of thermionic vacuum valves.

It is evident, however, that if we can once get out of the rut, there are almost limitless possibilities for radical changes to be made in our methods of applying the principle of the thermionic vacuum valve—changes which will permit us to employ the principle for our special requirements more economically or more efficiently than at present.



A TUBE THAT ACTS AS A MICROPHONE

FIGURE 5: *Notice that the diaphragm, S, vibrates, in this way changing the distance between the electrodes.*

BROADCASTS

Transmission Tests on Sets Ten Miles in the Air

JUST what radio reception may be when the signals are transmitted from a great height—possibly ten miles—may be determined by the experiments of two French aeronautical experts this spring. They have arranged to send up a small balloon, which will carry with it a very light radio set that will automatically send out signals. From a like set signals will be sent at the same time from the ground. The signals from both sources will be carefully recorded and compared with one another.

From the experiment it is hoped to obtain information regarding the effect of atmospheric conditions on the transmission of radio waves that will aid both aviation and radio.

* *

An "Automatic" Radio Operator

A RADIO signaling device to take the place in emergency of a ship's operator is the latest contribution to the radio art. It has been developed by Lieut. Pedro C. Andux of the Cuban Navy. Lieut. Andux says that the tests of his invention show that anyone can manipulate the device and that it provides ships with a means of sending distress signals without the necessity for a trained operator. The entire radio set, with batteries and automatic signaling device, weighs about fifty pounds.

* *

$1,000,000 Paid on a Signature Sent by Radio

ONE of the practical services that radio is rendering to business was told in a recent news item in the New York *Times*, which reported that payment of $1,000,000 had been made on notes presented at the Bankers' Trust Co. of London on March 1. The Mellon National Bank of Pittsburgh advised payment for its client, but it developed that the London organization was without a specimen of the signature on the note.

"There was no time to cable or mail the signature," the vice-president of the Mellon bank said. "Only one thing was left—wireless. We had the President and Treasurer of the business house we represented sign cards, which were sent to New York, from where they were sent yesterday across the ocean."

The Bankers' Trust Company at London received the signatures, compared them with the note and paid the $1,000,000, charging the Mellon account.

* *

A New Record in Chain Broadcasting

THE largest chain of radio stations ever joined together for simultaneous transmission of any event were linked February 22d by the National Broadcasting Company to carry the voice of President Coolidge from the House of Representatives in Washington to the radio audience of the United States. Forty-two stations were included in this record event.

* *

A Unique Contest for "Program Property Rights"

THE long expected fight over the property rights of programs broadcast broke recently when station WEAF of New York protested the action of the St. Paul Program Service Company in "tapping" or rebroadcasting WEAF programs by means of telephone wires. The company picked up the programs from WCCO, one of the WEAF chain stations and sent them out to over 1,000 subscribers whom they charged $5 a month for a loudspeaker connection with the telephone switchboard. Although the Program Company has discontinued the rebroadcasting of WEAF programs as a result of this protest, they are continuing to "tap" programs from other stations.

* *

A Radio Magazine for the Blind

A FRENCH publisher is now issuing a radio magazine for the blind. It is reported that the publication is being printed in Braille raised type.

A Test of Telepathy by Radio

WHEN the Society of Psychical Research in London recently undertook to conduct a practical test in thought transference from a broadcast station "to determine if it would be possible for persons cut off from communication with the outside world to get their thoughts across to persons listening in on radio sets," it was deluged with 25,000 letters from radio fans who participated in the experiment. These replies are now being studied; when this task is completed, Sir Oliver Lodge, who conducted the test, will report his findings in a speial article for POPULAR RADIO.

* *

"Bootlegging" Radio Messages

RADIO is not unknown to gamblers as a tool for carrying on their illicit activities. But it has remained for an ingenious fan in New Orleans to "bootleg" a small portable transmitting set into the Jefferson Park race course, presumably for the purpose of sending out information or the racing results to associates who could take advantage of the information. He was taken in custody by Federal authorities on the charge of violation of the law prohibiting broadcasting of public events without a license.

