

Current Science

RADIO AGE

Everyday Mechanics

Radio in the Next War
(See Page 19)



April
1927

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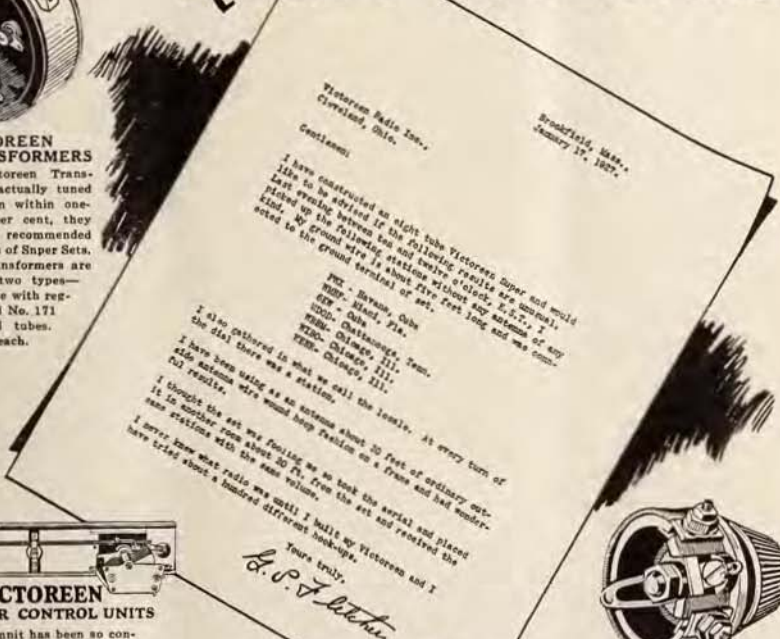
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Current Science
RADIO AGE
 Everyday Mechanics

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Chats With the Editor

WITH this issue our magazine enters its sixth year of service to radio fans of the world. Great progress has been made in the industry in that period but none of it has been of a revolutionary nature. For example we still have the regenerative set, the crystal detector, the reflex, the tuned radio frequency and the superheterodyne. We had all of these five years ago but their ability to perform is nothing compared to these same sets in 1927 when better production methods, keener research, more radio enlightenment and better broadcasting conditions are in effect. Of all these sets the last named, the superheterodyne, now seems to have the floor, principally on account of its distance getting qualities and the wavelength chaos which listeners have encountered in the air. This statement seems borne out by the tremendous interest manifest by our readers in the recent series on the Worlds Record models. Incidentally we shall have more data on supers in a forthcoming issue—a treatise on trouble shooting which should be appreciated by everybody who has ever tinkered with a superheterodyne.

Attainment of quality reproduction is another objective reached successfully this year, although still further improvements can be expected although these will be of a gradual rather than a startling nature. Any progress which we may expect will come step by step instead of through a breath-taking revolution in radio. So do not worry about having to junk your present receiver for some time to come.

Radio legislation has now been passed. The President, as we go to press, is about to name members of the radio commission and the disorganized aerial conditions give promise of being shortly straightened out to the satisfaction of millions of listeners who take their radio seriously. And while on this subject we do not know of a better broadcast list than the one in the back of this magazine. It is corrected every thirty days from figures furnished by the Department of Commerce.

Intermediate stage transformers peaked at a frequency value which prevent the appearance of the lower beat on the dial of an oscillator, have been developed. Their operation, together with the data on a dandy power amplifier, is described in the blueprint section of this issue. Elsewhere in this magazine will be found a method of single-controlling a superheterodyne, which is also an interesting improvement in design.

Frederick Smith

Editor of RADIO AGE.

Current Science

RADIO AGE

Everyday Mechanics

M. B. Smith
Business ManagerA Monthly Publication
Devoted to Practical
RadioFrederick A. Smith
Editor

Fun, Fascination and Profit in a Five-Tube Set

ARMSTRONG PERRY

THE MAN who starts to build a five-tube radio receiver will open up enough possibilities to keep him busy the rest of his life.

A five-tube set will take a current of 10 microamperes from the radio waves, which means 10 millionths of an ampere, and deliver to a loud speaker a current millions of times stronger. The output current, however, will retain all the characteristic oscillations of the feeble antenna current, and such a set, with a good loud speaker, is capable of reproducing the broadcast music from local stations with such fidelity that many listeners would be unable to distinguish the reproduction from the original music.

If a man could deliver as large an output in proportion to his input of corned beef and cabbage, those hog calling contests they are having would have to be prohibited by international law to prevent all the hogs in the world from swarming toward our own middle west.

There are several questions to be decided before the construction of the set begins. A kit or separate parts will cost from forty to fifty dollars and the tubes, batteries and loud speaker will increase the expense to \$100 or more. Mistakes and losses should be reduced to the minimum by careful planning.

A five-tube set usually has two stages of radio-frequency amplification, a detector and two stages of

audio-frequency amplification. If great distance rather than volume are desired, three stages of radio-frequency amplification may be used and only one stage of audio-frequency. Even four tubes may be used for radio-frequency amplification, but the interaction between circuits handling the high frequencies is so difficult to control that it is better to limit the radio-frequency side to two stages.

One stage of radio-frequency with two of audio-frequency should bring

in all the stations that the average fan wants, with good volume. There is not much use of trying to cut through the interference of the hundreds of eastern stations and bring in the western stations before midnight, regardless of the power of the receiver, and even less than five tubes should enable the night owls to get the coast before they say their prayers and go to bed in the morning.

Before going very far with the plans for the set, it is well to decide



This home-made set captured a first prize at the New York Radio World's Fair

whether it is to be attached to an outside aerial or operated with a loop aerial. It can be designed to use either or both. A five-tube outfit is powerful enough to give good results on local stations with a small loop, and it may even bring in stations several hundreds of miles away.

The loop is convenient and it eliminates much interference, but its small size limits the amount of energy it can gather from the radio waves. I have heard European code stations with loop sets in this country, but they were long-wave stations and the loops had many turns. A loop designed for broadcast reception has few turns and cannot be expected to do the work of an outside antenna.

Tuned or Untuned R. F.?

ANOTHER question to decide is what type of radio-frequency amplification to use. The amplifier may be of the tuned or untuned variety. If it can be tuned, it will bring in more stations because it will cover more wavelengths. Then there is the question of coupling. Coupling the stages through amplifying transformers gives a higher ratio of amplification, but resistance coupling reduces the tendency to distortion and broadens the range of wavelengths covered. Resistance coupling gives its maximum results on wavelengths of 1,000 meters or more, which are far above the broadcasting waveband, but it is used successfully in broadcast receivers.

The set builder should aim at perfect reproduction rather than to follow the example of those dealers who turn their big loud speaker horns upon the street crowds and demonstrate how much noise and distortion can be produced by brute force and ignorance. Distortion in a slight degree is almost inevitable in using

amplifying transformers. The higher the ratio of amplification, the more troublesome it is likely to be.

The audio-frequency transformer is less of a problem than the radio-frequency end of the set. The frequencies are much lower after the current passes the detector and there is not the same tendency for stray lines of force to fly all over the place and set up inductive effects that make the loud speaker howl. The audio-frequency amplifier is less critical in its adjustment. Changes in filament current have less effect. The builder who can work out the problems on the radio-frequency end should have little trouble when he reaches the audio end of the set.

The main decision to be made concerning the detector is whether it shall be regenerative or not. By feeding back part of the plate output to the grid circuit, the detector can be made to amplify the incoming signals considerably. This is accomplished by inserting a tickler coil in the plate circuit and placing this coil in inductive relation to the grid coil, or by simply connecting a wire from the plate to the grid circuit. The grid leak and condenser should be between the grid and the point where the wire connects, so that the "B" battery voltage will not be placed on the grid.

Whatever method is used, regeneration always increases the tendency to distortion. Many believe that the neutrodyne method is better. This consists of neutralizing the capacity that exists between the internal parts of the tube by placing small condensers in external circuits.

The types of tubes to be used should be selected at the start so that the proper sockets can be installed. If a change seems desirable after the set is in operation, adapters can be purchased that will make it possible

to use one type of tube in another type of socket, but it is better to have the correct socket for each tube.

Many prefer the low-voltage tubes lighted by dry cells. Others like the more powerful 6-volt tubes lighted by storage batteries. Dry cells are easier to handle and safer than storage batteries, but a good storage battery with a battery charger will give very little trouble after installation.

Dry-cell tubes can be used in some positions in a set and the larger tubes in other positions. Trying different tubes in different positions is one of the favorite indoor sports of the experimenter. The new power tubes have opened new possibilities in both volume and clarity of reception.

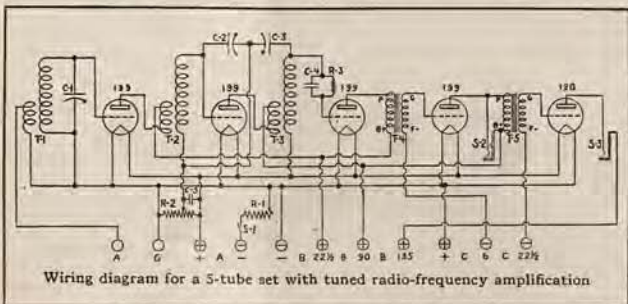
Types of Coils

THERE are several types of coils, each with its own special advantages and disadvantages. The selection may depend on whether the builder wants a small and compact receiver or is willing that it should occupy more space. A variometer or variocoupler composed of a cylindrical stator and a spherical rotor will occupy much more space and weigh more than one composed of flat spiderweb coils hinged so that their relative positions may be changed by turning a knob.

There are any number of condensers. Present opinion seems to favor those in which the possible losses are reduced by eliminating unnecessary metal, and those designed so station settings are well distributed over the dial or drum that guides the hand of the operator.

The old practice of mounting most of the parts on the upright panel is disappearing. Now, as many parts as possible are placed on the base or sub-panel. The advantage is obvious. Parts that might be affected by the body capacity of the operator are farther from him. Heavy parts that once placed considerable strain upon the thin upright panel, because of the leverage that an unbalanced weight has on its point of support, now sit securely on a firm foundation. If a modern set should slip from the hands of the man who was placing it on a table, and fall a few inches, it probably would sustain little if any damage. A heavily loaded panel might be split by the same kind of mishap.

Shielding should be considered by the builder of a five-tube set. Many



Wiring diagram for a 5-tube set with tuned radio-frequency amplification

of the stray lines of force that are developed when a set is in operation, as well as the capacity of the body of the operator and nearby objects, may be turned aside or neutralized by proper shielding.

Shields are made of metal and are grounded. Sometimes they are merely partitions that separate transformers and other units. In some sets they are metal boxes that completely enclose the parts to be isolated. Proper shielding can do no harm and it may improve the set greatly.

The tendency today is toward simplified control of tuning units and filaments, for most sets must be sold to persons who want to avoid all inconvenience in operation. One-hand tuning seems to be in demand, though what the operators want to do with the other arm is not quite clear in these days when the closed car has taken the place of the parlor sofa. It certainly does not increase the efficiency of tubes to control five or more filaments with one rheostat, nor does it improve the tuning of a set to turn all the condensers with one knob.

A reasonable amount of simplification is good, as anyone will testify who has ever operated an old-time amateur set in which there were so many knobs to twist that the program was over before the operator could discover what they all were for. However, there is much to be gained by having the detector filament under separate control, and the radio-frequency and audio-frequency amplifiers on separate rheostats. Automatic control of filament current is provided by some modern devices.

Tuning condensers are more efficient when separately controlled, provided the operator knows how to use them. Some of the better sets have the condensers mounted so that a single knob turns them all, but with individual controls for fine adjustment.

Having decided all the above questions, and having chosen dials or drums, panel and cabinet, the builder is ready to select the kit that he wants or to design a set to be made from parts selected separately. It never pays to try to save money by purchasing cheap parts for a set on which valuable time is to be spent. The best parts and materials cost so little more than poor ones, and poor parts do so much to waste the time and



A five-tube set designed for amateur builders. It is called the "duotrol" because it has two controls

energy of the builder, that there should be no hesitation about paying the right price for really good articles.

Any man who is investing in a five-tube set can afford to have a good set of tools also. A set of drills, plenty of pliers and side-cutters for different purposes, an electric soldering iron and a good assortment of wire, bus bar, lugs, clips, connectors and so on will save their cost by saving time and improving workmanship.

The final problem, perhaps, will be the choice between batteries and battery eliminators. Battery eliminators may not be desirable on sets with fewer tubes, but a good eliminator settles the problem of current supply unless the electric service in the town is too erratic. In my town it is, for the wires are on poles and every heavy storm fells trees, breaks wires and interrupts the service.

Perhaps the safest, quietest and most satisfactory source of power is a good storage "A" battery, a storage "B" battery with enough cells to deliver ninety volts or more, and an efficient battery charger. A trickle charger will take care of a battery operating two or three tubes, but for a five-tube set a charger with a rate of six amperes should be installed if the battery is designed to be charged at that rate. Some chargers will deliver either a trickle charge or a higher charge as may be desired.

A FIVE-TUBE kit can be purchased for less than fifty dollars. It does not include tubes, batteries, phones or loud speaker as a rule. The blue prints and instructions are so complete and explicit that even a beginner can put the outfit together and make it work even though he may have no technical knowledge.

A week's spare time should be sufficient for finishing the assembly and placing the set in operation. The expense involved will be no more than many a man loses on a prize fight, and it will enable the builder to follow the fights without being so deeply affected by the atmosphere created by the promoters for the purpose of lining up the public on the losing end of the gamble.

Sensibly used, a five-tube set will save its cost many times over by entertaining the family inexpensively and giving the youngsters better mental food than they are fed ordinarily in places of amusement. Games can be organized, based on distance covered and numbers of stations brought in by the different members. Evenings at home can be made as thrilling by such means as many of the outside attractions. A whole neighborhood group may be held together and safely led through the perilous years of adolescence.

A man who makes a five-tube set and presents it to a school or other institution where it is needed, or who even sets it up for an evening now and then and brings in some of the important broadcasts, is a real philanthropist. The tremendous opportunities offered by radio are being lost in thousands of schools for the lack of someone to demonstrate how easily radio service can be established and maintained.

The workman is worthy of his hire, and if a man can build or assemble these popular five-tube sets and install and service them, he may be able to work up a profitable spare-time business. He may even develop it to a point where he can escape from toil, endured merely for the sake of making a living, and find the joy of becoming his own boss.

An Inexpensive Eliminator for the Home Constructor

By WILLIAM H. FINE*

NINETEEN TWENTY-SEVEN brings with it a marked increase in the demand of radio fans for efficient devices with which to eliminate our old friend the "B" battery;—simple and inexpensive devices that can be readily attached to the house lighting system the same as a vacuum cleaner, flat-iron, washing machine or other household appliances.

Such a device, which must necessarily be designed to rectify or change the usual alternating current, in general use throughout the country for home consumption, to direct current suitable to be used for radio purposes, is made up of three major elements, viz:—a reliable method of converting the alternating current; an efficient and dependable filter system for smoothing out the ripples or pulsations after conversion, and a simple but reliable means of controlling and adjusting the final output of the eliminator to take care of the various voltages required for successful operation of the receiving set.

The majority of "B" eliminators now on the market employ a special type of tube for rectifying the alternating current and the publicity given this method through the press, has more or less side-tracked another and less expensive method.

Reference is made to the full-wave chemical rectifier and the following

text describes such a power unit any novice can build at a relatively small cost yet with positive assurance that the finished product will meet every expectation for dependable performance and furnish a constant source of plate current sufficient to meet every requirement of the average radio receiver.

All parts designated can be easily secured from practically all reliable dealers. After the parts are mounted on a suitable baseboard, the entire assembly can be housed in a metal container to suit the builder's fancy. Special stress is laid upon the importance of using only good parts, not necessarily the most expensive but those manufactured by companies who have established a reputation for building quality products. Care in their selection, plus neat workmanship, gives assurance of entire satisfaction in the finished job.

The necessary parts for the construction of the herein described eliminator are:

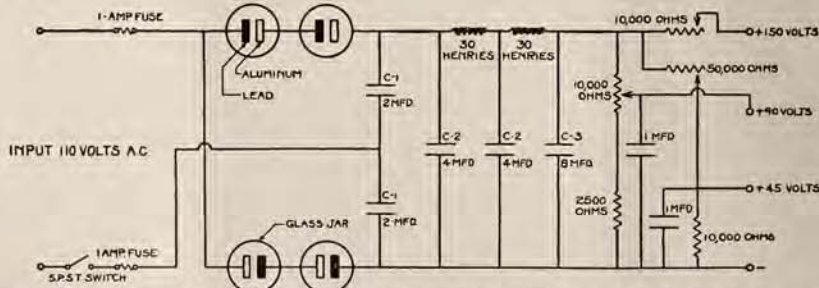
1 baseboard, 4 1-pint jars, 4 covers for jars (cut from bakelite or other dielectric material with one small vent hole in center and two larger holes to accommodate the electrodes), 2 30-henry choke coils, 1 terminal strip, 4 aluminum electrodes, 4 lead electrodes, filler for rectifier cells, 2 2. mfd. blocking condensers, 4 4. mfd. blocking condensers, 2 1.

mfd. blocking condensers, 6 binding posts, 1 2,500 ohm fixed resistance with mountings, 1 10,000 ohm fixed resistance with mountings, 10 ft. lamp cord, 1 attachment plug, 1 S. P. S. T. knife switch, 2 1 ampere cartridge fuses with mountings, 2 No. 10 M heavy duty Radiohms, 1 No. 50 M heavy duty Radiohm, wire, screws, etc.

The lead and aluminum electrodes, as well as the filler material for use in the rectifier cells can be obtained from any dealer or service station handling Willard storage batteries. While common borax can be used as a filler it is not recommended because it crystallizes and creeps over the exposed part of the electrodes. This creepage will eventually short the cell rendering it inoperative.

To prepare the solution, dissolve each package of filler in a pint of water, preferably distilled. Stir until all the filler is dissolved and then let stand for a few minutes until all foreign matter settles to bottom of jar. When liquid is clear, fill each cell about three-quarters full. After the electrodes have been attached to the covers insert them to about three-fourths of their length into the solution and the eliminator is now ready to attach to the receiving set. While the cells will not need any further attention for several months, in order

(Continued on page 47)



In the schematic above is shown the method of rigging up a homemade B eliminator. If proper care is taken in its construction, the plate supply problem will have been solved, except of course for the operation of an extremely large set

Portable Direction Finder Has Many Government Uses

By S. R. WINTERS

UNIQUE in that it is probably the only portable radio direction-finding device in the world that operates over such a wide band of wave lengths—from 39 to 3,300 meters—a new apparatus developed by Francis W. Dunmore of the Radio Laboratory of the Bureau of Standards may be transported and installed with quite the facility a large camera is put to service. Equally as simple in manipulation, this novel radio direction-finder is governed with but two controls.

When the entire United States is to be eventually crisscrossed with radio beacons for guiding aircraft along predetermined courses and with every ship depending upon radio for finding its port of safety, this new equipment for locating the source and direction of a radio signal makes its appearance at an opportune moment. Other radio direction-finders may be equally as efficient but the Dunmore device is said to excel in the particulars of operating at relatively short wave lengths and in the simplicity of control, two knobs, one for tuning the radio receiving set and the other for obtaining a balancing effect. These features, too, are not insured at the sacrifice of portability,

because the apparatus is relatively compact.

Experimenters and members of the "Homemade Radio Set Builders' Club" will be interested in knowing the popular fad of shielding radio receiving sets is adopted in the construction of this direction-finder. An aluminum box affords a cozy home for all of the radio receiving units, including batteries. The single exception to this sweeping statement is that the coil antenna is mounted on a bakelite shaft extending through the aluminum box. This pick-up coil is revolved in different directions of the compass by turning a handwheel under the shielding aluminum box. The shielding of circuits in radio receiving sets may be carried to extremes in some instances in response to a popular fad, but in designing this radio direction-finder the Bureau of Standards ventures the contention, "This shielding is important, especially when receiving the higher frequencies, since the directive effects are blurred if any circuits except the direction-finder coil pick up power from the wave."

CAM-ACTUATED tuning condensers, an idea of Mr. Dunmore's for which he was granted a patent during 1926, has made possible a reduction of the tuning controls of the super-heterodyne receiving set used with this direction-finder to a single one. This is accomplished by mounting the main tuning condenser and the heterodyne generator tuning condenser on the same shaft. The latter condenser has connected in parallel with it an auxiliary condenser of slightly smaller capacity operated by means of a cam which may be slipped on the shaft carrying the two tuning condensers. The movable plates of the balancing condenser are connected to an antenna, which is an integral part of each direction-finder coil. This antenna consists of a brass rod the height of the coil which passes through the center of the coil. Another rod is telescoped

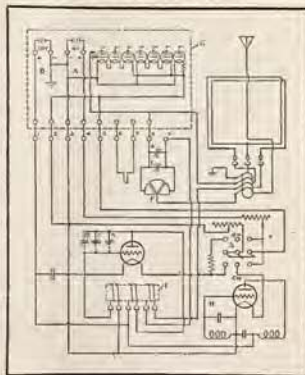
into this one, which, when extended, doubles the height of the antenna. Such an antenna, according to the Bureau of Standards, gives sufficient antenna effect for good balancing. It was found this small antenna connected to the movable plates of the balancing condenser was much more effective than grounding them. Seven cams of different shapes are necessary to the proper functioning of this direction-finding device.