Incidentally, the winner of the last race was named Radio.

* *

Radio Saves the Whaling Industry

RADIO has now become a part of the equipment of the present-day whalers in the waters around the South Polar Continent. That part of the ocean is now the world's great whaling ground, as these animals have been virtually exterminated in the more accessible oceans of the northern hemisphere. In the days when New England held supremacy in whaling, the signaling of the presence of a victim was accomplished only by such familiar short-range means as flags or guns; nowadays the South Atlantic whalers carry radio sets. The movements of the whales may be reported to other ships of the fleet as far away as a thousand miles. The whaling fleets now provide a single ship for the rendering of the oil and the preparation of the flesh for cattle food, fertilizer or other salable products; this ship also carries radio apparatus and may be summoned by the faster ships of the killing fleet to any part of the ocean where a kill has been made. Were it not for the use of those and other modern scientific devices it is doubtful if the whaling industry could survive at all, now that other materials have taken away the former high-priced markets for the whale oil and other products.

A Unique Broadcast Program for Charity

NEARLY 5,000 radio fans attended the benefit performance staged by the Chicago Broadcasters Association at Rainbow Gardens, Chicago, on February 28. Artists from the eleven stations that make up the association appeared and individually put on the acts which have endeared them to the listeners. The proceeds of the benefit are to be expended in continuing the charity work among broadcast artists. In addition to caring for radio artists in need of assistance, the association has helped nearly a score of needy musicians with sums varying in amount from $100 to $150 dollars each.

* *

Why This Will Be a Good Summer for Radio

ACCORDING to all predictions, this summer will be "the best summer radio has ever had."

In the first place, summer static has been dealt a staggering blow by the general increase in power. Formerly almost any kind of radio reception was hopeless during the summer months, but it was found by increasing the power that much could be done to overcome the discordant element.

In the second place, so rapid has been the increase in the number of large stations that almost every principal city now has one, and the residents there and in the suburbs can now depend upon that station at least. There are perhaps no more pesky summer conditions in any two cities in the country than Washington, D. C., and St. Louis, for instance, yet in both of these cities radio listeners are now as well served with good programs in the summer as the winter, and so far as their own city station is concerned they hardly know what static is. And this example could be repeated in many other parts of the country.

In the third place, the fans this summer may expect additional relief in the way of clearing up and stabilizing air conditions by the new radio commission.

* *

1,000,000 Farmers Listen In on Broadcast Market Reports

NINETY-FIVE radio stations in 35 States now are broadcasting Government crop estimates and market reports over the country, as shown in a list of broadcasting schedules, issued by the Bureau of Agricultural Economics, United States Department of Agriculture. This list includes most of the leading broadcasting stations. Arrangements for broadcasting daily market reports have been made by the bureau with local radio stations in every important market center where Government market news work is conducted. Government market reports, it is estimated, now are made available immediately to more than a million farmers.

Cressy & Allen

TUNING IN BY THE TOUCH SYSTEM

In this receiving set, at the Maine Institute for the Blind, the ordinary dial has been replaced by one marked with the Braille system of raised type; the tuning strip is shown at the left. At the right, Everett Astel, a mechanic at the Institute, is pictured while reading the dial with his left forefinger.

Changes in the List of Broadcasting Stations in the U. S.

During the month of March, 1927, the following changes were reported in the list of broadcasting stations:

STATIONS ADDED

KEX	Portland, Oregon	447.5
KGFN	Aneta, North Dakota	222.1
KGFP	Mitchell, South Dakota	263.0
KRLO	Los Angeles, California	440.0
WCOC	Columbus, Mississippi	265.3
WNBO	Washington, Pennsylvania	215.0
WNBQ	Rochester, New York	407.6
WNBR	Memphis, Tennessee	316.0

CHANGES IN CALL LETTERS

KGFA	Seattle, Washington	*change to*	KTCL
KGEX	Muscatine, Iowa	*change to*	KPNP

CHANGES IN WAVELENGTHS

KFXB	Los Angeles, Cal., 202.6	*change to*	352.7
KOCW	Chickasha, Okla., 252.0	*change to*	270.1
KUT	Austin, Texas, 230.6	*change to*	272.6
WHT	Deerfield, Ill., 238.0	*change to*	399.8
WJBY	Gadsden, Ala., 260.0	*change to*	270.1
WKBF	Indianapolis, Ind., 244.0	*change to*	249.8

* *

Radio Message Delivered by the Milkman

JUST before starting on his early morning deliveries, H. C. Jenson, a milkman of Hartford, Connecticut, makes a practice of listening in on his broadcast receiver. Recently, he tuned down to the amateur phone stations on 150 meters and was startled to hear an amateur radio station in Ohio sending a message addressed to K. B. Warner, secretary of the American Radio Relay League at Hartford. Mr. Jenson, remembering that Mr. Warner was one of his regular customers, copied the message and delivered it on his regular round within the next hour.

* *

One of the Vagaries of Radio Waves

IT is the common complaint of the broadcasting listener that he is unable to hear a certain station because "it is too far away"; the amateur radio telegrapher, on the other hand, often makes the complaint that he cannot hear another amateur station "because it is too near." A striking example of this is furnished by a radio message that a San José (California) amateur wished to send by short waves to his friend at Carmel. The distance between the two points is slightly more than fifty miles, but due to the habit that short waves have of angling into the upper atmosphere before being reflected back to earth, the two stations were unable to hear each other at all. Finally, the San José station, 6HB, recollected that 6HM, at Carmel, kept a regular schedule with an amateur in Singapore, Asia, and as this point was easy for each to reach, he sent the message to the Singapore amateur—who immediately relayed it to the Carmel amateur! The answer came back over the same route the next night. The message and answer together covered a distance of 32,000 miles in order to bridge the fifty-mile gap.

Trans-Oceanic Calls Heard

THE following stations were received and logged at the amateur station of Edward J. Sampson (NU-1DI), 15 East Ashland St., Brockton, Mass., using a Hertz type antenna 30 feet high and a Schnell short-wave receiver:

EF-8MAX—March 10, 1927; signal strength R7; 40 meters; some interference and static; fine rectified AC note; no fading;

EF-8UDI—March 6, 1927; signal strength R6; 40 meters; very bad interference and static; fine rectified AC note;

EF-8GI—February 27, 1927; signal strength R7; 40 meters; good AC note; no fading;

EI-1CR—February 23, 1927; signal strength R7; bad static and interference; good rectified AC note; no fading;

EF-8PX—March 4, 1927; signal strength R6; 40 meters; some static and interference; fine rectified AC note; no fading;

EB-4WW—March 4, 1927; signal strength R8; 40 meters; some static and interference; fine rectified AC note; no fading.

THE following stations were received and logged at the amateur station of S. Williamson (G-2ACI) at 22, Hurst Grove, Bedford, England, using a Reinartz receiver with one stage of low-frequency amplification:

NU-3JW—Oct. 2, 1926; signal strength R4; calling CQ on 38.8 meters; AC note; no fading;

U-5AC—Oct. 2, 1926; signal strength R4; AC note on 42 meters; interference R5; no fading;

NU-8BRC—Oct. 2, 1926; signal strength R6; calling 9CB on 39 meters; DC note; no fading; very clear signals;

NU-8AZS—Oct. 3, 1926; signal strength R6; calling 8ADU on 34 meters; AC note; no fading;

U-8KP—Oct. 12, 1926; signal strength R5; calling 1AMD on 35.8 meters; AC note; no fading;

NU-3AY—Oct. 31, 1926; signal strength R3-4; calling G-6YW on 42 meters; AC note; fading at 2-second intervals;

NU-5AB—Oct. 31, 1926; signal strength R2; calling CQ on 41.5 meters; DC note; no fading;

NU-9BQE—Oct. 31, 1926; signal strength R3; calling CQ on 38.4 meters; DC note; no fading;

NU-8BRD—Nov. 20, 1926; signal strength R1-5; AC note on 42 meters; fading at 4-second intervals;