The operation of this new apparatus over such a wide band of wave lengths—from 39 to 3,300 meters—is made possible by a set of seven interchangeable plug-in coils. These vary in size from $12\frac{1}{4}$ inches square to $24\frac{1}{2}$ inches square, the former having only two turns of wire, and the later sixty turns of wire, space wound in four layers. Each of these seven direction-finder coils has imprinted on it the wave-length range over which it operates, thus facilitating the plugging-in of different coils when wave length variations are desired. Each coil has a socket containing four terminal plugs, two connected to the end of the coil, one to the center of the coil, and the fourth to the brass rod antenna. The coils are enclosed, being wound on box frames made of wood.

(Continued on page 31)



Photograph showing the completed portable direction finder developed by Mr. Dunmore, having a wavelength range from 39 to 3,300 meters



Schematic diagram of the all-wave direction finder which has but two controls for its operation

Putting It Over— On the Mike

By GWEN WAGNER

ON THE face of it, it all appeared very innocent. Just the studio director coming to you and saying, "How 'bout a little talk over the air next Saturday afternoon? Something 'bout the activities of women. What they've accomplished. What they're going to do. 'Bout fifteen minutes."

You had been rambling around radio studios off and on for two or three years. You had never made a talk over the air but there was no reason why you couldn't. It certainly looked simple enough. Just sit down at a table in front of a microphone and talk. In an ordinary, conversational tone of voice. No fuss, no bother at all.

It never occurs to you, therefore, that you can't make the talk. Still, you feel that you must show a little modest reluctance so you remark, "Oh, I don't think I could talk over the air. I never did. I . . ."

"What of it?" demands the director. "You've been around here a long time. You know what it's all about. Just get some material together and come up here and broadcast it. That's all there is to it. Easiest thing you know!"

Oh yes, it's the easiest thing you know all right! Just about as easy as trying to convince a woman that she's not the type to wear bobbed hair; as easy as attempting to show a man where he's all wrong about his baseball pose; as easy as . . .

But, of course, before you broadcast, you don't know these things. All you know is that you have been asked to talk over the air. Talk over the air! Talk to millions of people! You! Well, now . . . not so bad.

At a later day you know it was some instinct of self-preservation that made you ask the studio director, as a kind of after thought, "I suppose I can give my talk from notes, can't I?"

You can't fathom the rather odd look he gives you, so you dismiss it when he says, a trifle hastily, "Certainly. That's the way you'll want to."

Nice, friendly places, studios.

Filled with people you've known for two or three years. Studio directors, announcers, pianists. This particular studio in which you have been selected to make your maiden voyage out into the ether, was one you liked particularly. Nice atmosphere. Everything jolly. Everybody friendly.

You go up rather early on the day you're to make your talk. Just so they'll know that you'll be there and ready to go on the air at the proper time. You've been up hundreds of times before but today you feel—er—well, not exactly superior, of course, but just a little . . .

You are having a delightful time, walking confidently around, chatting with this person and that, casually observing, now and then with a light laugh, "Oh what time is it getting to be? I'm going to give a little talk over the air this afternoon you know."

And receiving replies of, "Oh, you ARE?"

The first inking you have that things may not be all that they seem, comes to you when the young announcer approaches you and inquires solicitously, "Not getting nervous, are you?"

You look at him wide-eyed.

"Why of course not!" you reply. "Whatever made you think that?"

"Oh, nothing!" retorts the young announcer hastily. "Only some of them do, you know."

"Well," you assert sweetly, "I won't!"

"That's fine!" says the announcer, giving your shoulder a pat which, you know later, was a reassuring one. "We'll be ready for you pretty soon."

For the first time you begin to feel a little uneasy. So some of them got nervous. How silly. How perfectly ridiculous. Nervous! Why in a few minutes you are going to walk up to that thing they call a microphone and give a talk. In just a few minutes you are going to talk over the air.

But there's something that sticks in your mind rather unpleasantly.

Some remark. Oh, yes, the one the announcer had made. The one when he patted you on the shoulder and that had something 'to do with, "We'll be ready for you pretty soon."

Where had you heard that phrase before? You search your memory and then a chill settles along your spine. Oh yes, now you know where you had heard it. In the hospital, just before they took you into the operating room. The doctor had come in and patted your shoulder jovially and had remarked cheerfully, "Not nervous, are you? That's fine! We'll be ready for you pretty soon!"

Just then the announcer hails you cheerily, "Just two more minutes and then it will be your turn."

Two more min . . .

And then something happens inside of you. Something awful. In your breast a terrible commotion sets up. Some dreadful pounding. You clear your throat hurriedly and swallow. Or try to. Your mouth is dry! Your tongue is thick! And the announcer is saying, "Now come over here and sit down. I'll announce you in a couple of seconds. Got your notes ready?"

In a daze, you open your purse to look for your notes. Oh, merciful heavens, where are they? Here! No, that's a letter. Where . . . dear heaven . . . Ah! In your hands, your poor shaking trembling hands.

"Right here," says the announcer, placing a chair for you. "Quiet now! We're on the air!"

And then your name. "We announce with great pleasure . . ." Your name. It must be, that it sounds so strange. But for that matter, everything is strange. The studio, the announcer, those people who, a moment ago, you were talking to so gaily, now sitting motionless in their chairs, grinning like apes!

The announcer gives you a tap on the shoulder and a quick nod. You open your mouth. You reach frantically for a full breath. You speak! You are on the air!

(Continued on page 33)

Single-Controlling the Victoreen

MANY readers of this magazine have requested data on arranging the operation of the loop and oscillator condensers on a single dial in their superheterodynes. The article following deals with such a method of operation which has proved highly satisfactory with either the antenna pickup coil or the loop. The latter has been found more satisfactory of use in the larger cities where congestion exists, whereas if the super is to be used a hundred or more miles away from the big broadcasting centers the antenna coupling is permissible and quite satisfactory.

Going to single control on a super is not quite as hard a job as might be expected, especially if it is possible to trim one of the condensers against the other. In the Victoreen master control unit which was used in the laboratory model this trimming accomplishment is performed with the knob on the extreme left of the panel which compensates for capacity differences between the oscillator setting and that of the loop or antenna coupler condenser. Absence of a regenerative loop circuit also makes it a great deal easier to single control these two condensers than if a midget were provided for creating a regenerative loop circuit.

Two means of intermediate control have been used. The first is by means of a filament rheostat controlling the

filaments of the intermediate stages. The other is by alteration of the grid bias applied to the intermediate grids through a 400 ohm potentiometer. Further flexibility in operation is afforded by the special rheostat gang mounting which controls the filament temperature of the second detector and the first and second audio stages. These values are determined by test and the settings left alone until other tubes are used.

Instead of grid detection by C battery both the first and second detectors are operated with a grid leak and condenser. Biasing for the audio grids is allowed through the C battery placed next to the audio transformers and shown in the photograph of the baseboard arrangement of this super. Audio bias will depend upon the plate voltages applied. In this particular model all 201-A tubes were used with

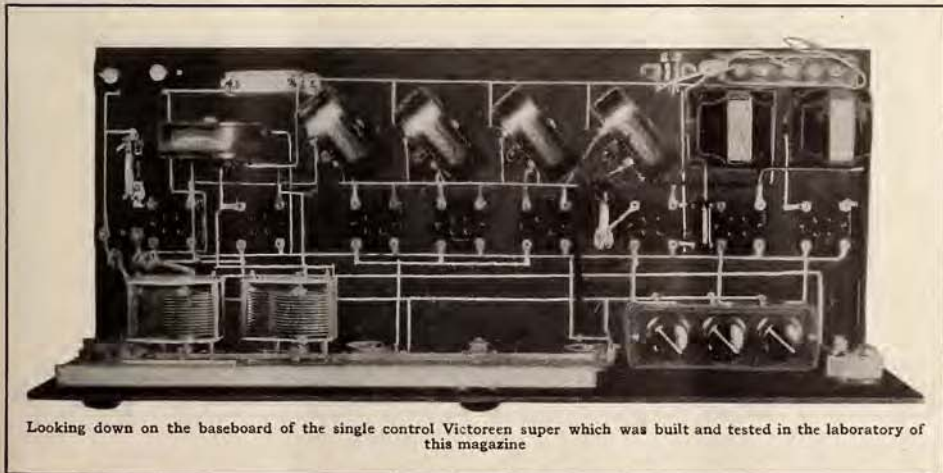
the exception of the last audio which is a UX-112.

Long wave transformers made by the Victoreen interests and peaked at 88 kilocycles were used throughout. Their position in the set may be seen by consulting the photograph of the finished model. Repetition of stations on half their frequency difference was greatly minimized through the peaking of these transformers at the value stated above. In addition through the single controlling of both the loop and oscillator dials, a great deal of interference that might have crept in through not having both dials in resonance all the time, was eliminated. This condition is particularly true of any large broadcasting center and where arrangements can be made to prevent the two dials from straying from resonance the results are always gratifying.

On account of the design of this



Front panel view of the Victoreen super as reduced to single control. The dial on the panel governs the master control unit carrying two variable condensers



Looking down on the baseboard of the single control Victoreen super which was built and tested in the laboratory of this magazine

model it is possible to use busbar in the assembly without having to use more than one or two pieces of spaghetti, this insulation only being used wherever there is a cross-over of wires or two wires running parallel which by sagging might short circuit themselves. The panel size used was seven by twenty-six inches while the baseboard was made nine and a half inches by twenty-five inches. If desired the same receiver may be adapted to the subpanel assembly and a great deal of the wiring run underneath the subpanel.

As is customary in wiring up any receiver it is a good idea to test all inductances and transformers before putting them into the set and wiring. For testing opens a voltmeter and a C battery will suffice, or even a head set and a C battery. However, visual indication is always much better so the battery and voltmeter method is more desirable. If the coil is open no reading will be secured when the voltmeter and battery is placed across the two ends of the coil. In testing the secondaries of transformers the voltage reading will generally be a little lower than when testing primaries

LIST OF PARTS

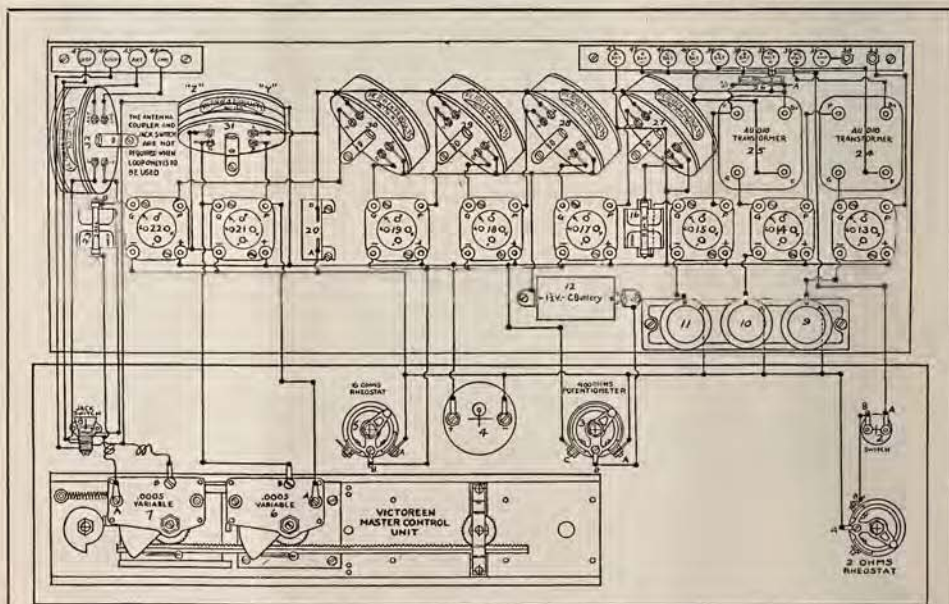
(Parts specified here were used in the actual model described. Other parts of equal merit may be used if desired.)

- 1 Victoreen master control condenser unit
- 1 Victoreen audio control unit
- 1 Victoreen 2 ohm master rheostat
- 1 Victoreen 6 ohm rheostat
- 1 Victoreen 400 ohm potentiometer
- 4 Victoreen RF transformers
- 1 Victoreen oscillation coupler
- 2 Samson audio transformers
- 8 Frost sockets
- 1 Dubilier 1mfd bypass condenser
- 2 Sangamo .00025 mfd grid condensers with clips
- 2 Durham 2 megohm grid leaks
- 2 X-L pushposts
- 1 Jones base mounting plug
- 1 Formica 7 by 26 by 3/16 panel
- 1 Wooden baseboard 9½ by 25 inches

due to the greater resistance of the secondary coils of the audio transformers. In intermediate stages very little difference will be found between readings on the primaries and secondaries. For condensers the test is the same only when a condenser is shorted readings will be secured whereas when the condenser is o. k. no reading will be obtained on the voltmeter.

The pictorial diagram shown with this article should suffice for even a novice since it shows exactly where all wires should be located. Be sure to make good solder joints in every case. Many a poor chap has blamed a set's operation for his indifference in making good joints. You cannot be too careful in soldering. Another thing to remember is that you do not have to finish the set between supper and bed time. Make a good job of your work and you will always find it profitable.

In actual operation the single control Victoreen proved itself a distance getter despite the absence of the regenerative feature in the loop circuit. Its selectivity was likewise good and the tone quality was very enjoyable.



Pictorial diagram of the single control super. Although Radio Age's model was made without antenna coupler, the pictorial diagram above shows either method of energy pickup. Binding posts shown in the diagram may be eliminated and a standard base mounting plug used instead for greater simplicity

The FROTH ESTATE

by Joseph Balsamo



The story thus far

Col. Maximilian Minimil, sets \$10,000,000 aside, out of his personally acquired colonial fortunes, for the purpose of financing the Fortunatus Gazette for his son Daly. The younger Minimil, while the great project is being organized, has some difficulty in making other people believe he intends to publish a newspaper that is to be free from the smut and hysteria of certain other dailies. He believes a clean journal will win out. Bill Rossom, publisher of the Clarion, is a former movie actor. A horse stepped on his face and, although putting him out of the picture game, so transformed his countenance that he has the appearance of a super-man. People do what Rossom wants because of the compelling power of the Rossom face. Rossom tries to prevent the sale of the first issue of the Gazette.

V

ROSSOM'S rise in Fortunatus has been the subject of so much comment it need be sketched here only briefly. It is interesting to point out a few rungs in the ladder of Bill's ascent which have been overlooked by the biographical enthusiasts. In the first place this man, who fell from the Parnassian heights of moviedom and had the good fortune to light upon a mattress, broke all the rules which are supposed to govern success. Bill would have been a wall-flower at the dance of the magazine advertising pages. That is to say he bought his toothbrush and his tooth lotion with reckless disregard of the almost universal warning that the gums soften and recede and that four out of every five are headed for dental desolation. Bill at times had hickies on his chin; yet the department manager did not turn him from the door when the day for promotions rolled around. He never read a halitosis classic, yet he was not thrown out of directors' meetings. He did not change his brand of bath soap because a fair dance partner declined the second dance. He simply changed partners. He was the life of the party although he never took a correspondence school course in conversation. He drank coffee for the caffeine there was in it and his brain functioned normally although he did not take his cereals seriously. He didn't register for primaries and he didn't vote at elections. He never had a savings account.

Mrs. Rossom's luxuriant hair was amber and her eyes were deep violet. Bill had picked a vivid beauty

as a background for his ascent to the heights. Isis was tall and she wore her dresses and gowns with an air that made other women envious and made men turn to look a second, or even a third, time. Hence it was the big well tailored Rossom and his surpassingly fair lady made their entry into Fortunatus under almost favorable conditions. It was true they had spent their last penny for tips and food on the train from Los Angeles. Isis was a little disturbed about it.

"Leave everything to me," Bill reassured her, "I can get farther on my face than some birds can with a roll that would ditch a war tank." She glanced at his face and was comforted.

Bidding the taxi driver wait Bill surrendered his bags to bellhops and doorman while he assisted Mrs. Rossom from the cab. The clerk saw them coming even afar off and the unctious flourish with which he made ready the register of the Hotel El Dorado shrieked of the prospective broaching of wine casks and the slaying of fatted calves.

"Mr. and Mrs. Rossom, from the coast," said Mr. Rossom expansively, as he strode to the desk and looked about the ornate foyer as if to give it the expert judgment of the man who may be satisfied with a place and again, may not.

"Something up and away from the noise and heat," said Bill. "Parlor, bedroom and bath will do, but the best you have; the best, you know."

The clerk raised a pink hand just a trifle. He conveyed by this that he was prepared with something simply made to order for the Rossom taste; high, cool, comfortable, roomy, quiet, rich in appointments, perfectly serviced.

The little parade of bellhops and the two welcome guests was starting for the elevators when Bill turned, laughing softly.

"I had forgotten the driver," he chuckled. "No chance to get to a bank—twenty will be okay for the moment—ah, thank you."

The yellow-back passed quickly to a bellboy who made haste to pay the taxi man and bring the change to the Rossom suite.

VI

BILL'S first day in Fortunatus was devoted to conferences with dealers in newsprint paper, printing house executives and the officers of a nation-

ally prominent advertising agency. He permitted it to be known, under strict admonition of secrecy, that he and his associates had been making a survey of the newspaper situation in Fortunatus and that they had decided to publish a tabloid daily. A tabloid newspaper is one whose pages are one half the size of the average newspaper page, and therefore in some quarters regarded as twice as good as the average page. So insistent was Bill's warning that not a word should be breathed about his plans that it was fully four hours before the publishers of the six Fortunatus newspapers heard of it and called a meeting to discuss ways and means of nipping this dangerous competitor in the bud.

Inquiries discreetly made at the Hotel El Dorado brought little information to the agents of the publishers. Bill has registered as "William Nathan Rossom and wife, San Francisco" and the wires soon were carrying questions to representatives of the Fortunatus publishers in that far western city. The San Francisco replies were prompt:

"Only Rossom known in California is Bill Rossom, punk movie actor who left state after being incapacitated by accident. Rossom a tall, pleasant-faced sheik. No personality, busted flat. Can't be your Rossom."

Agents of the Fortunatus publishers had another look at Bill as that self-possessed gentleman draped his tall figure over the telegraph counter and dictated several telegrams to Eastern points. "Pleasant-faced sheik." This impressive personage with the figure of a Viking and the face of an eagle? "Busted flat?" This urbane occupant of the best suite in the best hotel in Fortunatus? Wives of busted actors do not ask the manager to tuck away a handful of gems in the hotel safe. Mrs. Rossom had done that. Of course the manager should not be censured for being ignorant of the fact that the diamonds were only movie brilliants. And the manager could not be expected to know that the only genuine stones in the Rossom collection had been taken to a neighboring city on the day following the arrival in Fortunatus and had there been left in pledge for the repayment of a fund with which Isis came back to Bill and gave him as a working balance while the big tabloid deal should be simmering.

Not being able to identify and classify Rossom and assuming that he was associated with local interests who preferred remaining in the background until the tabloid newspaper was launched the six publishers got together and put up \$50,000. They sent for Bill.

"We can run you ragged if you start a newspaper in Fortunatus," they told Bill. "But we realize that you must have put some time into the preliminary work and probably it has involved some expense."

"You'd be surprised," said Bill, quite truthfully.

"In view of these facts," the committee spokesman summed up, "we are authorized to offer you \$50,000 as a reimbursement for your expenses and trouble. Accept it and abandon your idea. Reject it and get ready for the rough house."

Bill told Isis about it that evening as they sat under the softly shaded lamps in the main dining room of

the Hotel El Dorado. They were in a nook delightfully adapted for prandial confidences and Bill enjoyed the wonder and admiration that shone in the exquisite violet depths of Mrs. Rossom's eyes as he recounted the experiences of the day.

"Dearest!" she exclaimed, "do you mean they just took things for granted and passed over a check for \$50,000?"

"Not exactly for granted," explained Bill. "Even after they decided the safest course would be to make me an offer they continued their investigation as to who I was or might be. Just to keep them interested I sent off two telegrams this afternoon, one to a mythical broker in New York, ordering him to sell a thousand shares of R. S. V. railroad stock at the market and I wired a senator in Washington asking for the latest information on the prospective passage of a bill affecting the newsprint supply."

"But you don't know any senators and you have no R. S. V. stock," protested Isis.

"True enough, kid, but the newspaper boys don't know that yet. They only know that I sent the messages, a fact obtained by certain devious methods known to the initiate."

"What are you going to do now?"

"Just stay in Fortunatus and grow," said Bill, lighting a cigarette. "These newspaper gentlemen will want revenge and I don't want to rob 'em of a chance at it."

Bill looked into a convenient pier glass. He smiled at the reflection of his own evil countenance. His face, he mused, would be his fortune. He prayed for strength to remember in all times of stress that the world would accept those fiercely arrogant eyes at their own apparent value, the cruel lips would be a command even if they should remain closed. He would try to forget always that he was not the man he seemed to be.

Mrs. Rossom lifted her glass to him and he raised his rickety.

"Here's to the horse, Perceval," she said.

"May my mask never slip," said Mr. Rossom.

VII

ON the evening of June 29, 1926, Col. Minihil and his son were motoring toward the business center of Fortunatus. They agreed in attributing the main resistance to the launching of the Gazette to Mr. Rossom, of the Clarion.

"How did that bird happen to get into the newspaper business?" asked Daly as he and the Colonel settled back in the comfortable upholstery.

"Put in his stack with nothing but Jack high in his hand and got away with the bluff," said the Colonel.

"Meaning?" prompted Daly.