NU-4AP—Dec. 27, 1926; signal strength R3; AC note on 35.5 meters; no fading;

NU-4IO—Feb. 6, 1927; signal strength R5; calling SB-1AC on 40.7 meters; AC note; no fading;

NU-8ALY—Feb. 6, 1927; signal strength R3; calling 6FC on 36.5 meters; interference R4;

NU-3QW—Feb. 6, 1927; signal strength R3-5; calling 1ABX on 41.4 meters; DC note; fading at 3-second intervals;

NU-8AMU—Feb. 6, 1927; signal strength R5; calling CQ on 38 meters; atmospherics R4; AC note; no fading;

NU-2ALW—Feb. 20, 1927; signal strength R2-4; calling CQ on 19.9 meters; AC note; fading at 5-second intervals;

NU-2GP—Feb. 20, 1927; signal strength R3-6; calling CQ on 19.7 meters; AC note; fading at 7-second intervals;

U-1CPB—Feb. 20, 1927; signal strength R6; AC note on 20.5 meters; no fading;

NU-1ASR—Feb. 20, 1927; signal strength R1-3; calling 9BFF on 20.5 meters; AC note; fading at 10-second intervals;

NU-1IO—Feb. 20, 1927; signal strength R3-5; calling CQ on 19 meters; AC note; fading at 6-second intervals;

NU-8AHC—Feb. 20, 1927; signal strength R5-7; calling CQ on 19.8 meters; DC note; fading at 3-second intervals;

NU-8AM—Feb. 27, 1927; signal strength R4; AC note on 41.7 meters; atmospherics R4; no fading.

* *

Egypt's Lone, Mysterious Broadcaster

THE land of the Pharaohs has no actual authority or regulations for the broadcasting of news or entertainment. Nevertheless it has offered an occasional broadcast program from an unlicensed but tolerated station at Cairo. It is said to be operated by an amateur, unnamed and unknown. This station (which is the only one in all Egypt) is dubbed SRE by the many fans who tune in regularly for news, sporting events, such as horse races, and musical programs. It broadcasts on 255 meters with sufficient power to reach a large number of listeners in and around Cairo; on some occasions a Government band has been heard, and once a governmental official is said to have spoken, although the Government is not supposed to recognize it because of its lack of official status. It is tolerated chiefly because it has great popular appeal and no one wants to stop its operation. With the backing of the people and the press, this sole and more-or-less outlaw broadcaster, who has been in operation over a year, is now considered a local institution.

* *

The New "Radio Division"

To assist the Secretary of Commerce in carrying out the new responsibilities imposed upon him by the newly-enacted radio laws, Secretary Howe has just created a Radio Division in the following official terms:

> "The Radio Division established in the Bureau of Navigation to assist the Secretary in the performance of the duties imposed by the Acts of June 24, 1910, July 23, 1912, and February 23, 1927, relating to radio communication, in carrying out the International Radio Telegraphic Convention, and in the examination and settlement of international radio accounts, will hereafter be administered independently of the Bureau of Navigation, under the Secretary's immediate supervision; and such duties as have heretofore been performed by the Comissioner of Navigation with relation to the administration of the radio communication laws will be performed by the chief of the division. For the time being, the records of personnel and accounts, and other similar matters of administrative detail, will continue to be handled by the proper divisions of the Bureau of Navigation.
>
> "Mr. William D. Terrell, chief radio supervisor, Bureau of Navigation, is designated Chief of the Radio Division."