"He made a face like a man starting a new newspaper nineteen years ago," said the Colonel. "They bought him off with a \$50,000 check and tried to stop the check after they discovered Rossom had nothing, knew nothing, planned nothing. Old Man Halsey, owner of the Clarion went around to see Bill next day and made such a roar that Bill took pity on him and

offered to shoot most of the \$50,000 into Clarion stock. Old Halsey grabbed at it and Bill went into the Clarion organization. Less than a year after Rossom showed his ugly poker face in the Clarion office he owned the paper. He cleared it of debt and began to print this here now fodder for the feeble minded and it wasn't another year before every nitwit in Fortunatus was a Clarion reader."

"A proud record," commented Daly.

"Sometimes I got a hunch he has nothing to go on but a hard mug," said the Colonel. "Believe me if he's planning a bluff this time we will call him right off his chair."

"Right-ho," assented Daly.

The Colonel looked at him doubtfully as if pondering the use of the American language.

"About this fellow Rossom," went on Col. Minimil.

"He has pulled every boner a publisher can commit and yet he gets along as if he had a brain. He was against the war and he was sore about the peace. He has been on two sides of every public question in the last ten years and sometimes he has been on three sides. He raises the devil with women and girls for wearing short skirts and then he goes ahead and prints legs all over the Clarion pages. He roasts the city council for grafting and then turns around and steals an alley for a railroad spur track to his composing room door."

"He's a bad actor," said Daly. "Burroughs called me up to tell me that Rossom is getting the Flats gang in line to help his circulation crowd put it over on us tomorrow night when we try to distribute the Gazette to the newsstands."

"What about police protection?" asked the Colonel.

Daly laughed. "I would as soon try the League of Nations," he said.

"Then it's up to us."

"Yeah," said Daly. "Up to us to fight 'em and lick 'em."

Burroughs and his henchmen were waiting for the Minimils in the anteroom of Daly's private office. They knew zero hour was approaching and there wasn't a scrapper in the crowd who was unhappy. They quickly gave Col. Minimil and Daly a summary of the situation. Rossom's gang, it had been learned by spies in the camp of the enemy, were to go forth in motor cars on the night of the 30th and seize all the Gazettes delivered to corners in the downtown district. They were to dump these into the railroad canal. At other corners, early on the morning of the first, they were to plant husky men with newspapers and these Janizaries were to make life completely uncomfortable for any Gazette men who tried to turn an honest penny at any of the four corners at the aforesaid intersections. The enemy was to be possessed of weapons that would be most serviceable in street combats.

"Do they figure they can carry on such a fight indefinitely?" inquired Daly.

"Not at all," explained Burroughs. "They do figure, though, that if they keep the high pressure up for a day or so it will be a hard job for the Gazette to hire

men to take the chance of trying to sell our paper."

"Then our job is to whip 'em right at the start," mused Daly.

"Right-whoa," agreed Col. Minimil. The Colonel visibly was picking up in spirits.

VIII

DALY and the Colonel became acquainted that night. Each found in the other hitherto unsuspected qualities of shrewdness, generalship, resourcefulness and courage. Daly's mind was working smoothly and efficiently.

Before dawn a small fleet of trucks had appeared at the warehouses of the Northern Paper Corporation and had removed therefrom great quantities of paper. An expert eye might have observed that the paper was not in rolls, but appeared to be wrapped in huge bundles. These trucks were unloaded, also before dawn, at the entrance of the Gazette's mailing rooms and thence were whisked inside and the place was locked and bolted against all possibility of intrusion by curious outsiders.

Burroughs laughed when Daly told him the plan of campaign for the opening skirmish. Both Daly and his father were in Daly's office all day. Throughout the great building were the stirring sounds of preparation for the first issue of the Gazette. Pressrooms, engraving rooms, composing rooms, editorial rooms, business offices went joyfully about their difficult but enjoyable tasks.

Burroughs was as busy as a popcorn salesman at a Sunday double-header. He gave final instructions to his wagon men and to the leather-lungs who were to man the stands. The first issue of the Fortunatus Gazette was to go on sale at 9 o'clock that evening, with a summary of baseball, racing and other sport results and a condensation of the important news of the day, local, national and foreign. It had been decided for reasons that will appear later that only one hundred of the most important downtown corners of the city were to be covered with that early edition. Later issues would go forth to the stands in the residence districts, the suburbs, the country towns, by wagon, motor truck, street cars, railroad trains and by express and mail to the more remote points.

Fortunatus citizens began to take an interest. It is the good fortune of the newspaper publisher to be able to establish an impression in the minds of the customers that the newspaper is a civic institution whose proud duty it is to lead the people aright on all questions of politics and finance, public economy, morals of the stage and of the magazines, progress of the gentler arts, to condemn the public bitterly when it votes for the wrong candidate and to praise without stint those civic leaders and their satellites who do just what the newspaper wants them to do. For this service the newspaper charges so much per paper at the newsstand and so much per page from the advertiser. It is rarely admitted by publishers that they are operating their journals as business institutions, actually

striving for a profit on their enterprise in dollars and cents in addition to the huge revenues they receive in the form of soul satisfaction as a reward for service well performed for a helpless and puzzled populace. So the good citizens of Fortunatus were eager to welcome another newspaper. They craved it but they could not have told why.

One item of dramatic interest was the rumor that had been travelling the streets all day to the effect that Bill Rossom and Hard Max Minimil were staging a battle. At 9 o'clock restless thousands, who never seem to be quite awake until the bright lights were switched on, were milling about at the intersection of McKinley Boulevard and Cleveland Avenue. That corner was the peak of activity in Fortunatus, both by day and by night. Street cars, motor cars and the lowly citizens who try to get about on foot converged here in rushing torrents or in whirling eddies. It was a reserved seat in the civic theater, from which to watch the advent of the Minimil newspaper.

The first Gazette delivery truck came into view promptly at 9 o'clock. Its approach was heralded by strident blasts from a horn, calling general attention to the handsome machine, dressed up like a Baltimore oriole in glistening black and orange. A huge bundle of newspapers was dragged from the gleaming chariot and deposited by the side of a black and orange stand of steel, which was the first market place of the Fortunatus Gazette. "Bull" Edmunds, the best all around, catch-as-catch-can, mauler, gouger, biter and gunman in the Gazette's selected army of circulation promoters, was in charge of that stand. "Bull" made a move to loosen the rope that bound the bundle of papers. As he did so a large automobile which had been parked a few yards distant, moved up to the corner stand and stopped. Three men leaped out. They were the sort of men one yearns not to meet in a dark alley. One of them had a gun in his hand. He advanced toward "Bull" and shoved him back a few paces into the crowd. To the astonishment of observers who knew "Bull" and his notched record that individual made no resistance. In an open window, a few feet above the crowd a photographer set off a flashlight just as the two other banditti lifted the bundle of newspapers into the tonneau of their car. The three agents of a free press then leaped into the car and as the lights were shifting from red to green they dashed across the street intersection and were lost in the maze of speeding traffic.

"Newspaper hi-jackers" yelled somebody in the crowd. "Old Max Minimil has been tricked by Bill Rossom."

It seemed true. Yet it was strange that "Bull" Edmunds should be leaning against his devastated stand, smiling and calm.

A few minutes later another car drove up to the corner. Again a load of newspapers was delivered to Edmunds, this time a much larger load. As "Bull" arranged the papers on his stand and on the curb beside

it he raised his power-speaker in a perfect roar of verbal advertising.

"Get a Gazette, the new newspaper!"

Several other cars edged up to the curb. They were occupied by men who were obviously contented to remain there, effectually blocking the parking of other cars in that part of the street, and watching with intense interest the operations of "Bull" Edmunds and of the members of the crowd that engulfed him.

At ninety-nine other corners the same sequence of events had taken place. The first deposits of newspapers had been carried off by rough gentlemen and the supply had been refilled.

It was 9:30 o'clock when Col. Minimil called Bill Rossom on the telephone.

"Bill, somebody has been stealing your Clarions and I thought as we were old pals I would tell you about it."

"What's the joke?" asked Rossom.

"Can't make it out," said the Colonel. "In order to make sure our first issue would get off smoothly we went over to the Northern Paper Corporation's warehouses last night and bought up a lot of old Clarions that you folks had turned in for old paper. The unsold copies, you know. Well we sent these in bundles to our downtown stands tonight just as a sort of a rehearsal, you understand. If you will believe me, somebody sent gansters around to all the corners and robbed us of your Clarions."

There was an eloquent interval of silence after the Colonel finished speaking. Then Rossom snapped an answer.

"How do you figure all this interests me?"

"Any guy with a plush-lined sense of humor like yours would be interested, Bill."

"Where is the laugh?"

"The big laugh is coming now, Bill. As soon as the mysterious gangsters disappeared with those decoy bundles we delivered the real bundles of Gazettes to the corners and they are selling fine, thank you. I might mention that there are at least three automobiles standing by at each corner, loaded with boys who are quick on the trigger and if any of the birds who stole your Clarions should come back and try to carry off our Gazettes, McKinley Boulevard will begin to look like a Hindenburg line. And that goes tomorrow morning and the next morning and from then on regardless."

Bill Rossom said something over the wire that sounded so much like blasphemy that the Colonel fairly beamed.

"I forgot to tell you, Bill, that at twenty corners we took flashlight photographs of the gunmen stealing newspapers. The pictures came out fine. If there is any more of this gang stuff started we are going to print the pictures."

Rossom hung up the receiver. Outside of a few skirmishes on the following morning the Gazette circulators met with no trouble in placing the paper on sale. (To be continued)

Everyday Mechanics

Cooling By Steam



Lester P. Barlow, who has invented a new cooling system for automobiles and airplanes, that will take the place of the present radiator, by installing a vaporizing dome on the motor head which will be "Cooled by Steam"

First Duraluminum Shell Built For Naval Academy



A single scull shell of duraluminum, a light but extremely durable alloy, has just been completed at the Philadelphia Naval Aircraft factory for the Annapolis Naval Academy. The shell weighs half as much as the cedar craft of the same type and size. It was built under the direction of Walter Hoover, noted single sculls oarsman. If the shell proves satisfactory, the Naval Academy expects to have an eight-oared shell constructed of the material. It is 26 feet long and weighs only 26 pounds. Photo shows Lieut. Calvin Bolste, shop superintendent, inspecting the duraluminum shell.

Making a Ground-Glass Drawing

DID you ever hear of ground-glass drawings? They are easy to make and transfer, but it will be necessary to make a drawing box in order to make the copies. You draw pictures just as you see them with this drawing box, and portraits can be handled in the same way.

Construct a light pine box from dry-goods boxes, making it twelve inches long, ten inches deep, and ten inches high. The box is enclosed except at one end, and one side is hinged in order to make the ground-glass focus easily. In the front end of the box cut out an opening into which a small reading glass lens will fit tightly. Any clear, highly magnifying glass of this nature will do. Make slots one-eighth inch deep in the top and floor boards of the box so they are paired, and a ground glass may be slipped into the grooves in a perpendicular position. Make six of these slots, each one being one inch from the other. Make a swinging door for one side of the box by hinging the board to the front edge, and the box is completed and ready for the ground-glass. This must be cut out to fit the box so it will slip readily into the slots. Ground glass can be

made by filing and sandpapering common clear glass on one side until it has the surface of a piece of commercial ground-glass.

Throw a cloth over the box, keeping the lens uncovered, and adjust the box in front of the scene you wish to take. If it is a person, he should be sitting near a window. Place the box a few feet away so you can see the image on the ground glass. Now swing back the side door, and make your focal adjustment. Try out all six slots until you find the one which gives the sharpest image on the ground glass. Use an indelible pencil to make the drawing, and again throw the cloth covering over the box and your head, excluding most of the light except that which comes through the lens upon the ground-glass plate. Copy the image directly upon the ground-glass with the pencil, shading lightly here and there, and making a clear-cut outline.

Now slip the ground-glass from the box and lay it upon a table. Slightly moisten a sheet of drawing paper with a sponge, and lay it flat upon the ground-glass, pressing it down evenly. Now peel off the paper, and the drawing will appear upon the paper in purple lines. Rinse off the ground-glass, slip it back again in the box, and it is ready for another drawing.



Table Lamp Made from Old Table Leg



Showing table lamp made from leg and leaf of old dining table. Marshal Taylor Brown, great grandson of Michigan pioneer who made original table, and his mother, Mrs. Harold P. Brown

Grandfather's table legs are coming to the front. They are lighting the way to progress—or at least helping to illuminate some of the parlors and reception rooms in Chicago.

Merle Meyers, a young teacher in the manual training department of the Chicago public schools, seems to be responsible for the emancipation of grandfather's table legs. And here is a hint for any bright boy or his father who knows how to use a few simple tools.

"I am a fiend for looking around in garrets and store rooms for old furniture," said Mr. Meyers. "And I often tell the boys in my classes that many fine treasures may be found that are simply going to waste there. Not long ago while prowling through the basement storeroom of one of my neighbors I came on an old dining table. It was made of solid black walnut. I found the owner was saving the table simply because he could not bring himself to throw it away. It had been made by his grandfather who had cut down the trees, milled the lumber and built the sturdy old piece with his own hands.

"The legs were neatly fluted and turned. There had been five such legs originally but one had been broken off and lost. I offered to make my neighbor a table lamp from one of the legs and part of a leaf if he would

give me the balance of the material. He gladly accepted the offer.

"The rest of the task was easy. With a hammer and screw driver I took the whole table apart. I found some pencil marks had been made in 1849 by the old Michigan pioneer who had put the parts together originally. In making the lamp I simply bored a hole through the center of the leg and extended a three-quarter inch brass tube from the end where the caster formerly had been to a height of seven inches.

"From the top of this tube I suspended a bracket for the lamp shade and also the attachments for a pair of electric light bulbs. The large end of the table leg was attached to a round base turned from one of the leaves. I drilled a hole laterally through the base and through this strung the wire up through the center of the leg and to the bulbs."

The owner of the old table was very much pleased to get this artistic memento of his grandfather's work of almost a century ago and Mr. Meyers found material for many other valuable articles of woodwork. And the poor old table legs—what a dramatic rise after being kicked around by so many shoes from one generation to the next. This item of information about the old table legs is written by the light of that very lamp.

Submarine Hauled from Bottom of the Sea by Locomotives



The U. S. Submarine S-48 which was wrecked off Portsmouth, N. H., two years ago, was hauled out of the sea by locomotives on two timbers, making an improvised drydock. Never before has a vessel of this kind been attempted with a vessel of this size. A cradle was first built around the sub and then the ways greased. Three locomotives were coupled to the end of a five-mile long steel cable which turned over many blocks and thru pulleys and at a given signal the locomotives started pulling, the submarine being slowly brought up on dry land

Noted Pianist Spends Spare Hours in Machine Shop



An interesting sidelight on the life of Josef Hoffman, world famous pianist, is his hobby of mechanics. He spends much of his spare time in the machine shop of Edward W. Bok, noted publisher, at Merion, Pa., where he makes useful and ornamental things with the tools the shop is provided

Restoring Old Ship Models Is Lawyer's Hobby



Henry B. Culver, New York lawyer, has adopted as his hobby the restoring and repairing of ancient ship models. He has just completed the work of rigging and repairing "The Dartmouth," a contemporary seventeenth century named for Lord Dartmouth, whose mother was a Washington of Sulgrave, kin of George Washington

April Evening Skies

*Leo, and the "Sickle" Succeed Orion as Prominent Southern Constellation—
Mizar, in Great Bear, Really Three Stars*

By JAMES STOKLEY

LEO, the Lion, with its familiar "Sickle" in the southern sky, Orion about to disappear until next fall below the western horizon, and Virgo, the Virgin, with its brilliant star Spica, and Bootes with the shining Arcturus in the southeast—to the student of the heavens, these mean that spring has arrived. The maps show how these stars, and the others, are placed in the April evening sky.

The lion, Leo, or at least the stars of the constellation, seems to bear little resemblance to the figure of the king of beasts, but in ancient times, in India and Egypt, it was represented in the same way as today. The blade of the sickle represents the lion's head, as he is facing west, and the rest of the constellation the body. Even the medieval Christians who endeavored to remove the pagan star groups from the sky and replace them with biblical characters, left the lion as one of those with which Daniel was associated.

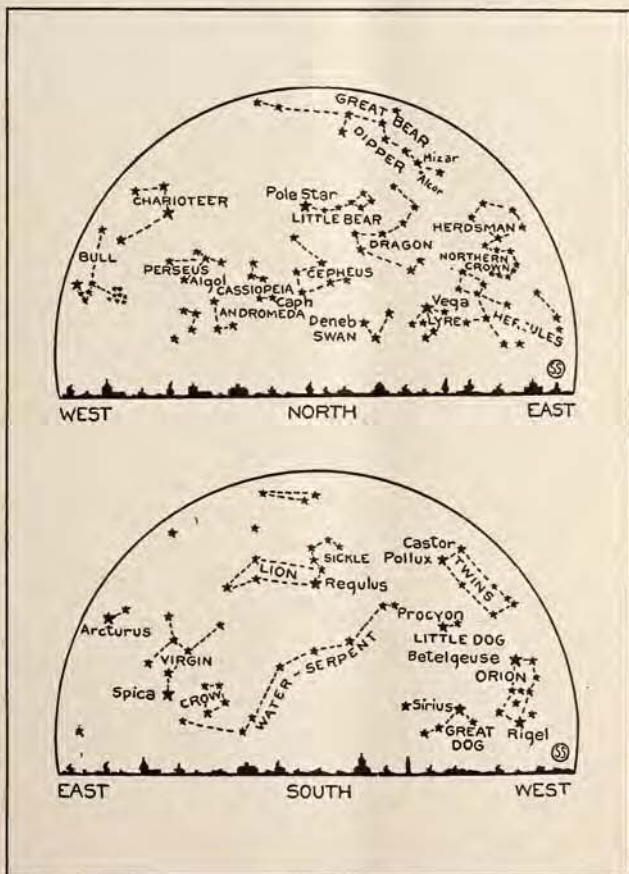
One explanation of the origin of the sign is that in midsummer, when the sun is among the stars of the constellation, the lions in Egypt came down to the banks of the Nile to escape from the heat, for at that time the river overflows. As Egypt has from the earliest days been dependent on the annual inundation of the Nile, the sign of Leo was also an object of worship among the Egyptians, according to Pliny.

According to the Greek mythology, the lion represents the one slain by Hercules in the first labor, and was placed in the heavens by Jupiter to commemorate the historic conflict. The second of his labors is associated with the neighboring constellation of Hydra, the water serpent. This group represented to the Greeks the water snake slain by Hercules after he had finished with the lion. According to this legend, the snake had many heads, varying in number from nine to a hundred, depending upon which version of the story we accept. The center head was immortal. As fast as Hercules destroyed one head two

new ones appeared, and so the encounter would have doubtless ended in disaster for Hercules, but for the fortunate suggestion of his nephew, Iolaus, that he burn them off. This they did, burying the immortal head under a rock, where the monster was unable to find it. Thus, having completely lost his head, the serpent annoyed Hercules no more!

In the northern sky, the large dipper, or the Great Bear, is very conspicuous, as it is nearly overhead in

the early evening. In this position, it affords a good opportunity to see the interesting pair of stars, Mizar and Alcor, which are shown on the map. Mizar is the second star from the end of the handle of the dipper—the one at the turn of the handle. Keen eyesight will reveal near it a much fainter star, which is Alcor, so that the pair is sometimes called "the Horse and Rider." Many early peoples, as well as the American Indians, are said to have used this as a test



of keen eyesight. But in large cities the smoke and haze in the atmosphere, as well as the glare of the lights, make it difficult to see, even with keen sight. But such slight optical aid as a pair of opera glasses reveals it easily.

Double Stars

FROM early times it was thus known as visual double star—a star that could be seen as two with the unaided eye. But in the year 1550 the Italian astronomer Riccioli, who is famous for having named the craters of the moon, turned his telescope on it from his observatory in Bologna. Not only did he see the bright Mizar, and the fainter Alcor, but he saw that Mizar itself was double, as it consisted of two stars of nearly equal brilliance, but too close together to be seen separately by even the keenest eyesight. This was the first "double" star to be discovered, but since then many more have been found. In fact we now know that on the average one star out of every 18 in the sky is double. Many of these were discovered and observed by the late Prof. S. W. Burnham, at the Yerkes Observatory of the University of Chicago. After his death, his mantle fell on Prof. Eric Doolittle of the University of Pennsylvania, and when he died it went to Prof. Robert G. Aitken, the associate director of the Lick Observatory of the University of California. Dr. Aitken now spends most of his time observing these double stars with the great 36 inch telescope of the Lick Observatory, and plotting their motion. The members of such pairs do not remain in the same place all the time, but revolve around each other. Their motion is much the same as would result with two heavy balls, tied at the end of a short string, and thrown into the air, spinning around together. They would revolve around the center of gravity of the two, and so do the double stars, showing that they, like the balls on the earth, are under the influence of gravitation.

But Mizar is more than an ordinary double star. It is what is called a spectroscopic double, and, in fact, was the first star of this kind to be discovered, as well as the first double. The brighter of the two stars that Mizar is shown to be by means of the telescope looks single with even the most powerful optical aid, but by

analyzing its light with the spectroscope, which turns white light into a rainbow-like band of color, it is shown to be two stars. This band of color, the spectrum, of star light, is crossed with numerous dark lines. The position of the line in the spectrum depends on the speed with which the light which produces it is vibrating, the lines in the red part of the spectrum, for example, being produced by light vibrating more slowly than the lines in the blue part.

Sound Wave Analogy

ANYONE who has heard a fire engine, or a locomotive, go past, ringing its bell, knows that the sound of the bell is shriller as it approaches, and deeper as it goes away. This is because the sound is caused by waves in the air, and the pitch of a bell depends on the speed with which these waves vibrate. As the bell approaches, the waves strike the ear closer together than if the bell were standing still. As a bell of higher pitch would also cause the waves to come closer together, the person who hears it thinks that the bell is of higher pitch than it really is. And then as it goes away, the waves are spread out more than ordinarily, and the sound is interpreted as of lower pitch.

The same thing happens with light. When a star is approaching, the light waves are closer together, and the lines in the spectrum appear nearer the blue end than if it were still, and when it is receding they appear nearer the red end. The result is that by measuring the position of the spectrum lines very accurately, it is possible to tell whether the star is moving towards, or away from us, and how fast.

But the curious thing about Mizar is that the brighter member of the pair, when its light was analyzed through the spectroscope, showed that the lines were sometimes double and at other times single. This meant that when the lines were double the star was both approaching and receding, at the same time, a contradiction which could be explained if the star itself were double. This is the case, and the two revolve around each other once in about 20 days and 14 hours.

No planets are well placed for observation all evening during April, but Venus and Mars can be seen in the western sky in the early evening, and late in the evening Saturn ap-

pears above the eastern horizon, and is directly south at 2:53 a. m. None of these are shown on the maps, but Venus, which sets about 2 hours and 45 minutes after the sun, may be recognized because of its great brilliance as it shines in the west.

New Speed Camera Shows Lightning Travels in Spirals, Not Jagged Lines



J. W. Legg, an engineer of the Westinghouse Company, has just invented a new high-speed camera capable of making 2,600 pictures a second and by which he has demonstrated in experiments that lightning and electrical flashes do not travel in jagged lines but in complicated spirals. The jagged line is but an optical illusion resulting in the inability of eye and cameras hitherto in use to record the true nature of the flashes. Mr. Legg says the flashes traverse many times the distance of a straight line between the points of termination and origin. The Legg camera is fitted with 22 lenses and a shutter operated by a small motor and can be adjusted to any speed, up to 2,600 exposures per second. Photo shows Mr. Legg photographing an electrical flash with his new camera.

Heart Beats Heard Like Roar of Train Thru Loud Speakers



Students sat in the Amphitheatre of the clinic of the Medical School, Univ. of Penn., and heard heart beats of patients which were as clear as the rumbling of a train. Dr. C. J. Gamble is shown with stethoscope placed on the chest of a patient, during a diagnosis in which heartbeats and murmurs were amplified millions of times.

Current Science

Radio Will Play Big Part in Future Wars

WARS of the past have unquestionably been bad but a more terrible aspect is given to the picture of future wars by the greater extent to which radio is to be used in controlling the annihilation of the enemy's troops or cities. If radio played an important part in the World War how much more important it will be in the next war can readily be seen from the great amount of research, both military and civil, that is being carried on to further harness electric energy that travels through space at 186,000 miles per second.

Perhaps chief attention now centers on the use of an aerial torpedo, either launched from a mother ship at a distance and guided to its destination by radio, or radio controlled planes which will drop high explosives over a crowded city and return to their base without guidance other than the radio control signals. The same radio control principle may be applied to a torpedo discharged from a submarine. Its activity after leaving the submarine may be controlled by wireless waves. Under such conditions the accuracy of such torpedoes will be far greater than the old type where once discharged the torpedo must follow a prescribed course. While the detection of submarines by radio is better developed so far nothing has been designed to detect an oncoming torpedo, if submerged.

Where in previous wars the battles have been fought largely on land in the next conflicts the action will probably take place principally on the water and in the air. Here two factors will take a part; men and machinery. To be successful these battles must be waged at a saving of man power, so we may expect to see radio, electricity and mechanics combined intensively in the destruction of an enemy's forces or territory with the least expenditure of human energy. With this in view

the war of the future becomes a fight between nations having the greatest financial resources to be able to carry on a war of machinery. In it the scientist will be called upon to develop more terrifying destructive machines with which to punish an enemy, and at the same time the same scientist will be called upon to discover protective measures against the enemy using the same tactics.

In the case of the aerial torpedo scheme as soon as a method of properly directing the course of the torpedo is discovered, other scientists set about to find a means of preventing the same torpedo from reaching its destination. Thus a radio barrage may not be hard to conceive of in the next war; the barrage to consist of a number of signals sent out in the hope of at least some of these signals interfering with the operation of a radio controlled plane or torpedo.

Detection of vessels at sea by means of the underwater oscillator was a stunt used during the past war. In the next one even better means

of locating such craft will probably be used in which radio waves are directed ahead of the ship. If these waves rebound back to the ship the direction of the craft ahead is shown, although its distance is not known very accurately unless it is possible to measure the time involved in the going and coming of the radio waves. This method is being used with some success at present in a radio altitude meter for use on planes where the time involved in the sending of the wave and its return to the plane is calculated so as to determine the height of the plane above the earth or water. This same means is employed in showing (during night flying or in foggy weather) whether the plane is dropping too low for safety. Another possibility of the same device is the direction of icebergs at sea, giving a warning to a vessel so her course may be altered.

If these measures are applicable in time of peace it seems certain many more applications will be found for use in the wars of the future.

Does the Moon Affect the Weather?

By DR. W. J. HUMPHREYS*

*Meteorological Physicist, U. S. Weather Bureau. Author of "Physics of the Air", "Weather Proverbs and Paradoxes", etc.

IF YOU ever had the good fortune to live in the country, or even to spend a few summers in the mountains, you surely are familiar with the confident assertion that as soon as the moon changes the weather will get better. If the fields are parched, there will be rain when the moon changes; if they are too wet the change of the moon will bring fair weather and clear skies. Whatever you want in the way of weather, that, they tell us, you will get, when the moon changes—a cheery, hopeful expectation inherited from grand-dad's grand-dad, an ancient legacy of faith, misplaced to be sure, but so comforting that it were a pity to destroy

it, if we had nothing so good or better to offer in its stead. But let us destroy it, for really the moon does not control the weather, and there are indeed much better guides to follow than the olden tradition that it does.

But how do you know, the faithful ask and have a right to ask, that the moon does not influence the weather? It is certain that the great tides of the ocean are caused mainly by the moon; and even the continents, mountains and all, are raised and lowered, twice a day, nearly a foot by the tug of the moon. Surely, then, so the moon advocates insist, the tides of the light, mobile atmosphere must be many times larger—so large indeed as to



Dr. W. J. Humphreys, meteorological physicist of the U. S. Weather Bureau, who explains the fallacy of supposing that the moon regulates the weather

produce great changes in the weather. All this appears very reasonable, we must admit, but it happens that the atmosphere does not behave that way, and so far from it, indeed, that its tides are so minute that they can be detected only by the most searching and delicate means. We must give up the idea, then, that the moon pulls the atmosphere about in great ebbs and flows, and thereby affects the weather—must give it up, because, on careful examination, we find that nothing of the kind happens.

But how about the heat from the moon, our friends, the faithful, inquire with good reason; isn't that greater at full moon than at new moon and enough greater to change the weather? Yes, we must answer, it is greatest at full moon, but even then, as shown by direct measurement of the moon's radiation, so small that it can alter the temperature of the earth by only one or two thousandths of a degree, a change so trivial that no one could be certain of it, nor would take any account of it if he were. In quite a different, and hidden, indirect manner, however, the moon changes the temperature of the earth manyfold as much as by its own conspicuous radiation. It does so in this way: Since both it and the earth swing around the sun together, and at the same time rotate about each other like a big weight and a little weight at the two ends of a stick hurtling end over end through the air, it follows that at full moon, the time when the moon is on the opposite side of the earth from the sun, the earth itself is closest to the sun, and at new moon farthest away. This action of the moon changes, between full moon and new moon, the distance of the earth

from the sun by about 6,000 miles. That is, at full moon the earth on the average is about 6,000 miles nearer the sun than it is at the time of new moon. Well then, says our moon friend, if you change your distance from the fire that heats you by 6,000 miles surely you will make a big change in your temperature. Truly, 6,000 miles seems a long way when thought of in terms of travelling over the face of the earth, but it is a mighty little part of our 90-odd million miles from the sun, and the temperature effect of this relatively small change in the total distance from our great source of heat is correspondingly minute, in fact only about one fiftieth of a degree, far less than one measures on any ordinary thermometer, and much too small to be noticed in connection with the weather.

Perhaps, now, our moon champion will offer another and very pretty bit of evidence in favor of the idea that the moon greatly affects the weather. Why, he says, many a time I have seen the moon just eating up the clouds. The sky was nearly covered with clouds at sundown, and then in less than an hour the moon was shining bright and there scarcely was a cloud to be seen. The moon had devoured them all, and surely we must agree that the weather is different under a clear sky from what it is under a cloudy one. Of course, we agree to that, for the difference is very real, and we agree, too, to the statement that often a sky that is considerably clouded at and before sunset is seen, during the light of the moon, to clear off rapidly as the twilight deepens. But we do not admit that the moon had anything to do with causing the clouds to disappear. It just enabled us better to see them getting smaller



The moon as it is to the astronomer. Photograph made by the great hundred inch reflecting telescope of the Mt. Wilson Observatory—the largest in the world

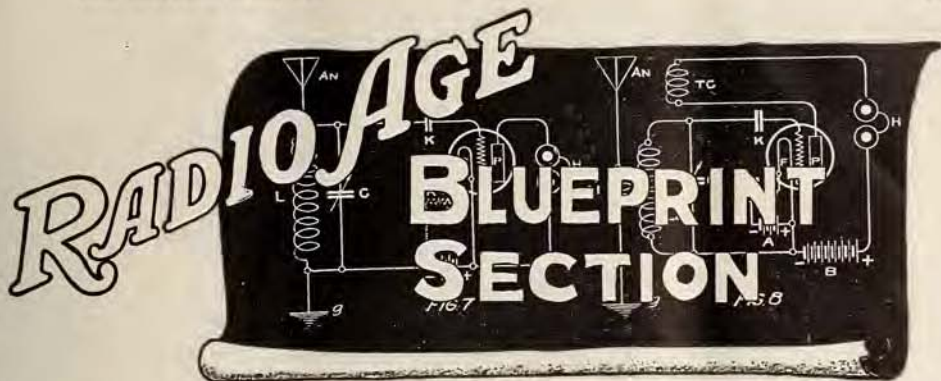


The weather man does use a telescope, but not to observe the moon. This shows James M. Brady, of the U. S. Weather Bureau at Washington, observing a pilot balloon with a theodolite. Twice a day, at Washington, and a number of other places, these small balloons are sent up and watched till they disappear from sight, to determine which way the air high overhead is moving

and fewer and farther between. This is how it all comes about: When the sun goes down, clouds cool faster than the dry air. They lose heat and also chill the air they are in. This chilled air contracts, as cooled things do, becomes correspondingly denser, and sinks to lower levels, pulling the cloud particles along with it. As it sinks it gets warmer and warmer, and stops sinking and warming only when it comes to the same temperature as the air that then surrounds it. Now, as the sinking air gets warmer, of course the cloud droplets in it evaporate and the cloud disappears. The whole process is very simple and evidently happens just as well when the moon is below the horizon as when it is above. The difference is with ourselves. We don't see so clearly the vanishing of clouds on a dark night as on a bright one. In fact, we scarcely see it at all except when there is a moon to make the clouds distinctly visible. And so it happens that we mistakenly attribute the disappearance of the clouds to some action peculiar to the moon, when as just explained, the moon has nothing to do with it.

The moon then does not make big tides in the air; it does not in any way appreciably affect the temperature of the atmosphere; and although it seems to dissipate clouds—to eat them up, as we say—it does nothing of the kind. We are sure, therefore, after all this, that the moon does not noticeably control the weather. But our moon friend is not so sure of it.

(Continued on page 37)



Superheterodyne Minus Repeat Points on Oscillator

One Spot Super and Power Compact Best Ever Made

By F. A. HILL
(Associate Editor)

FORTUNE has at last smiled on radio fans interested in securing a super without the repeat positions so generally considered objectionable. Our own jubilation over running across such a desirable set has risen to such a point it will be rather difficult to restrain our enthusiasm as this is written.

Two factors have contributed to bring about a state of receiver perfection that is so high we frankly have not previously found such a condition possible. In the super end credit is due to the Madison-Moore interests in Denver who have produced an intermediate stage transformer peaked at a frequency value that prohibits the appearance on the oscillator dial of the repeat point, or beat, so common to the ordinary superheterodyne. In the audio end we have to thank Thordarson for the design and manufacture of a 210 power compact whereby even the novice may now have reception such as he has never encountered heretofore. The careful combination of these two features in the RADIO AGE model of the One Spot super has resulted in a receiver and power amplifier that surpasses any-

thing with which we have experimented.

Having opened up a field for the use of intermediates peaked at such a high frequency that the second beat does not appear in the set's operation, it is not very difficult to see a large portion of the transformer industry swinging into line before many more moons have waxed and waned. Anticipating the keen interest of the thousands of super fans who have followed our models and answering the questions of hundreds who have complained of the two beats on an oscillator, we have prepared the superheterodyne to be described in these columns. We hope it will be the means of satisfying our readers' expressed wishes for a distance getter without repeats and with a quality of output equal to if not better than anything that has been placed on the market. Naturally this design will be the forerunner of many similar models involving the use of other quality parts whereby the same results may be achieved. Having produced this particular model we are content to rest until another set of parts is produced which can be made into such

an excellent combination. So much for the enthusiasm. Now let us get down to the history of the component parts which have played a most important part in the excellent results secured.

Shortly after having made up the One Spot model and found that it was an ideal set for our readers, we interrogated the makers of the transformers as to the steps leading up to their production of an intermediate with such a high frequency. From Madison-Moore we learned their cue had been given by the enormous number of super fans who were quite satisfied with their old type intermediates but who wondered if it would be possible to make an intermediate that would eliminate the high beat that so often interfered with the reception of desirable stations. The Denver manufacturers decided the time was ripe for such a departure in transformer design and set about to build one. They decided upon a frequency of 480 kilocycles (624.6 meters) Transformers were then worked up for the intermediates so as to obtain maximum amplification without oscillation. This, however, was the eas-

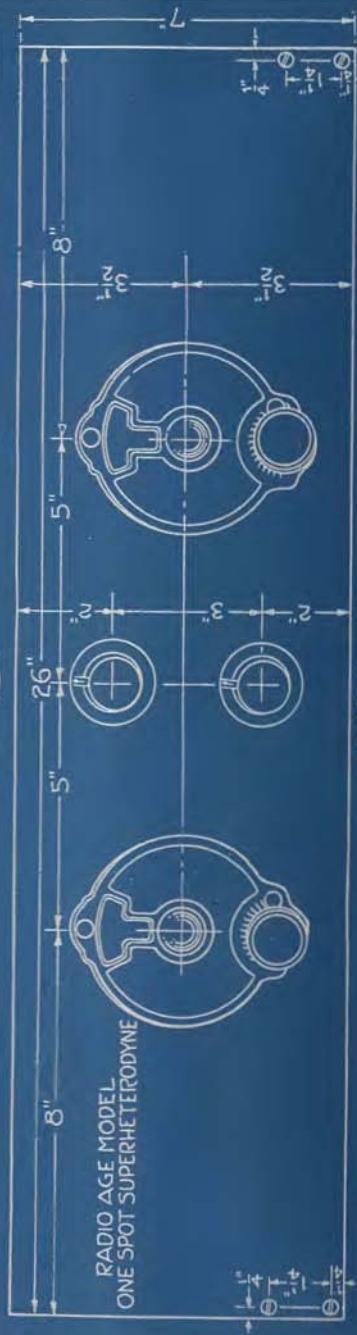
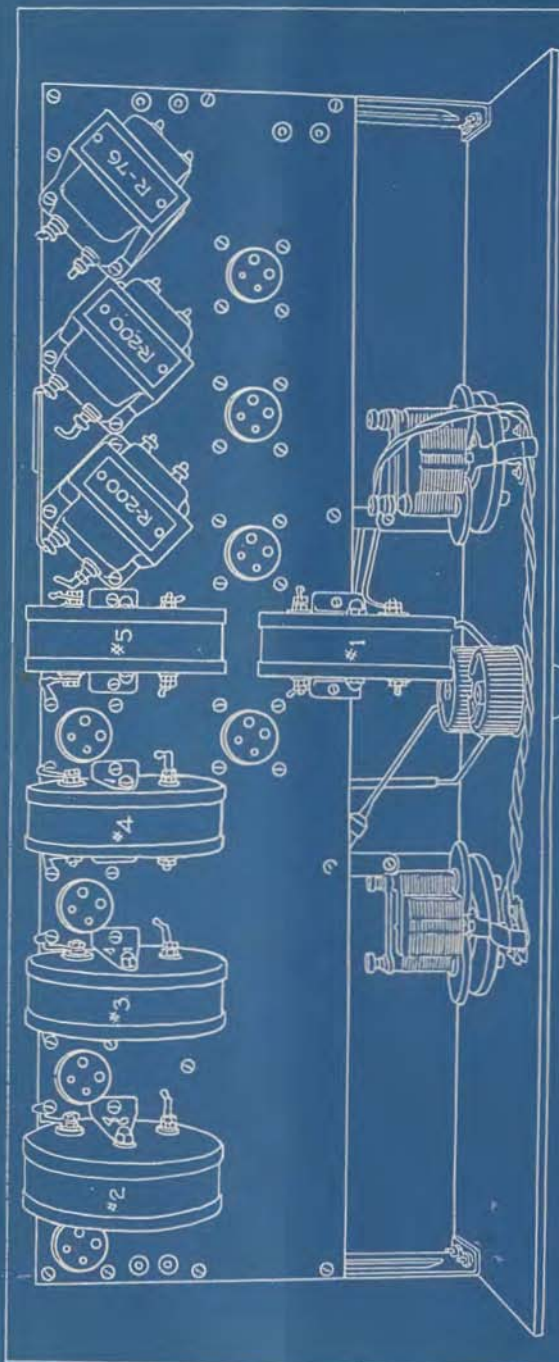


FIG. 1

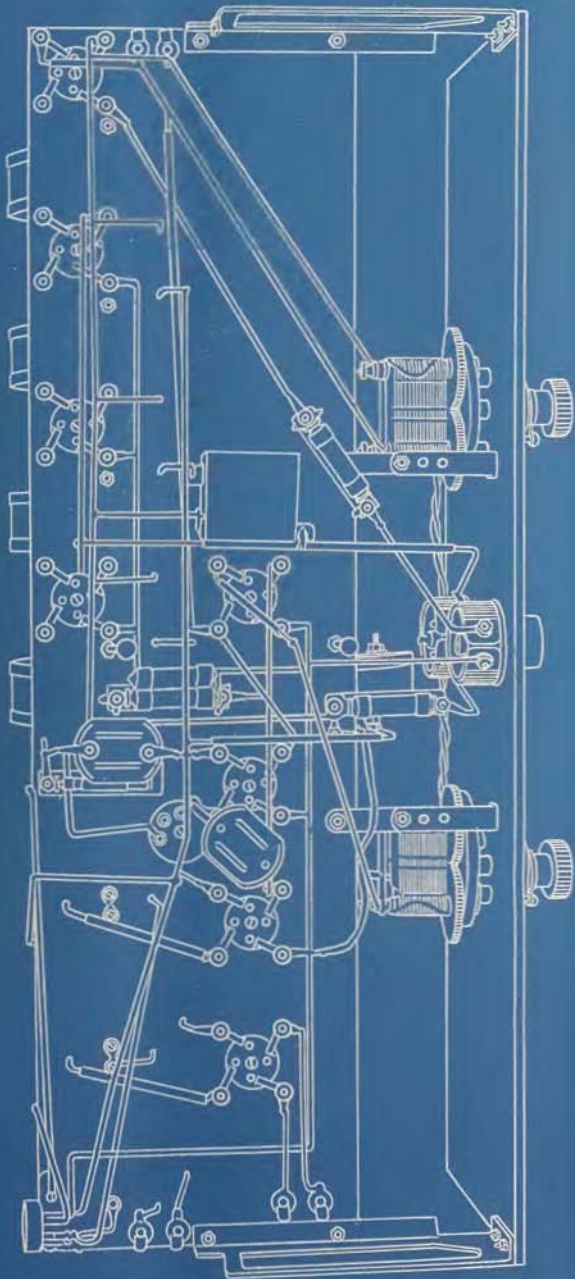


FIG. 2 BOTTOM VIEW OF THE
RADIO AGE MODEL
ONE SPOT SUPERHETERODYNE

jest job of all. When these transformers were incorporated in a set there was absolutely no pick up of strength on distant signals even when using the 200-A detector tube. It was then necessary to do considerable experimental work in order to give the set sensitivity, and the new head end hookup as used in this receiver (see schematic) is the outcome of this experimental work. In the receiver to be described only 45 volts are used on the intermediate stages and with grid returns to the negative A, instead of a bias on these grids since it was felt that some tendency towards rectification might be present with such a bias. Also no potentiometer is used. If one were used greater amplification might be secured but with the following objectionable results: A sacrifice of selectivity and tone quality (the former has been noted by all super enthusiasts) due to the fact the potentiometer would handle the grid returns of number three, four and five tubes, or it would be connected to the grid return posts of transformers number two, three and four. Any variation of this potentiometer would slightly change the tuning of these units, whereas the number five unit which is not so treated, would still have its normal output and detector grid return. Thus the number five unit would continue to function at a pre-determined frequency with the units preceding tuned to whatever frequency might occur as the operator twirled the po-

tentiometer. Another reason for the elimination of the potentiometer was the desire to conserve on the plate current required to operate the set. (Our laboratory model ran a total of $12\frac{1}{2}$ milliamperes on the 45 volt tap which supplies the intermediates.) What further development work will be done on intermediates peaked in the neighborhood of 480 kilocycles we are not in position to know, but we feel a vote of thanks should be extended the Madison-Moore interests for their trail blazing work in this respect.