Statement of the ownership, management, circulation, etc., required by the act of Congress of August 24, 1912, of POPULAR RADIO, published monthly at New York, N. Y., for April 1, 1927, State of New York, County of New York.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Douglas H. Cooke, who, having been duly sworn according to law, deposes and says that he is the Publisher of the POPULAR 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 411, Postal Laws and Regulations, printed on the reverse of this form, to wit: 1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Douglas H. Cooke, 627 West 43d Street, New York City, N. Y.; Editor, Kendall Banning, 627 West 43d Street, New York City, N. Y.; Managing Editor, Kendall Banning, 627 West 43d Street, New York City, N. Y.; Business Manager, E. A. Harm, 627 West 43d Street, New York City, N. Y. 2. That the owner is: POPULAR RADIO, Inc., whose stockholders are: Douglas H. Cooke, 627 W. 43d Street, New York City; Kendall Banning, 627 West 43d Street, New York City; Laurence M. Cockaday, 627 West 43d Street, New York City; Theodora W. Cooke, 59 Beechmont Drive, New Rochelle, N. Y. 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. 4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. Douglas H. Cooke, Publisher. Sworn to and subscribed before me this 1st day of April, 1927. Sadie M. Nilan, Notary Public, Queens County. (My commission expires March 30, 1928.)

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RADIO TUBES *ARE* BETTER!

201A Type, $1.75 ***Super Detector, $4.00*** ***Power Tube, $4.50***

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400 Milliamperes
Price, $7.00

We also make the same tube in 60 or 85 milliamperes as used in the Varion Power Pack described in this issue.

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The First 400 Milliampere **Gas Rectifier Tube**

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After two years of intensive laboratory experiments we have developed a 400 milliampere gas rectifier tube, that solves the A, B and C power supply problem. Eliminates all batteries and all AC hum in any set up to ten tubes.

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Factories at: Chicago—New York—San Francisco—Toronto, Canada—Sydney, Australia—Utrecht, Holland

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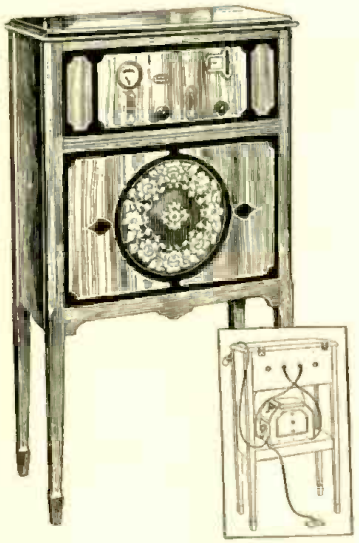

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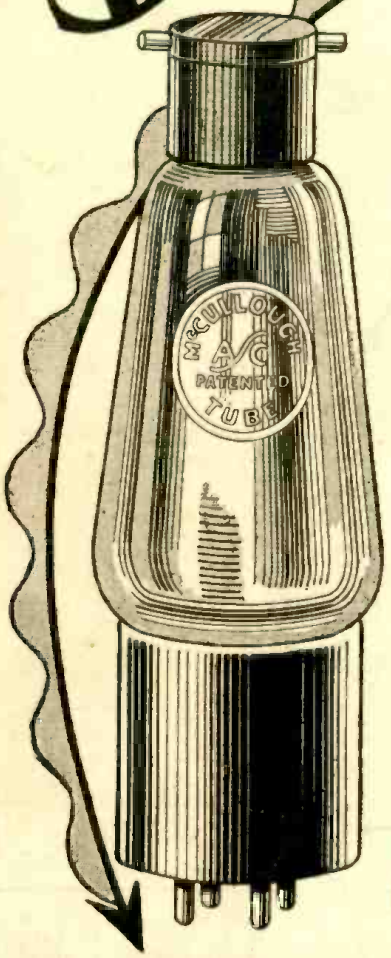

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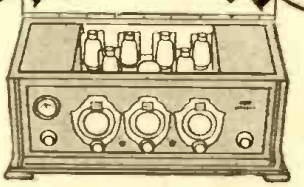
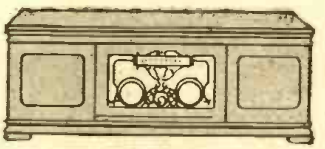
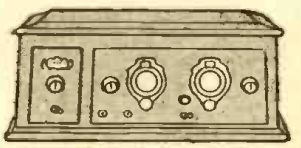
Makes radio a sounder business for Manufacturer, Jobber, Dealer.



The MARTI Electric Power Radio is equipped with McCullough AC Tubes



The WALBERT is equipped with McCullough AC Tubes



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