Another vote of thanks should be extended by the "quality hound" to the Thordarson company for the production of the 210 compact (they also have a 171 compact described in the March issue of RADIO AGE) but chief interest centers now in the 210 combination for plugging in the power compact on any receiver instead of having to build the receiver for the power compact. This departure should permit every fan to have a standard power set onto which he may hitch any type of receiver he desires without any more exertion than the taking out of the last tube in the receiver and plugging into the vacant socket an adapter which carries the grid input into the 210 tube. This scheme is shown pictorially in the diagram on page 28.

Having bestowed proper credit where it is due, we will now take up the discussion of the various diagrams in this article and try to make them

LIST OF PARTS

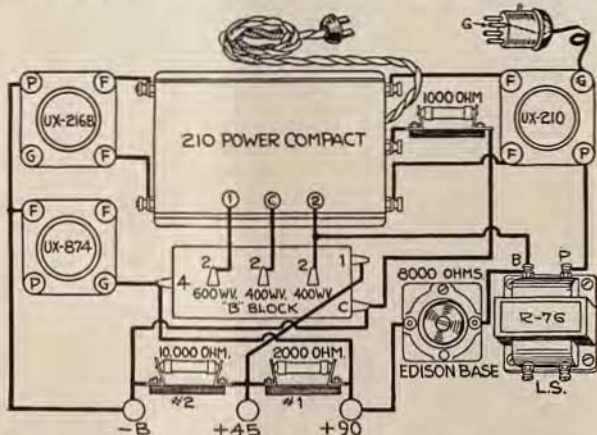
Parts listed below were used in the construction of the RADIO AGE model One Spot Superheterodyne. Other parts of equal merit may be used if desired.

The Receiver

- 1 Set (No. 1 to 5 inclusive) Madison-Moore units
- 1 Thordarson R-76 output transformer
- 2 Thordarson R-200 audio transformers
- 8 Benjamin UX cushion sockets
- 1 pair Benjamin panel brackets
- 2 Remler variable condensers, 1-.0005 mfd 1-.00035 mfd
- 2 Frost rheostats, 1-10 ohm, 1-20 ohm
- 2 Radiall No. $\frac{3}{4}$ Amperites
- 1 Radiall No. 1-A Amperite
- 1 Silver-Marshall RF choke coil
- 1 Sangamo 1 mfd bypass condenser
- 1 Sangamo .00025 mfd grid condenser
- 1 Sangamo .002 mfd fixed condenser
- 1 Durham 2 megohm grid leak and mounting
- 1 Jones base mounting plug
- 2 National type C vernier dials, O-200 clockwork
- 6 Carter tip jacks
- 2 Formica 7x26x3/16 panels
- 1 Qualitone loop
- 1 Abco filter
- 1 Balkite type AJ rectifier

Separate Power Compact

- 1 Thordarson R-210 power compact
- 1 Tobe Deutchmann condenser block for 210 compact
- 4 Ward-Leonard resistors, 1-8000; 1-10,000, 1-2000, 1-1000 ohm
- 3 Daven mountings
- 2 Benjamin UX cushion sockets
- 3 X-L Pushposts
- 1 UX-210 power and amplifying tube
- 1 UX-216-B half wave rectifying tube
- 1 UX 874 voltage regulator tube



This arrangement of the power pack is more desirable for those who wish one power amplifier to fit all receivers. All you do is to remove the last tube of any receiver and plug in the adapter for the power compact. The pictorial layout is shown here instead of the schematic for greater simplicity.

clear for our readers. The old timers will realize the value of the stunt at first glance, but some of our newer readers may need a little help.

Upon referring to blueprint Figure 1 the reader will find the front panel layout and that of the subpanel. All unnecessary gadgets and deadwoods have been eliminated in the interest of economy of parts and simplicity of operation. On the front panel there are only two major controls; the loop dial on the left and the oscillator dial on the right. The upper knob controls the rheostat governing the filaments of the intermediate stages, while the lower one determines the brilliancy of the first detector filament and thus affords that critical balance between regeneration and os-

cillation, which balance is so essential for bringing in to the best volume those distant stations that every experimenter continually seeks. With this set the quality on distant stations was found nothing short of remarkable.

Unit number one, shown in the center of the subpanel, is the oscillator, having only grid and plate windings. There is no pickup coil used, since the plate feed for the first detector (Unit two) and that of the oscillator are seriesed and run to the 45 volt tap. Mixing is accomplished in this fashion without the necessity of a pickup coil. Units two, three, four and five are the 480 kilocycle intermediates with the second detector feeding into a 200-A tube instead of the conventional 201-A. Two audio transformers and an output transformer are placed at the right of the fifth unit. Since the intermediates and the oscillator are completely shielded their position in the layout does not matter. Ours was arranged in the manner shown for the purpose of getting everything on a seven by twenty-six inch subpanel, with the subpanel set back further from the front panel than usual so as to clear the two tuning condensers. The braided wire extending from one condenser to another is the twisted pair carrying the 6 volts of filament current for the illumination of the two National type C vernier dials. Body capacity in both dials is absent regardless of how

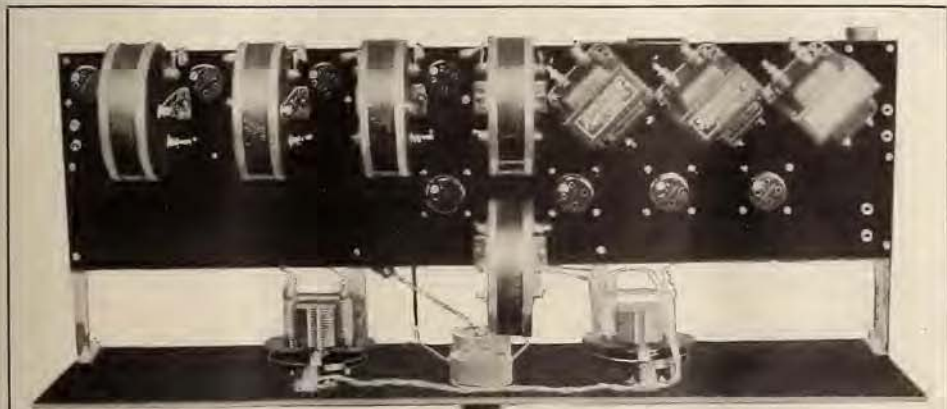
much the set may be forced—the Remler twin rotor condensers serving to bring about that objective.

Judging from the appearance of the subpanel in blueprint Figure 2 there is very little to be seen, which is more or less true. All sockets have been mounted in the subpanel using the Benjamin unassembled type (the same as their UX except for subpanel mounting). A few Amperites, a Sangamo bypass condenser, Carter cord tip jacks and the Jones base mounting plug are about all that have to be placed under the panel. The wiring is simplicity itself, only a few lengths of spaghetti being required to cover crossover wiring.

Schematically in blueprint Figure 3 may be seen the method of connecting up the Thordarson 210 compact, the Tobe Deutschmann condenser block for same, Ward Leonard vitrohms (fixed resistances) voltage regulator tube, 216B half wave rectifier tube, and the fixed resistance for giving the grid bias to the 210 power amplifying tube. On account of the compactness of all these items it is possible to build the entire power outfit into a small space of about 6 by 12 inches. The use of the UX 874 voltage regulator tube makes certain that no voltage fluctuations will occur in the 45 or 90 volt lines. On account of using the superheterodyne where a heavier pull is made on the 45 volt line than in conventional receivers, the resistance between the 45 volt and 90

taps in Schematic Figure 3 is made 2,000 ohms instead of 10,000 ohms as is customary in other types. This insures an ample voltage and current on the 45 and 90 volt tubes. On the 210 power tube a 400 volt potential is applied with an automatic bias on the grid, this value being determined by the amount of current drawn in the plate of the 210 tube. All of the apparatus shown within the dashed lines in the drawing is contained inside of the Thordarson 210 compact. In this diagram all connections are arranged so the builder may make the unit up for use with the One Spot set. However by consulting the pictorial diagram on page 28 the builder may see how this compact may be constructed so it will serve as a power supply for any type of receiver that it may be desired to use, since the compact furnishes the power tube voltage as well as the B voltages for the balance of the receiver.

Most attention should be directed by the reader to the blueprint Figure 4 which is the schematic of the receiver. It will be seen at first glance that only two terminals of the loop are shown. As such the loop would not be regenerative. However on account of the series arrangement of the plate coil of the first intermediate and the plate coil of the oscillator, together with the fact a rheostat is provided for altering the filament current of the first detector, it is possible to cause regeneration and oscillation



Neat arrangement of parts and clean cut wiring predominate in this subpanel assembly of the One Spot super. Here the output transformer is located in the set itself and use is made of the power compact shown schematically in the blueprint, Figure 3

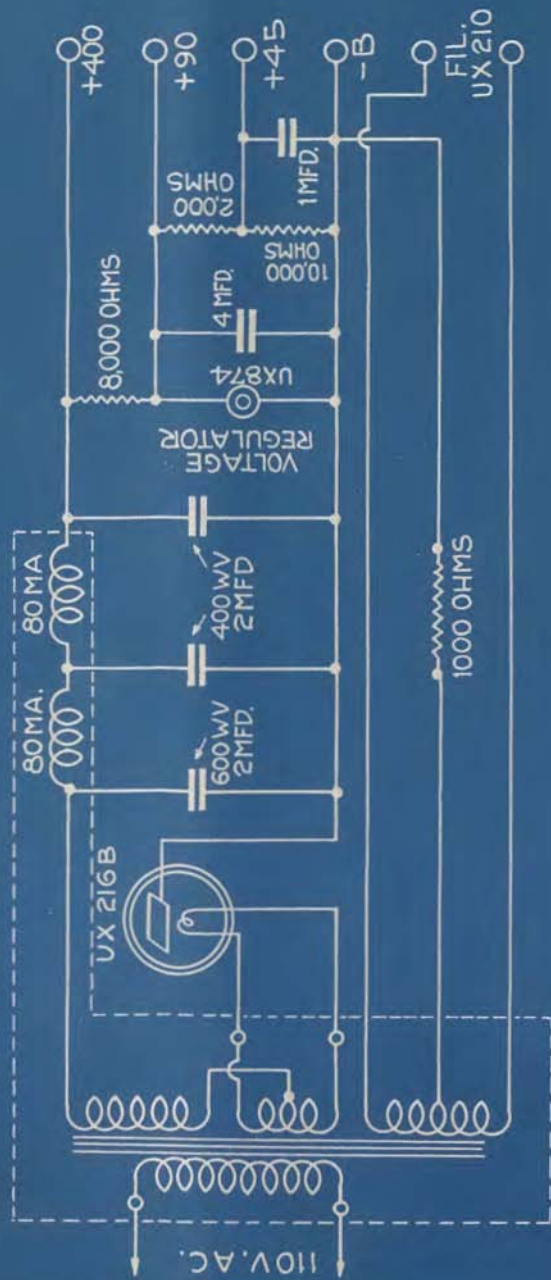


FIG. 3
 210 POWER COMPACT FOR
 USE WITH RADIO AGE MODEL
 ONE SPOT SUPERHETERODYNE

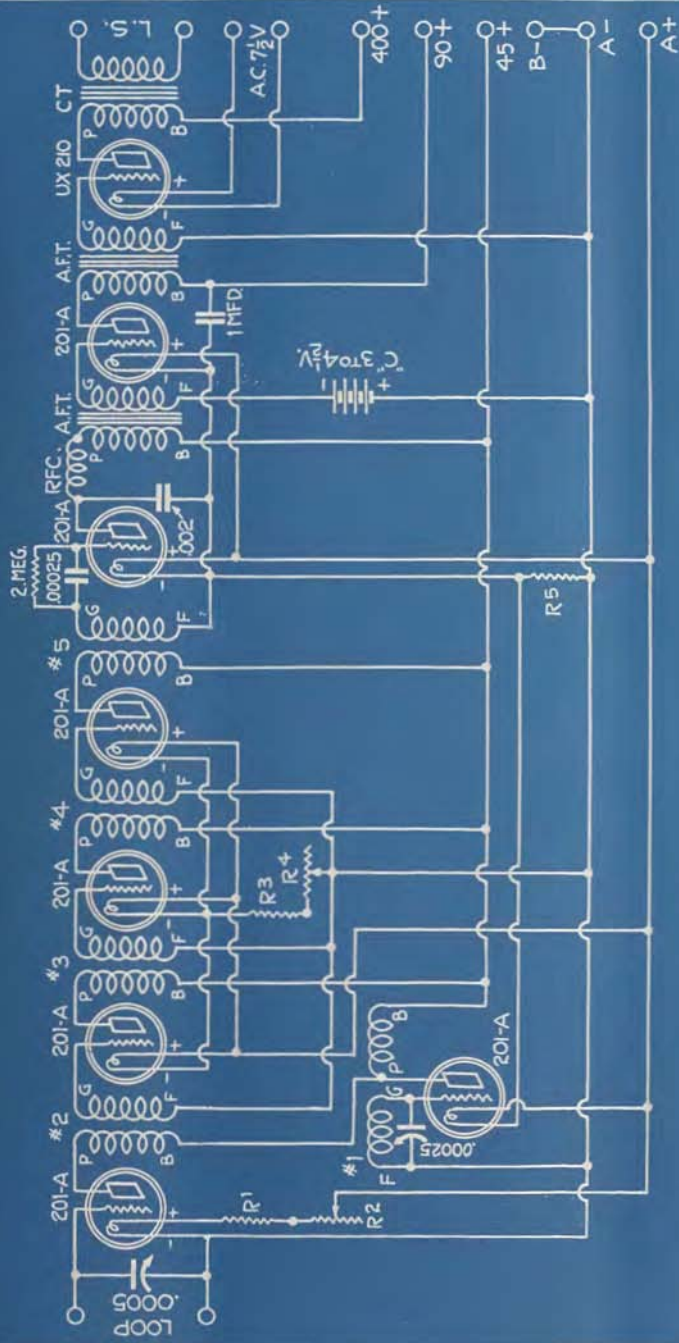


FIG. 4 SCHEMATIC CIRCUIT
RADIO AGE MODEL
ONE SPOT SUPERHETERODYNE

in the first detector. Under the former condition signals will come through fine and no repeat points will be found on the oscillator. However if the first tube is thrown into oscillation then repeat points will appear, but the output will be so hashed that no one but an escaped inmate of the nut factory would listen to it for a moment. Thus this receiver penalizes the chap who has an erroneous idea that oscillation is necessary for reception. Let the oscillator do the oscillating instead of supplying added confusion by throwing the first tube into oscillation. The resistance R1 is a quarter ampere Amperite and is placed there to prevent an abnormal voltage being placed on that tube. The resistance R2 is a 20 ohm rheostat. Filament control for the intermediates is through a three-quarter ampere Amperite in series with a 10 ohm rheostat so that in this case too much filament current may not be placed on the tubes. Do not get an idea in your head that you can dispense with these Amperites and handle it all on a rheostat—these current limiting devices were put in those positions for the very purpose of making sure you would not have any trouble in tuning the set, so take our word they are necessary. The filament control for the oscillator, second detector and the first audio is placed on a three-quarter Amperite since it will not be necessary to adjust these voltages. This resistance is shown as R5.

As shown in this schematic the oscillator is of the tuned grid-filament type and if necessary an ordinary grounded rotor condenser may be used, the same applying to the loop tuning condenser. Our preference happened to be for the .0005 mfd Remler for the loop and the .00035 mfd Remler for the oscillator. The plate coil of the oscillator is a straight series feed and no choke coil will be necessary as is usually included in the parallel feed oscillators. It will be also noticed the plate potential for the plate of the first detector is only secured after it has passed through the plate coil of the oscillator. It is here the mixing action of the locally created frequency is accomplished against the received signal frequency. Please note that grid returns of units two, three and four go direct to the negative filament. The grid return for unit five goes to the tube direct instead of going direct to the negative of the filament. However for unit

one, which is the oscillator, the grid return is direct to negative. Remember these points when building the set and do not deviate from the schematic. The balance of the set is not difficult to arrange and little need be said. A Silver-Marshall RF choke coil was placed in series with the plate of the second detector and bypassed to the filament—this was done on general principles. The two Thordarson R200 audio transformers are shown in the diagram with the bias of the first audio grid being obtained through a C battery while the negative return of the second stage is direct to the negative A and B line, which when connected to the power compact will give the proper bias to the grid of the 210 power tube regardless of whether the common AB negative line is grounded or not. Terminals are provided for the 7½ volts AC supplied by the compact; other taps are shown for the loud speaker and the loop. Instead of using binding posts on the loop, loud speaker and filament terminals we used the Carter cord tip jacks which greatly simplified our work. The second detector uses a grid condenser and leak for rectification instead of the grid biased rectification method used in our previous models. Since the 200-A is utilized this form of detection is believed to be better.

Now for a description of the 210 compact when used as a separate unit to be applied for use with any type of receiver regardless of its make. This idea appeals to us as best of all for the real experimenter because of the facility with which he may slap on any receiver and be assured of quality output as long as he has a set of decent transformers in the set under test. Of course no power amplifier will be a cure for poor audio transformers in a set, but from our experience with this combination it will certainly make quite a difference in a large number of sets now on the market.

This unit may be built up in a metal box if desired, or it may be laid out on a wooden base with rubber feet placed underneath to prevent its scratching any surface on which it may be placed. The sockets for the 216-B half wave rectifying tube and the 874 voltage regulator are placed at the left of the power compact. The condenser block is placed in front of the compact, while the Edison base

receivable, the output transformer and the socket for the 210 tube are located at the right of the compact. The Canotex adapter for plugging into the last stage socket of any set is shown at the upper right of the drawing and is attached to the grid of the 210 tube. It will be furnished with the compact. This adapter is available on the market now. If desired it may be made by breaking off the glass on a UX tube, finding the grid prong and soldering a wire to it (inside the socket) then attaching the other end of the line to the grid of the 210 tube. Thus you can make your own adapter. The resistances in this compact are those chosen for operation of superheterodynes instead of tuned RF receivers. The 8000 ohm vutrohm made by Ward-Leonard will handle 40 mills, while the 10,000, 2,000 and 1,000 ohm cartridge resistances made by the same concern will handle the desired current rating in that portion of the circuit. Only three binding posts are required on this assembly because the high plate potential lead goes direct from the condenser block to the B post on the output transformer.

Operating instructions on this set are simple. You will expect and you will get ten kilocycle separation regardless of whether the locals are on or not. You will find no repeat points unless you are unwise enough to let the first detector oscillate. The left hand condenser will govern the loop readings, while the right hand one will be for the oscillator settings. With given tubes and given voltages as supplied by the power unit, the set may be logged and regardless of where it is carried the oscillator loggings will run the same. Different types of loops will give different reading on the left hand dial. The filament setting of the first detector will be the critical one. The filament setting of the intermediates is not so very critical though both of these controls may be turned too far and either the detector or the intermediates thrown into oscillation. This condition will at once be manifest to the operator due to the squeals that will result.

This set was operated with complete A and B elimination, an Abox filter being placed on the output of a 3 ampere rectifier. This furnished is our filament current. The power compact furnishes A, B and C voltages for the power tube. This gave

(Continued on page 36)



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THE material appearing under the title "Pickups and Hookups by Our Readers" in RADIO AGE, is contributed by our readers. It is a department wherein our readers exchange views on various circuits and the construction and operation thereof. Many times our readers disagree on technical points, and it should be understood that RADIO AGE is not responsible for the views presented herein by contributors, but publishes the letters and drawings merely as a means of permitting the fans to know what the other fellow is doing and thinking.

OUR attention has recently been called to a condition against which many radio fans might desire to protect themselves in the operation of a charger. J. G. Lindsay, 2452 Geneva Terrace, Chicago, Ill., nearly burned up his radio set through the use of an old type bulb charger in which the winding was that of an auto-transformer instead of the true transformer consisting of a primary and a secondary, inductively coupled. The accident occurred when Mr. Lindsay turned on the charger (after someone else in the family had reversed the cord plug) so the high side of the 110 volt circuit was grounded through the charger itself. Very few old style chargers remain, however, but if you happen to have one it would be a good idea to either provide yourself with a polarity plug so the 110 volt plug could not be put in wrong; or else turn in the old style charger and get a new one. At the time the old type was made they were used only for charging batteries in service stations. The sudden rush of radio interest swamped the manufacturers so it took nearly two years before the proper type of isolated windings were placed in rectifiers, thus effectively barring the possibility of accidents through placing the high potential side of a line to ground through the charger.

OWEN BAILEY, 522 Reynolds Ave., Columbus, Ohio, amuses himself by compiling a list of distant reception which carries in addition to the station call, the wattage of the transmitter. His list is a formidable one, reception having been accomplished on a three tube set within the space of three weeks.

RADIO signals on 32.79 meters, inaudible 200 miles from the transmitter, were heard and copied

with 100 per cent accuracy by a listener in Australia, 11,400 miles from the transmitter.

This fact is brought out in the report of engineers of the General Electric Company, following a series of propagation tests on modulated or voice signals and telegraph signals, on 32.79, 65.16, 109 and 140 meters.



Lady of the House: "An' when you get thru tuning that piano you can tune the radio too. It's sounded like it need tuning for a long time."

It was the purpose of the engineers of the General Electric Company, under the direction of M. L. Prescott, to conduct a series of tests and chart the signal strength and intelligibility at different distances. In making the tests four observers were stationed at intervals of 50 miles from the transmitters and each man made simultaneous observations of all test transmissions. The schedule for each of four wavelengths lasted two weeks. During the first week the stations were on the air from midnight until noon of the same day and during the next week the observations were made from 12 noon until midnight. Comparative reception records were made on voice modulated and telegraph signals. Power outputs of 150, 500 and 2000 watts were used successively to obtain a direct comparison between the reliability of the received signal and the power of the transmitter.

Conclusions reached by Mr. Prescott are:

Channels comprising wavelengths shorter than those of the 66.3 to 75 meter channel will not give economical service at points within 100 miles of the transmitter.

The 66.3 to 75 meter channel, the 85.7 to 105 meter channel, and the 133 to 150 meter channel are capable of rendering economical service at points within 100 miles of the transmitter.

For daylight communication at distances not greater than 90 miles from the transmitter, the 133 to 150 meter channel will give better service than the 85.7 to 105 meter channel. Similarly the 85.7 meter channel will give better service than that which can be obtained under the same conditions using the 66.3 to 75 meter channel.

The above conditions are reversed when distances between 90 and 200 miles are considered. In this case the 66.3 to 75 meter channel will give better service during daylight than the 85.7 to 105 or 133 to 150 meter channel.

DR. MILES R. BRUEMMER, 2629 Grand Ave., Milwaukee, Wis., reports excellent results with the Ideal Model of the World's Record super illustrated in the blueprint section of the March issue of this magazine. He says the tone of that set is unsurpassed and its distance consistently remarkable. He believes in it so much he has helped three of his friends to make similar sets.

S. O. S.

Radio Age would appreciate having the address of W. Lemkin who drew the cartoon which appeared on page 34 of the February 1927 issue of this magazine.

Should Mr. Lemkin see this note we would be glad to have him furnish us with his address.

—Editor

Portable Direction Finder Has Many Government Uses

(Continued from page 7)

The use of seven heterodyne coils is required to embrace the wavelength range from 39 to 3,300 meters. This, as previously stated, necessitates seven cans, each of different shape; these with their respective heterodyne generator coils and corresponding direction-finder coil antenna cover the wide band of wave lengths. These generator coils, like the direction-finder coils, are of the plug-in type; having six terminal plugs, four of which constitute the terminals of the plate and grid coils, the other two being the terminals of the coupling coil, which is in series with the direction-finder coil. The turns of wire on this coupling coil vary for each of the coils. The generator coils are wound on tubes $2\frac{3}{4}$ inches outside diameter and $2\frac{1}{4}$ inches long. They are protected with a layer of varnished cambric and by two bakelite disks, one over each end of the coil. A socket is provided to receive these coils, to which the wires of the receiving set terminate. In each of the heterodyne generator coils the plate winding is on the lower half of the coil form with the outside end of the coil connected to the plate. The grid winding is on the upper half of the coil form with the outer end connected to the grid. The grid and plate coils are wound with the same size wire and have the same spacing.

The receiving set used with this direction-finder is a super heterodyne, employing a standard Signal Corps

amplifying unit. It is known as Type BC-116 and makes use of seven Western Electric Company Type 215A electron tubes, the amplifier being operated from a 4-volt storage or dry battery. This amplifying unit consists of the usual first detector stage, three stages of 4,500-meter wave length intermediate-frequency amplification, second detector, and two stages of audio-frequency amplification. The amplifier is enclosed in a wooden box which is contained in the rear-left corner of the shielded aluminum box.

Extreme sharpness in tuning for minimum signal when locating the source and direction of a transmitting station is obtained by use of an auxiliary antenna. "Tests made in an open field," reports the Bureau of Standards, "one mile from a 500-watt transmitting station show the small antenna connected to the movable plates of the balancing condenser made possible in perfect null point on the minimum. With these plates grounded it was difficult to obtain a good minimum.

This direction-finder in its completeness is not of a complex design, rather it is of the simple rotating coil type which is common with most equipment of this kind. The bakelite shaft supporting the direction-finder coil is made of insulating tubing in two sections, one of which is removable. The fixed section accommodates the slip rings, plug terminals for connecting to the removable section, and a socket in lower end for receiving the operating handwheel. The removable section has four socket connections in each end for connecting the slip rings to the terminals and center of the direction-finder coil and to the antenna on the direction-finder coil. The magnetic compass is designed to plug into the opening which receives the movable shaft section before the latter is put into position. As this would imply, radio bearings are taken with respect to magnetic north. Not unlike the operation of a camera, this device makes use of a tripod and it may be put into service readily afield.

"The radio direction-finder," comments the Radio Laboratory of the Bureau of Standards, "is an effective means of locating the source of a radio signal whether it comes from a train in distress, from a radio beacon, from an airplane in flight, or any other source."

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Toronto Water Faucets Act As Radio Receiver

By JAMES MONTAGNES

A PHENOMENON in radio reception has been recently noticed in a florist shop underneath one of the large Toronto broadcasting stations. It appears for some unknown reason everything that is broadcast or finds its way into the microphone while the radio transmitter is on can be heard quite clearly through the faucets in the florist shop with the metal sink acting as a loud speaker.

Although a number of telephone and radio engineers have investigated the possible connections between the broadcasting station and the hot and cold water taps in the shop, nothing has been found which would account for this peculiar effect. It is thought by some to be magnetism.

Music is received with much more volume than speech, although the latter can be heard at a distance of three feet when the speaker is talking with less than average force into the microphone. The operator of CFCA, E. J. Bowers, reports one evening while a concert was being broadcast by remote control the music could be heard very plainly outside the locked door of the shop, some ten feet away from the water taps.

The owner of the shop, when asked as to whether the continuous flow of music was irksome, replied he did not find it so, and often came to the shop at night to hear a good concert. He has listened in this manner to church services broadcast through CFCA.

"The only time that it is bothersome," he said, "is when the radio and music store across the street opens with its loud-speaker and re-broadcasts above the noise of traffic. Then I am in between two fires."

Just what is the cause of this freak reception has not been definitely established. Samuel J. Ellis, radio inspector for the Toronto district, has investigated with telephone engineers in an effort to solve the mystery.

"We tested every pipe near by and in other parts of the building, but nowhere was the volume as great as at the taps. Near-by pipes would record to a slight extent when a fiddlestick was used," said Mr. Ellis.

This, Mr. Ellis explained, was a small wooden rod, some eighteen inches long and similar in appearance to an ordinary broomstick. One end had been sawed off diagonally and a small wooden disc, the size of one's ear, nailed onto it. The other end was grooved to fit on a pipe. When the fiddlestick was placed against a pipe and held to the ear, music and speech were audible.

"It is either magnetism or mechanical vibration," said Mr. Ellis. "Just what it is we have not yet determined."

E. J. Bowers, operator of the broadcasting station, holds somewhat similar views. Since he explained that the station is in no way connected with the pipes, it being thoroughly grounded where necessary and the leads from the motor generator to the tubes contain more than the required number of radio frequency chokes and by-pass condensers, it would seem that mechanical vibration is accountable for this "tap music."

The case has aroused considerable interest among Toronto radio fans. Reports from England tell of a similar case in which a metal lamp pole near Station 2LO in London acts in a like manner and daily brings crowds about it.

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5-2 National Theat. Bldg., Cincinnati, Ohio

Putting It Over—On the Mike

(Continued from page 8)

NO WORDS ever written could hope to convey the agony of those first few moments. A horrible feeling that you are shouting overcomes you. You have the terrible consciousness that this voice, this body, these hands, these lips, do not belong to you. And then that singular, ghastly sensation of fighting against an anesthetic.

Just as you are positive that you cannot endure another moment of it and that, come what will, you can NOT go on, a change takes place. A blissful, soothing, heartening change. You discover, to your amazement, that the studio is righting itself. That the announcer's face is beginning to assume normal proportions. That there is being injected into the room, a comforting quality of familiarity.

Why there is your voice! Going ahead smoothly, easily glibly. Not bad at all. In fact, it's rather good. You had never liked women's voices over the air, but yours . . . a depth, a resonance . . . not at all bad.

You are gaining confidence every minute. You're almost liking it. You think . . .

There! What's that down in the middle of the page? That word. What IS it? You've seen it a million times, you've spoken it as many, but there's something about it now that eludes you. How do you pronounce it? How in heaven's name, **DO YOU PRONOUNCE IT?**

A kind of sickness takes possession of you. A nausea in the pit of your stomach. Hot water in your throat. You give the announcer a pale, fleeting smile, a smile at once pleading and despairing. Two more sentences. One more. The word!

Well, you've pronounced it. How, you have not the faintest idea. But it's out. It's gone. Your knees become stabilized. Your nausea passes. Besides, even if you hadn't pronounced it correctly, who would know it? What person is there that could distinguish the mispronunciation of one word out of a hundred others? What person . . .

And then, for the first time, you become fully aware of your audience. For the first time you realize that thousands of people are listening to you. Millions perhaps.

A wave of such terror assails you that you are almost suffocated. Oh, why had you ever done this thing? Why had you not gone home this afternoon and cleaned up the house and baked a cake—blessed drudgery! Why had you ever wanted to be anything but an unknown? If you could only be some place else. Any place.

With a start you realize that in another few minutes, unless something happens, you are going to blubber into the microphone. Now that would be fine, wouldn't it, with everybody listening in?

Some latent pride that has in it no quality of courage, comes to your rescue. You clutch at your reeling senses and somehow, some way, you stumble on.

This paragraph finished. Another. And another. And then—

Oh, what can that be down there at the bottom of the page? Surely not the little mark you had unconsciously set there to designate the end of your talk. Surely heaven could not be so benign as that. Surely . . .

But it is the mark! One more paragraph, four more sentences, six more words—finish!

As you grope your way out of your chair you hear the announcer naming the next number. Carefully you make your way across the studio, through the door and into the ante room beyond. You are trembling, quivering in every muscle.

Save for you, the room is deserted. O beautiful solitude! O lovely silence! How long had you talked? Surely it must have been an hour at least. Your wrist watch says only thirteen minutes, but that's wrong of course.

And then the studio director bustles in. Perhaps he senses something of what your experience has meant to you for he approaches you and beams, "Fine! Absolutely perfect! Not a trace of nervousness!"

Not a trace of nervousness! Suddenly you begin to laugh. Violently, hysterically, bitterly, you begin to laugh. Not a trace of nervousness! Why you are a nervous wreck. You are prematurely aged. Your courage is shattered, your moral fiber rotted. But what does that matter? What do nerves, age, mental collapse or blasted courage matter? At last you are a power in the earth! You have broadcast!



Bradleyohm-E

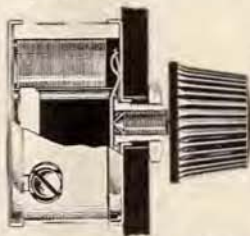
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Free Edge Cone Speaker Quite Easy to Build

APPEARANCE of an article on the construction of a 36 inch cone speaker in the February issue of this magazine quickened the interest of readers on the subject to an extent where it has become necessary to describe another form of speaker, known as the free edge cone speaker. On account of the use of but a single cone sheet the construction of the outfit is materially simpler. Of the several forms on which constructional data is available we preferred the 36 inch wall type which is illustrated in this article.

In Figure 1 the lower section of the drawing shows dimensions for cutting of the paper. Line A for the 36 inch size should be 19 inches; line B should be $18\frac{3}{4}$ inches and dis-

tance from edges at C should be $6\frac{1}{4}$ inches. Cutting is performed along the full lines. The direction of the grain of the paper is shown by the arrows in the sketch. In the upper right corner of the sketch is shown the method of cutting out the small paper cone for the apex. At top of the sketch can be seen the method of assembly of the small paper cone and the metal cones which are supplied with the unit. A $\frac{3}{8}$ inch flange is left which should be bent back as shown in the upper diagram.

Supports for the cone may be a pair of cross sticks 36 by $1\frac{1}{4}$ by $\frac{5}{8}$ inch of any wood, as illustrated in Figure 2. The cone is fastened with wood screws and washers at the four ends of the sticks. Mounting of the

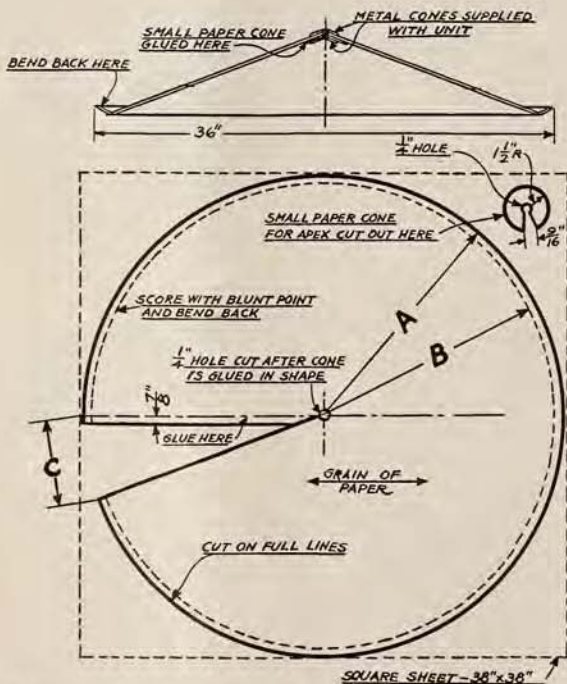


Figure 1. Simple sketch to show method of cutting paper for a three foot cone speaker. For this size the distance from center through line A should be 19 inches; center through line B is $18\frac{3}{4}$ inches and distance from edge at C is $6\frac{1}{4}$ inches. Dimensions for other sizes are included in the literature accompanying the speaker units

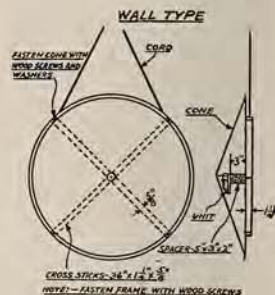


Figure 2. Wall type speaker diagram showing method of mounting to wall, and scheme of unit attachment to block in rear of cone

unit itself is upon a block called the spacer, 5 by 3 by 2 inches. Since but a single cone is used the placement of the unit into position is much easier than in the double cone.

Figure 3 shows a sketch of the mechanism of the speaker unit which is interesting because it is probably the simplest device we have yet seen. N and S in the sketch represent the bar magnet of tough tungsten steel. C is the coil winding in series with the plate of the last audio stage. The air gap shown at G is located at the center of the coil to reduce magnetic leakage. Action of the armature is up and down, the long threaded rod carrying the two nuts at the top being the driving rod of the unit. Adjustment of the air gap is quite simple. If the air gap is too small the speaker will chatter. Reduced vol-

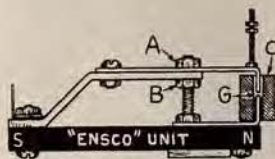


Figure 3. Pictorial sketch of the speaker unit used in making up of a thirty-six inch cone speaker. Nuts A and B are for altering the air gap (G) which is located at center of the coil to cut down magnetic leakage. N-S is the steel bar magnet

time will be apparent if the gap is too wide. If the gap is too small loosen nut A about an eighth of a turn and tighten nut B about an eighth of a turn. For a gap that is too wide the process is reversed, loosening nut B about an eighth of a turn and tightening A by the same amount. Although units are adjusted in the factory some slight adjustment will be made by the builder to get best results according to his own standards.

In operating the cone it will be observed the speaker terminals will have a polarity effect. The marked lead (the one with the tracer) should go to positive B, while the other goes to plate. In case you are not sure try switching terminals until you get maximum volume. Operating voltages up to 250 volts may be used.

We found no restriction on the type of set to which this cone could be attached. It was tried on all sets in the laboratory from the smallest to the largest and performed satisfactorily in each event. Most pronounced results were secured, however, when used in conjunction with the power amplifier arrangement mentioned in the blueprint section of this month's issue.

Wins Honors



Miss Audrey Call, the seventeen year old violinist of Edison Studio, Westinghouse Station KYW won the first high honor of a promising career when she made her debut recently with the Chicago Symphony Orchestra at Orchestra Hall, playing D'Ambrosia Concerto, and receiving a tumultuous applause.

The privilege of appearing as soloist with the Chicago Symphony Orchestra is an honor bestowed each year on the winner of the competitive test of pupils of Chicago music teachers. This prize is, of course, one most keenly striven for, and the winner who is selected by Frederick Stock, director of the Symphony, has well earned the honor bestowed upon her.

To followers of KYW, Audrey Call is well known. She appears on the station's daily programs, as soloist and as a member of the Edison String Trio, a group which has also firmly established themselves with KYW'S fans

Making Terminals For Storage B Batteries

LEAD plate storage "B" batteries usually are not furnished with binding posts of any sort. The two terminal plates have an inch or so of their posts protruding through the cell cap, and a clip or some other makeshift method of connecting the battery to the set is resorted to. In time, due to the acid, the clip and post become so corroded there is practically no contact left. A nickel plated composition top binding post provides an ideal terminal, but necessitates drilling a hole, which is likely to result in damaging a new battery.

With a fine file, rub the top of the post until you expose a bright, clean and flat surface. Solder a tinned lug on the end of a piece of bus bar, about an inch and a half long. On the other end, using a pair of round nose pliers, make a loop of the same diameter as the battery post. The loop end of the piece of wire is soldered in place, flat on the cleaned top surface of the battery post. The leads from the set should be provided with lugs, and small nuts and screws are used to join them with the lugs on the batteries.—John C. Heberger.

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Extra Offer: 4 Batteries in series (56 volts) \$10.50.

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WINDSOR FURNITURE COMPANY
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Super Heterodyne Without Repeat Points

(Continued from page 28)

us eminently satisfactory operation without any battery troubles. In fact such an arrangement is now standard equipment at the laboratory and is used on all sets tested.

For the benefit of those to whom the One Spot idea is new we would again say to be sure to use good tubes. Especially is this true in the case of the first detector, and even in the intermediate stages. Poor tubes in these positions will almost completely nullify any good results which

might otherwise be expected from the set.

Loop operation on this set was used to secure maximum benefit from directional qualities. The loop shown below, the Qualitone, was found admirable for use with the model described.

For supplying the A current we found the Balkite interests have made a special type AJ rectifier which when combined with the Abox filter, furnishes enough current for sets containing up to and including ten tubes. In using such a device on smaller sets it is advisable to have a master rheostat in one of the leads from the filter so the voltage to the tubes may be thereby regulated. A two and a half ohm rheostat will suffice for that purpose.

For the benefit of our readers located in places where they are unable to secure standard advertised radio parts locally, we are this month establishing the

Set Builders' Quick Shopper

Those interested in our April feature, the One Spot Super, described in the blueprint section, may secure any or all parts shown in the list below by remitting to this office the list price shown beside each item. These articles will then be purchased for our readers and shipped immediately, passing through our laboratory before shipment.

This is not a local service but one designed for the reader in isolated sections where goods advertised in our columns cannot be secured.

Goods are shipped the same day order is received. Be sure to send exact price shown in the list.

The Receiver

	Each	Total
1 Set (No. 1 to 5 inclusive) Madison-Moore Units.....	\$11.00	\$ 55.00
1 Thordarson R-76 output transformer.....	6.00	6.00
2 Thordarson R-200 audio transformers.....	8.00	16.00
8 Benjamin UX cushion sockets.....	.75	6.00
1 Pair Benjamin panel brackets.....	.70	.70
2 Remler variable condensers, 1-.0005 mfd., .00035 mfd.....	5.00	10.00
2 Frost rheostats, 1-10 ohm, No. 810 1-20 ohm, No. 820.....	.75	1.50
2 Radiall No. 3/4 Amperites.....	1.10	2.20
1 Radiall No. 1-A Amperite.....	1.10	1.10
1 Silver-Marshall RF choke coil.....	.60	.60
1 Sangamo 1mfd bypass condenser.....	1.25	1.25
1 Sangamo .00025 mfd grid condenser.....	.50	.50
1 Sangamo .002 mfd fixed condenser.....	.50	.50
1 Durham 2 megohm grid leak and mounting.....	.85	.85
1 Jones base mounting plug.....	4.50	4.50
2 National type C vernier dials, O-200 clockwise.....	3.00	6.00
6 Carter cord tip jacks.....	.15	.90
2 Formica 7x26x3/16 panels.....	3.65	7.30
1 Qualitone loop.....	10.00	10.00
1 Abox filter.....	19.50	19.50
1 Balkite type AJ rectifier.....	19.50	19.50

Separate Power Compact

1 Thordarson R-210 power compact.....	20.00	20.00
1 Tohe Deutschmann condenser block for 210 compact.....	13.00	13.00
1 Ward-Leonard resistor:		
1-8.00 ohm and socket.....	4.50	4.50
Aerovox cartridge resistors:		
1-10,000, 1-2000, 1-1000 ohm.....	1.00	3.00
3 Daven mountings.....	.30	1.05
2 Benjamin UX cushion sockets.....	.75	1.50
3 X-L Pushposts.....	.15	.45
1 UX-210 power and amplifying tube.....	9.00	9.00
1 UX-216-B half wave rectifying tube.....	7.50	7.50
1 UX 874 voltage regulator tube.....	5.50	5.50

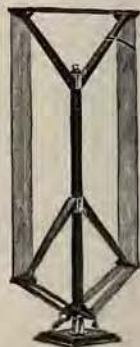
\$235.40

RADIO AGE

Set Builders' Quick Shopper

500 North Dearborn St.,

Chicago, Ill.



In the schematic circuit shown in the blueprint section the bypass condenser across the negative A and the positive 45 volt terminal has been omitted. This bypass should be used. In the set it is a 1 mfd. Sangamo and is located from the B plus terminal of Unit No. 1 to the negative filament line.

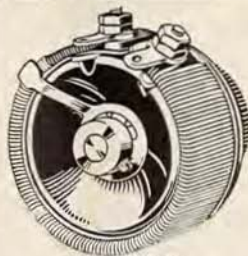
Another thing to remember in connection with operation of the set. When signal audibility on out of town stations is down to R 1 (barely audible) the results will not be good compared to the local signal strength. This is true of all receivers. However, when the outside signal approaches a decent level, R3 to R5, then it will compare very favorably with a local signal. This to a great extent governs the selectivity of the set. If out of town signal level is down the local signal will creep, but if the outside signal is fairly strong then full ten kilocycle separation is possible.

Does the Moon Affect the Weather

(Continued from page 20)

In fact, he is not sure of it at all, and frankly tells us that no matter what our arguments the real proof of the pudding is in the eating, and he is absolutely certain that when the moon changes the weather changes, and that it seldom changes without a change of the moon. In both these cases he is absolutely right, not because the moon changes the weather, but because as both are always changing they have to change together. You see, there are only about 28 days from new moon to new moon, and in that time the moon shows four changes, as they ordinarily are counted, that is, first quarter, full moon, third quarter, and new moon; in short, one change every seven days. Besides, these changes are not abrupt affairs, but, as we usually observe and note them, each is spread over at least two or three days. Then, too, those who forecast the weather in this manner generally give it a leeway of a few days in which to make good. Our moon friend, therefore, however honest his belief, really is playing the game of "heads I win, tails you lose," for as all the time is used up, it would be impossible to find any date on which a change of the weather could occur without being close to some change or other of the moon.

Well, then, if we can't trust the change of the moon to bring a change of the weather, what can we trust? We can trust two things: In the first place, weather commonly goes in short spells, at least over the more densely populated portions of the temperate zones. That makes for abundant vegetation and good crops—one reason why these places are densely populated. Here the weather usually is fair a few days, and then cloudy to foul a day or two. This is the rule, and so whatever the weather, it is apt but not certain, to change sometime soon, but not for long—another change will quickly come, and others without end. The second thing we can trust in this connection, not as an infallible guide, but as far the best we have, is the official forecast of the coming weather issued by the Weather Bureau. These forecasts are not infallible, as just stated, but their failures nearly always concern trivial matters. When a cold wave, a killing frost, a destructive



FROST-RADIO

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Rheostats are Specified in the One Spot Super

NOTE that in the One Spot Super hookup described in this issue of Radio Age Frost-Radio 10 ohm and 20 ohm Rheostats are specified. These are the most compact, smoothest working rheostats made. They are precision-built, have non-burn-out Nichrome resistance wire and genuine Bakelite pointer knobs. Your dealer can supply them: Metal Frame Type, each, 50c. Bakelite Frame Type, each, 75c. Mail coupon for free literature about these rheostats.

FROST-RADIO

No. 530 Sockets are Used in the Victoreen described in this issue



When building your Victoreen be sure to obtain 5 Frost-Radio No. 530 Sockets, and thus do away with noises due to poor tube-prong contacts. These sockets have phosphor bronze springs that grip the tube prong for almost entire length. Absolutely self-cleaning. Price, each 40c. Mail coupon for literature.

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hurricane, a devastating flood, or any other major weather phenomenon of real importance is officially predicted it is practically certain that the prediction will be 100 per cent correct.

But, says our friend, what about dry moons and wet moons, that tell us what sort of weather we are going to have for nearly a whole month? You know, he says, that when both horns of the new moon point up it can hold lots of water without spilling and therefore brings enough to furnish a dozen rains or more. On the other hand when the new moon

SM

652

RESERVOIR B



AVE you ever hooked up a B eliminator, anticipating wonderful results, then turned it on and heard a whole crop of new noises, "motor-boating," "popping," and a lot more your local experts couldn't tell you how to eliminate? And then when you did apply a good suggestion for clearing up your troubles, you found that the quality of reception was not up to batteries? And maybe a condenser went West with a discouraging bang? And finally, when you did set it working, turn the knobs as you might, you could only guess at the voltages your tubes were getting?

These are exactly the points you won't encounter with the new S-M Reservoir B, for it's guaranteed not to "motorboat" with the largest set, and its output voltage is constant to a few percent. No matter if your set uses from one to ten tubes, you KNOW the 30 volt tap won't vary more than good batteries. And the 180 volt tap will really supply enough power to a 171 to give real quality—the 45 volt tap gives a more constant output than any other eliminator! That's the answer of S-M engineers to common eliminator troubles—the 652 kit. You can put it together in two hours on the live-iron table, and it's guaranteed to give you greater satisfaction than batteries or other eliminators, for its voltages are always constant, and it won't "motorboat" with any normal set, be it a one or ten tuber.

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KDLR	Radio Electric Co.	Devils Lake, N. D.	231	KFSD	Airfan Radio Corp.	San Diego, Calif.	246
KDYL	Intermountain Bdsrg Corp.	Salt Lake City, Utah	247	KFSG	Echo Park Evan. Assn.	Los Angeles, Calif.	275
KELW	Earl L. White	Burbank, Calif.	535	KFUL	Thomas Groggan & Bros.	Galveston, Texas	258
KEX	Western Broadcasting Company	Portland, Ore.	447	KFUM	W. D. Corley	Colorado Springs, Colo.	240
KFAB	Nebraska Buick Auto Co.	Lincoln, Neb.	341	KFUO	Concordia Seminary	St. Louis, Mo.	545
KFAD	Electrical Equipment Co.	Phoenix, Ariz.	273	KFUP	Fitzsimmons General Hospital	Denver, Colo.	234
KFAF	A. E. Fowler	San Jose, Calif.	217	KFUR	Peery Bldg. Co., Inc.	Ogden, Utah	224
KFAU	Independent School Dist.	Boise, Idaho	280	KFUS	Louis L. Sherman	Oakland, Calif.	256
KFBB	F. A. Buttrey & Co.	Havre, Mont.	275	KFUT	University of Utah	Salt Lake City, Utah	263
KFBC	W. Z. Azbill	San Diego, Cal.	380	KFVD	Chas. & W. J. McWhinnie	Venice, Calif.	268
KFKB	Kimball-Upson Co.	Sacramento, Calif.	535	KFVE	Benson Broadcasting Corp.	St. Louis, Mo.	240
KFBL	Leese Bros.	Everett, Wash.	224	KFVG	First M. E. Church	Independence, Kans.	236
KFBS	School District No. One	Trinidad, Colo.	238	KFVI	Headquarters Troop, 56th Cavalry	Houston, Texas	240
KFBU	Bishop N. S. Thomas	Laramie, Wyo.	375	KFVN	Carl E. Bagley	Fairmont, Minn.	227
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KFVR	Olinger Corporation	Denver, Colo.	244
KFCR	Santa Barbara Broadcasting Co.	Santa Barbara, Calif.	413	KFVS	Cape Girardeau Battery Sta.	Cape Girardeau, Mo.	224
KFDD	St. Michael Cathedral	Boise, Idaho	275	KFVY	Radio Supply Co.	Albuquerque, N. M.	250
KFDM	Magnolia Petroleum Co.	Beaumont, Texas	316	KFWB	Warner Bros. Pictures	Hollywood, Calif.	252
KFDX	First Baptist Church	Shreveport, La.	236	KFWC	L. E. Wall	San Bernardino, Calif.	291
KFDY	South Dakota State College	Brookings, S. D.	300	KFWF	St. Louis Truth Center	St. Louis, Mo.	214
KFDZ	Harry O. Iverson	Minneapolis, Minn.	231	KFWH	F. Wellington Morse, Jr.	Eureka, Calif.	254
KFEC	Meier & Frank	Portland, Ore.	252	KFWI	Radio Entertainments, Inc.	San Francisco, Calif.	250
KFEL	Eugene P. O'Fallon, Inc.	Denver, Colo.	254	KFWM	Oakland Educational Society	Oakland, Calif.	326
KFEQ	Scroggin & Co.	St. Joseph, Neb.	268	KFWO	Lawrence Mott	Avalon, Calif.	211
KFEY	Bunker Hill & Sullivan	Kellogg, Idaho	233	KFWU	Louisiana College	Pineville, La.	238
KFFP	First Baptist Church	Moberly, Mo.	242	KFWV	KFWV Studios	Portland, Ore.	213
KFGQ	Boone Biblical College	Boone, Iowa	300	KFXB	Bertram C. Heller	Los Angeles, Calif.	353
KFH	Hotel Lassen	Wichita, Kans.	268	KFXD	Service Radio Co.	Logan, Utah	205
KFHA	Western State College of Colo.	Gunnison, Colo.	252	KFXF	Pike's Peak Broadcasting Co.	Denver, Colo.	430
KFHL	Penn. College	Oskaloosa, Iowa	240	KFXH	Bledsoe Radio Company	El Paso, Texas	242
KFI	E. C. Anthony, Inc.	Los Angeles, Calif.	467	KFXJ	R. G. Howell	near Edgewater, Colo.	216
KFIF	Benson Polytechnic Institute	Portland, Ore.	248	KFXR	Classen Film Finishing Co.	Oklahoma City, Okla.	214
KFIT	North Central High School	Spokane, Wash.	272	KFYX	Harry M. Costigan	Flagstaff, Ariz.	205
KFIO	First Methodist Church	Yakima, Wash.	256	KFYF	Carl's Radio Den.	Oxnard, Calif.	214
KFIU	Alaska Electric Light & Power Co.	Juneau, Alaska	226	KFYJ	Chronicle Pub. Co. (Portable)	Houston, Tex.	238
KFIZ	Commonwealth Reporter	Fond du Lac, Wis.	273	KFYR	Hoskins-Meyer, Inc.	Bismarck, N. Dak.	248
KFJB	Marshall Electric Co.	Marshalltown, Iowa	248	KGA	Northwest Radio Service Co.	Spokane, Wash.	341
KFJJ	National Radio Mfg. Co.	Oklahoma City, Okla.	261	KGAR	Tucson Citizen	Tucson, Ariz.	244
KFJI	E. E. Marsh	Astoria, Ore.	246	KGBS	A. C. Dailey	Seattle, Wash.	227
KFJM	University of North Dakota	Grand Forks, N. D.	278	KGBU	Alaska Radio Co.	Ketchikan, Alaska	229
KFJR	Ashley C. Dixon & Son	Portland, Ore.	263	KGBX	Foster Hall Tire Co.	St. Joseph, Mo.	348
KFJY	Tunwall Radio Co.	Fort Dodge, Iowa	246	KGBY	Dunning & Taddikon	Shelby, Neb.	203
KFJZ	W. E. Branch	Ft. Worth, Tex.	254	KGBZ	Federal Livestock Remedy Co.	York, Neb.	333
KFKA	Colo. State Teachers College	Greeley, Colo.	273	KGCC	C. W. Greenley	Decorah, Iowa	280
KFKB	J. R. Brinkley	Milford, Kan.	434	KGCB	Wallace Radio Institute	Oklahoma, Okla.	331
KFKU	The University of Kansas	Lawrence, Kans.	275	KGCC	Moore Motor Co.	Newark, Ark.	234
KFKX	Westinghouse Elec. & Mfg. Co.	Hastings, Neb.	288	KGCH	Wayne Hospital	Wayne, Neb.	434
KFKZ	State Teachers College	Kirkville, Mo.	225	KGCI	Liberty Radio Sales	San Antonio, Texas	240
KFLR	University of New Mexico	Albuquerque, N. M.	254	KGLL	Louis Wasmer	Seattle, Washington	238
KFLU	San Benito Radio Club	San Benito, Texas	236	KGGN	Concordia Bdsrg. Co.	Concordia, Kansas	235
KFLV	Swedish Evangelist Church	Rockford, Ill.	229	KGCR	Cutler's Broadcasting Service	Brookings, S. D.	252
KFLX	George Roy Clough	Galveston, Texas	240	KGCU	Mandan Radio Ass'n	Mandan, N. D.	285
KFMR	Morningside College	Sioux City, Iowa	261	KGCV	First State Bank	Vida, Mont.	240
KFMX	Carlton College	Northfield, Minn.	337	KGDA	Home Auto Co.	Dell Rapids, S. D.	254
KFNF	Henry Field Seed Co.	Shenandoah, Ia.	461	KGDE	Jaren Drug Co.	Barrett, Minn.	232
KFOA	Rhodes Department Store	Seattle, Wash.	453	KGDJ	R. Rathert	Cresco, Iowa	203
KFOB	KFOB, Inc.	Burlingame, Calif.	225	KGDM	V. G. Koping	Stockton, Calif.	217
KFON	Nichols & Warriner, Inc.	Long Beach, Calif.	233	KGDO	C. H. & Henry Garrett	Dallas, Tex.	285
KFOR	Tire & Electric Co.	David City, Neb.	226	KGDP	Boy Scouts of America	Pueblo, Colo.	261
KFOT	College Hill Radio Club	Wichita, Kans.	231	KGDR	Radio Engineers	San Antonio, Tex.	240
KFOY	Tech. High School	Omaha, Neb.	248	KGDY	William Erwin Antony	Shreveport, La.	291
KFOZ	Beacon Radio Service	St. Paul, Minn.	252	KGDY	J. Albert Loesch	Oldham, S. Dak.	210
KFPL	C. C. Baxter	Dublin, Texas	252	KGDW	Frank J. Rist	Humboldt, Neb.	242
KFPM	The New Furniture Co.	Greenville, Texas	242	KGEF	Trinity Methodist Church	Los Angeles, Calif.	517
KFPR	Los Angeles County Forestry Dept.	Los Angeles, Cal.	231	KGEH	Eugene Broadcast Station	Eugene, Oregon	236
KFPW	St. Johns M. E. Church	Cartersville, Mo.	258	KGEK	Beehler Elect. Equipment Co.	Yuma, Colo.	252
KFPY	Symons Investment Co.	Spokane, Wash.	273	KGEL	Ernest W. Ellison	Jamestown, N. D.	225
KFQA	The Principia	St. Louis, Mo.	261	KGEN	E. R. Irey & F. M. Bowles	El Centro, Calif.	281
KFQB	Lone Star Bdsrg Co.	Fort Worth, Texas	508	KGEO	Raymond D. Chamberlain	Grand Island, Neb.	271
KFQD	Anchorage Radio Club	Anchorage, Alaska	300	KGEP	Fred W. Herrmann	Minneapolis, Minn.	330
KFQU	W. E. Riker	Holy City, Calif.	231	KGER	C. Merwin Dobyns	Long Beach, Calif.	326
KFQW	C. F. Knierim	Seattle, Wash.	216	KGES	Central Radio Electric Co.	Central City, Neb.	205
KFQX	Alfred M. Hubbard	Seattle, Wash.	210	KGEU	L. W. Clement	Lower Lake, Calif.	222
KFQZ	Taft Products Co.	Hollywood, Calif.	226	KGEV	City of Fort Morgan	Fort Morgan, Colo.	256
KFRB	Hall Bros.	Beeville, Texas	248	KGEY	J. W. Dietz	Denver, Colo.	204
KFRD	Don Lee, Inc.	San Francisco, Calif.	268	KGEZ	Flathead Broadcasting Assn.	Kalispell, Mont.	352



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stands on end, or nearly so, it is a dry moon. It can hold but little water, and of course for the next three or four weeks there will be very few rains, and even these will be light. Yes, we tell him, we heard all that long ago, and we also heard forecasts and explanations just the reverse of his: That is, we heard some people say, as he does, that when both horns of the new moon point up there will be lots of rain; and we heard others say, just as positively, that the whole month would be dry, because when both horns are turned up, very little water can spill out. Similarly, these others called the tilted new moon wet and not dry, because being tilted it must spill out abundant rains. In short, while the moon weather-prophets all agree that there is a wet moon and a dry moon they differ completely as to which is which; what the one insists is a dry moon the other declares to be a wet moon, and what the first calls a wet moon the second calls a dry moon. Each is wholly wrong, but their average is exactly right, for there is no wet moon and no dry moon. If there were, then since the pointing of the new moon's horns is the same everywhere along any parallel of latitude, wet spells and dry spells would not be scattered irregularly over the earth as they actually are, but form continuous belts around the world, which certainly they do not. Furthermore, careful studies of the records kept at hundreds of weather stations all over the earth show that neither the pointing of the new moon's horns, nor any of the moon's changes, has the slightest relation to warm weather or cold, wet or dry, fair or foul.

The moon is a wonderful theme in song and story, in love and war, in sentiment and science, but it never did and never will, have anything to do with causing or changing the

FANS may be interested in a new radio book just published by the McGraw-Hill Book Co., and written by James A. Moyer, director of university extension, and John F. Wostrel, instructor in radio, division of university extension, Massachusetts Department of Education. The title of the book is: "Practical Radio Construction and Repairing." For those who repair their own sets, for the dealer and for the builder the new volume should prove of more than ordinary interest.

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KGFB	A. G. Dunkel	Iowa City, Ia.	224	KTNT	N. Baker	Muscatine, Iowa	333
KGFF	Earl E. Hampshire	Alva, Okla.	205	KTUE	Uhalt Electric	Houston, Texas	263
KGFG	Full Gospel Church	Oklahoma City, Okla.	384	KTV	First Presbyterian Church	Seattle, Wash.	454
KGFH	Frederick Robinson	La Crescenta, Calif.	219	KUJ	Puget Sound Broadcasting Co.	Seattle, Wash.	352
KGFI	M. L. Eaves	Fort Stockton, Texas	220	KUOA	University of Arkansas	Fayetteville, Ark.	300
KGJF	Ben S. McGlashan	Los Angeles, Calif.	218	KUOM	University of Montana	Missoula, Mont.	244
KGFK	Kittson County Enterprise	Hallock, Minn.	225	KUSD	University of South Dakota	Vermillion, S. D.	278
KGFL	Trinidad Broadcasting Co.	Trinidad, Colo.	222	KUT	University of Texas	Austin, Texas	273
KGFM	Geo. W. Johnson	Yuba City, Calif.	450	KVI	Puget Sound Broadcasting Co.	Tacoma, Wash.	342
KGFN	Haralund & Thingstad	Aneta, North Dakota	222	KVOO	Southwestern Sales Corp.	Bristow, Okla.	375
KGFP	Mitchell Broadcast Co.	Mitchell, South Dakota	263	KVOS	L. L. Jackson	Seattle, Wash.	333
KGGO	General Electric Co.	Oakland, Calif.	361	KWBS	Schaeffer Mfg. Co.	Portland, Ore.	200
KGRG	Gene Roth & Co.	San Antonio, Texas	315	KWGR	H. F. Parr	Cedar Rapids, Iowa	296
KGRS	Gish Radio Service	Amarillo, Texas	233	KWJ	Portable Wireless Telegraph Co.	Stockton, Calif.	248
KGTT	Glad Tidings Tabernacle, Inc.	San Francisco, Cal.	207	KWKC	Wilson Duncan Studios	Kansas City, Mo.	236
KGU	Marion A. Mulroy	Honolulu, Hawaii	270	KWLC	Luther College	Decorah, Iowa	431
KGW	Oregonian Publishing Co.	Portland, Ore.	492	KWSC	State College of Washington	Pullman, Wash.	349
KGY	St. Martins College	Lacey, Wash.	270	KWTC	J. W. Hancock	Santa Ana, Calif.	261
KHJ	Times-Mirror Co.	Los Angeles, Calif.	405	KWUC	Western Union College	Le Mars, Iowa	252
KHQ	Louis Wasmer	Spokane, Wash.	395	KWWG	Chamber of Commerce	Brownsville, Texas	278
KICK	Atlantic Automobile Co.	Anita, Ia.	273	KXL	KXL Broadcasters	Portland, Ore.	400
KJBS	J. Brunton & Sons Co.	San Francisco, Calif.	220	KYA	Pacific Broadcasting Corp.	San Francisco, Calif.	400
KJR	Northwest Radio Service Co.	Seattle, Wash.	384	KYW	Westinghouse Electric & Mfg. Co.	Chicago, Ill.	535
KJP	City of Seattle, Harbor Dept.	Seattle, Wash.	260	KZM	Preston D. Allen	Oakland, Calif.	240
KLDS	Reorganized Church of Jesus Christ, Independence, Mo.	Independence, Mo.	441	WAAD	Ohio Mechanical Institute	Cincinnati, Ohio	258
KLIT	Lewis Irvine Thompson	Portland, Ore.	380	WAAF	Chicago Daily Drivers Journal	Chicago, Ill.	278
KLS	Warner Brothers	Oakland, Calif.	250	WAAM	Isaiah R. Nelson	Newark, N. J.	263
KLX	Tribune Publishing Co.	Oakland, Calif.	598	WAAT	F. V. Bremer	Jersey City, N. J.	235
KLZ	Reynolds Radio Co.	Denver, Colo.	384	WAAW	Omaha Grain Exchange	Omaha, Nebr.	384
KMA	May Seed & Nursery	Shenandoah, Iowa	461	WABB	Harrisburg Radio Co.	Harrisburg, Pa.	204
KMED	W. J. Virgin	Medford, Ore.	250	WABC	Atlantic Broadcasting Corp.	New York, N. Y.	316
KMIC	J. R. Fouch	Inglewood, Calif.	387	WABF	Markle Broadcasting Corp.	Pringleboro, Pa.	411
KMJ	Fresno Bee	Fresno, Calif.	234	WABI	1st Universalist Church	Bangor, Me.	240
KMJM	M. M. Johnson Co.	Clay Center, Nebr.	229	WABO	Hickson Electric Co., Inc.	Rochester, N. Y.	278
KMO	Love Electric Co.	Tacoma, Wash.	250	WABR	Scott High School	Toledo, Ohio	263
KMOX	Voice of St. Louis	St. Louis, Mo.	280	WABW	College of Wooster	Wooster, Ohio	207
KMTR	Radio Corp.	Hollywood, Calif.	372	WABX	Henry B. Joy	Mt. Clemens, Mich.	246
KNRC	C. B. Juneau	Santa Monica, Calif.	238	WABY	John Magaldi, Jr.	Philadelphia, Pa.	242
KNX	Los Angeles Express	Los Angeles, Calif.	337	WABZ	Colis Place Baptist Church	New Orleans, La.	275
KOA	General Electric Co.	Denver, Colo.	322	WADC	Allen T. Simmons	Akron, Ohio	258
KOAC	Oregon Agriculture College	Corvallis, Oreg.	280	WADF	Albert P. Parfet	Detroit, Mich.	312
KOB	N. Mex. College of Agric.	State College, N. Mex.	349	WAGN	R. L. Miller	Royal Oak, Mich.	275
KOCH	Omaha Central High School	Omaha, Neb.	258	WAGS	Willow Garage, Inc.	Sommerville, Mass.	250
KOCW	Oklahoma College for Women	Chickasha, Okla.	270	WAIT	A. H. Waite & Co.	Taunton, Mass.	229
KOIL	Mona Motor Oil Co.	Council Bluffs, Iowa	306	WAIU	American Insurance Union	Columbus, Ohio	294
KOIN	KOIN, Inc.	Portland, Ore.	319	WALK	Albert A. Walker, Portable	Bethayres, Pa.	285
KOLO	Gerald K. Hunter	Durango, Colo.	355	WAMD	Raddison Radio Corp.	Minneapolis, Minn.	244
KOMO	Fisher's Blend Station, Inc.	Seattle, Wash.	306	WAOK	A. H. Andreasen	Ozone Park, N. Y.	248
KOPW	Frank A. Moore	Walla Walla, Wash.	285	WAPI	Alabama Polytechnic Institute	Auburn, Ala.	461
KPCB	Pacific Coast Biscuit Co.	Seattle, Wash.	521	WARG	American Radio & Research	Medford, Mass.	261
KPJM	Wilburn Radio Service	Prescott, Ariz.	215	WARS	Amateur Radio Specialty Co.	Brooklyn, N. Y.	295
KPNP	Central Radio Co.	Muscatine, Iowa	256	WASH	Baxter Laundry Co.	Grand Rapids, Mich.	256
KPO	Hale Bros., Inc.	San Francisco, Calif.	428	WATT	Educon Elec. Illum. (Portable)	Boston, Mass.	244
KPPC	Pasadena Presbyterian Church	Pasadena, Calif.	229	WBAA	Purdue University	W. Lafayette, Ind.	273
KPRC	Houston Printing Co.	Houston, Texas	297	WBAC	James Milliken University	Decatur, Ill.	270
KPSN	Star-News	Pasadena, Calif.	316	WBAK	Pennsylvania State Police	Harrisburg, Pa.	275
KQW	First Baptist Church	San Jose, Calif.	333	WBAL	Consolidated Gas & Power Co.	Baltimore, Md.	246
KQV	Douleday-Hill Electric Co.	Pittsburgh, Pa.	275	WBAP	Carter Publication, Inc.	Ft. Worth, Tex.	476
KRAC	Caddo Radio Club	Shreveport, La.	220	WBAW	Waldrum Drug Co.	Nashville, Tenn.	236
KRE	Berkeley Daily Gazette	Berkeley, Calif.	256	WBAX	John H. Stenger, Jr.	Wilkes-Barre, Pa.	256
KRLD	Dallas Radio Laboratories	Dallas, Tex.	357	WBBC	Brooklyn Bdstg. Corp.	Brooklyn, N. Y.	268
KRLR	Freeman Lang & A. B. Scott	Los Angeles, Calif.	440	WBBL	Grace Covenant Presbyterian Church	Richmond, Va.	229
KROW	Oregon Broadcast Co.	Portland, Ore.	231	WBMM	Atlas Investment	Chicago, Ill.	226
KROX	N. D. Brown	Seattle, Wash.	265	WBPP	Petoskey High School	Petoskey, Mich.	238
KRSC	Radio Sales Corp.	Seattle, Wash.	500	WBRR	People's Pulpit Assoc.	Rossville, N. Y.	416
KSAC	Kansas State Agricultural College	Manhattan, Kans.	341	WBWW	Ruffner Junior High School	Norfolk, Va.	222
KSBA	W. G. Patterson	Shreveport, La.	261	WBYY	Washington Light Inf.	Charleston, S. C.	268
KSD	Pulitzer Publishing Co.	St. Louis, Mo.	545	WBZZ	C. L. Carrell	(Portable), Chicago, Ill.	216
KSCJ	The Journal	Sioux City, Iowa	444	WBEN	Foster & MacDonnell	Chicago, Ill.	266
KSEI	Broadcasting Association	Pocatello, Idaho	261	WBES	Bliss Electrical School	Takoma Park, Md.	227
KSL	Radio Service Corp.	Salt Lake City, Utah	300	WBET	Weston Transcript Co.	Boston, Mass.	384
KSMR	Santa Maria Valley Railroad	Santa Maria, Calif.	283	WBKN	Arthur Faske	Brooklyn, New York	291
KSO	Berry Seed Co.	Clarinda, Iowa	405	WBMC	Malbrook Co.	Woodside, N. Y.	294
KSOO	Sioux Falls Bdst. Ass'n	Sioux Falls, S. D.	360	WBMM	Braun's Music House	Detroit, Mich.	353
KTAB	Associated Broadcasters	Oakland, Calif.	303	WBMS	G. J. Schowrer	North Bergen, N. J.	274
KTAP	Robert B. Bridge	San Antonio, Texas	263	WBNO	Baruschrome Corp.	New York, N. Y.	322
KTBI	Bible Institute	Los Angeles, Calif.	294	WBQY	Atlantic Bdst. Corp.	Richmond Hill, N. Y.	238
KTBR	M. E. Brown	Portland, Ore.	263	WBRC	Birmingham Broadcasting Co.	Birmingham, Ala.	244
KTCL	Amer. Radio Tel. Co.	Seattle, Wash.	306	WBRE	Baltimore Radio Exchange	Wilkes-Barre, Pa.	244
KTHS	New Arlington Hotel	Hot Springs, Ark.	375	WBRL	Booth Radio Laboratories	Tilton, N. H.	244



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WBRS	Universal Radio Mfg. Co.	Brooklyn, N. Y.	394	WENR	All-American Radio Corp.	Chicago, Ill.	266
WBSO	Babson's Statistical Org.	Wellesley Hills, Mass.	242	WEPS	Matheson Radio Co., Inc.	Gloucester, Mass.	295
WBT	Charlotte Chamber of Commerce	Charlotte, N. C.	275	WEW	St. Louis University	St. Louis, Mo.	360
WBZ	Westinghouse Elect. & Mfg. Co.	Springfield, Mass.	333	WEAA	Dallas News & Dallas Journal	Dallas, Tex.	476
WBZA	Westinghouse Elect. & Mfg. Co.	Boston, Mass.	333	WEAM	Times Publishing Co.	St. Cloud, Minn.	273
WCAG	Connecticut Agricultural College	Mansfield, Conn.	275	WEAV	University of Nebraska	Lincoln, Neb.	270
WCAD	St. Lawrence University	Canton, N. Y.	263	WEBC	First Baptist Church	Knoxville, Tenn.	255
WCAE	Kaufman & Baer Co.	Pittsburgh, Pa.	461	WEBE	Garfield Place Hotel Co.	Cincinnati, Ohio	232
WCAJ	Nebraska Wesleyan University	University Pl., Nebr.	254	WEFG	The Wm. F. Gable Co.	Altoona, Pa.	278
WCAL	St. Olaf College	Northfield, Minn.	337	WEFJ	St. John's University	Collegeville, Minn.	236
WCAM	City of Camden	Camden, N. J.	337	WEFL	The Onondaga Co.	Syracuse, N. Y.	252
WCAO	Monumental Radio Inc.	Baltimore, Md.	275	WEFM	Merchants Heat & Light Co.	Indianapolis, Ind.	268
WCAR	Southern Radio Corp.	San Antonio, Texas	263	WEFR	Fifth Infantry National Guard	Baltimore, Md.	254
WCAT	School of Mines	Rapid City, S. Dak.	240	WEFZ	Knox College	Galesburg, Ill.	254
WCAU	Universal Broadcasting Co.	Philadelphia, Pa.	278	WEFC	Frank Crook, Inc.	Pawtucket, R. I.	258
WCAV	University of Vermont	Burlington, Vt.	250	WFDL	F. D. Fallain	Flint, Mich.	234
WCAZ	Carthage College	Carthage, Ill.	246	WFHH	Fort Harrison Hotel	Clearwater, Fla.	355
WCBA	Charles W. Heinbach	Allentown, Pa.	254	WFI	Strawbridge and Clothier	Philadelphia, Pa.	394
WCBD	Wilbur Glenn Voliva	Zion, Ill.	345	WFIW	The Acme Mills, Inc.	Hopkinsville, Ky.	357
WCBE	Uhart Radio Co.	New Orleans, La.	263	WFKB	Vesta Battery Corp.	Chicago, Ill.	217
WCBH	University of Mississippi	Oxford, Miss.	242	WFLA	Boca Raton Radio Corp.	Boca Raton, Fla.	440
WCBM	Hotel Chateau	Baltimore, Md.	229	WFLR	Flatbush Radio Labs.	Brooklyn, N. Y.	330
WCBR	C. H. Messter	Providence, R. I.	234	WGAL	Lancaster Elec. Supply & Const. Co.	Lancaster, Pa.	248
WCBS	H. L. Dewing, Portable	Providence, R. I.	242	WGBB	H. H. Carman	Freeport, N. Y.	244
WCFO	Washburn-Crosby Co.	Anoka, Minn.	416	WGBG	First Baptist Church	Memphis, Tenn.	278
WGFL	Chicago Fed. of Labor	Chicago, Ill.	492	WGBF	Fink Furniture Co.	Evansville, Ind.	239
WGFT	Knights of Pythias Home	Tullahoma, Tenn.	252	WGBL	Scranton Broadcasters, Inc.	Scranton, Pa.	240
WCGU	C. G. Under	Lakewood, N. J.	351	WGBS	Gimbel Brothers	Astoria, L. I., N. Y.	316
WGLO	C. E. Whitmore	Camp Lake, Wis.	231	WGBU	Florida Cities Finance Co.	Fulford By-The-Sea, Fla.	384
WCLS	WJLS Inc.	Joliet, Ill.	214	WGBX	University of Maine	Orono, Me.	234
WGMA	Culver Military Academy	Culver, Ind.	258	WGCP	May Radio Broadcast Corp.	Newark, N. J.	252
WGOA	City of Pensacola	Pensacola, Fla.	252	WGES	Oak Leaves Broadcasting Corp.	Chicago, Ill.	316
WGOE	Crystal Oil Co.	Columbus, Miss.	265	WGH	G. H. Phelps	Detroit, Mich.	270
WCOM	172nd Field Artillery	Manchester, N. H.	252	WGLI	International Broadcasting Corp.	New York, N. Y.	442
WCOU	Jacob Conn	Olneyville, R. I.	265	WGM	Verne and Elton Spencer	Jeanette, Pa.	269
WCRW	Clinton R. White	Chicago, Ill.	411	WGMU	A. H. Grebe & Co.	(Portable) New York	236
WCSH	Congress Square Hotel Co.	Portland, Maine	500	WGN	The Tribune	Chicago, Ill.	303
WCSO	Wittenberg College	Springfield, Ohio	248	WGR	Federal T. and T. Co.	Buffalo, N. Y.	319
WCWK	Chester W. Keen	Fort Wayne, Ind.	234	WGST	Georgia School of Technology	Atlanta, Ga.	270
WCWS	Bridgeport Bcst. Sta. (Portable)	Bridgeport, Conn.	232	WGW	Radioeast Corporation	Milwaukee, Wis.	384
WCX	Detroit Free Press	Pontiac, Mich.	517	WGY	General Elec. Co.	Schenectady, N. Y.	379
WDAD	Dad's Auto Accessories, Inc.	Nashville, Tenn.	226	WHA	University of Wisconsin	Madison, Wis.	535
WDAE	Tampa Daily Times	Tampa, Fla.	273	WHAD	Marquette University	Milwaukee, Wis.	275
WDAF	Kansas City Star	Kansas City, Mo.	366	WHAM	Stromberg-Carlson Tel. Mfg. Co.	Rochester, N. Y.	278
WDAG	J. Laurence Martin	Amarillo, Texas	263	WHAP	W. H. Taylor Finance Corp.	New York, N. Y.	431
WDAH	Trinity Methodist Church	El Paso, Texas	268	WHAR	F. D. Cooks Sons	Atlantic City, N. J.	275
WDAY	Radio Equipment Corp.	Fargo, N. Dak.	261	WHAS	Courier-Journal & Louisville Times	Louisville, Ky.	401
WDBE	Gilham Electric Co., Inc.	Atlanta, Ga.	270	WHAZ	Rensselaer Polytechnic Institute	Troy, N. Y.	379
WDBJ	Richardson Wayland Elec. Corp.	Roanoke, Va.	229	WHB	Sweeney School Co.	Kansas City, Mo.	366
WDBK	Bcst. Co.	Cleveland, Ohio	227	WHBA	C. C. Shaffer	Oil City, Pa.	250
WDBO	Rollins College	Winter Park, Fla.	240	WHBC	Rev. E. P. Graham	Canton, Ohio	254
WDBZ	Kingston Radio Club	Kingston, N. Y.	233	WHBD	Chamber of Commerce	Bellefontaine, Ohio	222
WDBL	Wilmington Elec. Specialty Co.	Wilmington, Del.	266	WHBF	Bearsdy Specialty Company	Rock Island, Ill.	222
WDGY	Dr. George W. Young	Minneapolis, Minn.	263	WHBL	C. L. Carrell (Portable)	Chicago, Ill.	216
WDDO	Chattanooga Radio Co., Inc.	Chattanooga, Tenn.	256	WHBM	C. L. Carrell (Portable)	Chicago, Ill.	216
WDRG	Doolittle Radio Corp.	New Haven, Conn.	268	WHBN	First Ave. Methodist Church	St. Petersburg, Fla.	238
WDWF	Dutec Wilcox Flint, Inc.	Cranston, R. I.	441	WHBP	Johnstown Automobile Co.	Johnstown, Pa.	256
WDWM	Radio Industries Broadcast Co.	Newark, N. J.	280	WHBQ	WHBQ, Inc.	Memphis, Tenn.	233
WDXL	WDXL Radio Corp.	Detroit, Mich.	297	WHBU	Riviera Theatre & Bing's Clothing	Anderson, Ind.	219
WDZ	J. L. Bush	Tuscola, Ill.	278	WHBW	D. R. Kienzel	Philadelphia, Pa.	216
WEAF	National Broadcasting Co.	New York, N. Y.	491	WHBY	St. Norbert's College	West de Pere, Wis.	250
WEAI	Cornell University	Ithaca, N. Y.	254	WHDI	W. H. Dunwoody Institute	Minneapolis, Minn.	278
WEAM	Bor. of N. Plainfield	North Plainfield, N. J.	261	WHEC	Hickson Electric Co., Inc.	Rochester, N. Y.	258
WEAN	The Shepard Co.	Providence, R. I.	367	WHFC	Triangle Broadcasters	Chicago, Ill.	258
WEAO	Ohio State University	Columbus, Ohio	294	WHK	The Radio Air Service Corp.	Cleveland, Ohio	273
WEAR	Willard Storage Battery Co.	Cleveland, Ohio	389	WHN	George Schubel	New York, N. Y.	361
WEAU	Davidson Bros. Co.	Sioux City, Iowa	275	WHO	Banker's Life Co.	Des Moines, Ia.	526
WEBC	Walter Cecil Bridges	Superior, Wis.	242	WHOG	Huntington Bcstcs. Assn.	Huntington, Ind.	242
WEBE	Roy W. Waller	Cambridge, Ohio	234	WHT	Radiophone Broadcasting Corp.	Deerfield, Ill.	400
WEBH	Edgewater Beach Hotel	Chicago, Ill.	370	WIAD	Howard R. Miller	Philadelphia, Pa.	250
WEBJ	Third Avenue Railway Co.	New York, N. Y.	273	WIAS	Home Electric Co.	Burlington, Iowa	254
WEBL	R. C. A. Show (Portable)	New York, N. Y.	226	WIBA	Capital Times-Strand Theatre	Madison, Wis.	236
WBO	Tate Radio Corp.	Harrisburg, Ill.	226	WIBG	St. Paul's Protestant E. Church	Elkins Park, Pa.	222
WEER	H. H. Howell	Buffalo, N. Y.	244	WIBI	Frederick B. Zittel, Jr.	Flushing, L. I., N. Y.	219
WEBW	Beloit College	Beloit, Wis.	268	WIBJ	C. L. Carrell (Portable)	Chicago, Ill.	216
WEDE	E. Denmark Station	Chicago, Ill.	250	WIBM	C. L. Carrell (Portable)	Chicago, Ill.	216
WEEL	The Edison Elec. Illuminating Co.	Boston, Mass.	349	WIBO	WIBO Broadcasters, Inc.	Chicago, Ill.	226
WEHS	A. T. Becker	Evanston, Ill.	242	WIBR	Thurman A. Owings	Weirton, W. Va.	346
WEKD	Foulkrod Radio Engineering Co.	Philadelphia, Pa.	250	WIBS	T. F. Hunter	Elizabeth, N. J.	207
WEMC	Emanuel Missionary College	Berrien Springs, Mich.	316	WIBU	The Electric Farm	Poyntette, Wis.	222

Talking Movies Now, Practical Scheme

TALKING motion pictures in which the simultaneous timing of action and sound is all times assured have been announced and demonstrated by the General Electric Company. The process, the result of several years of experimenting in the General Engineering Laboratory of the company, means but slight change in standard motion picture projectors, since it involves only the addition of a sound-reproducing attachment and a loud speaker suitable for auditorium use. Both the picture and the sound are recorded on the same film.

One of the demonstrations has been with music to accompany feature films, the music being by a full concert orchestra. Development of this field requires no change in the technique of making the original film. After the original picture film has been made and titled, the accompanying music is played by a concert orchestra and is recorded on a film. The picture and sound records are then printed on one film in the proper time relation.

Another type has been the showing of singers and instrumentalists while they are presenting programs. Thus, when an orchestra is shown on the screen, it is possible to follow the playing of each musician, and see his actions on the screen and hear him. Even cymbals—among the most difficult to reproduce faithfully—sound like cymbals. Similar demonstrations have been made with vocal and instrumental soloists, with string and with vocal quartets, and with speakers.

To the casual observer the talking film does not differ from the usual motion picture positive. It is of standard width, but along the left margin there is a strip a small fraction of an inch wide on which is a series of horizontal light and dark bands and lines, of varying widths and intensities. It is this series of bands and lines, which produces the sound. The film is passed through the reproducer at constant speed, and, as these light and dark bands pass rapidly before a tiny slit in an optical system, the amount of light is varied. The ever-changing amount of light is received by a photoelectric cell—the electric eye—which is extremely sensitive to any change in the amount of light striking it.



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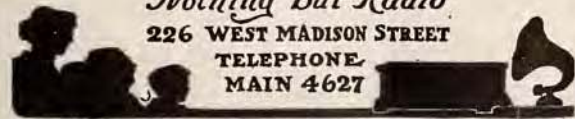
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WIBW	C. L. Carrell (Portable)	Chicago, Ill.	216	WLBR	Alford Radio Company	Belvidere, Ill.	335
WIBX	WIBX, Inc.	Utica, N. Y.	234	WLGI	Lutheran Association	Ithaca, N. Y.	266
WIBZ	A. D. Trum	Montgomery, Ala.	231	WLJB	Liberty Weekly, Inc.	Elgin, Ill.	303
WICC	Bridgeport Bdst. Station	Bridgeport, Conn.	285	WLIT	Lit Bros.	Philadelphia, Pa.	394
WIL	Benson Radio Co.	St. Louis, Mo.	258	WLPP	Robert A. Fox	Ashland, Ohio	220
WIOD	Earl G. Fisher Co.	Miami, Fla.	248	WLS	Sears Roebuck & Co.	Crete, Ill.	345
WIP	Gimbel Bros.	Philadelphia, Pa.	508	WLSL	Lincoln Studios	Cranston, R. I.	441
WJAD	Jackson's Radio Eng. Laboratories	Waco, Texas.	353	WLTS	Lane Technical High School	Chicago, Ill.	258
WJAG	Norfolk Daily News	Norfolk, Neb.	270	WLW	Crosley Radio Corp.	Harrison, Ohio	422
WJAK	Kokomo Tribune	Kokomo, Ind.	254	WLWL	Paul's Fathers	New York, N. Y.	384
WJAM	D. M. Perham	Cedar Rapids, Iowa	268	WLBT	Harold Wendell	Crown Point, Ind.	230
WJAR	The Outlet Co.	Providence, R. I.	484	WLBU	Matthew B. Greiner	Canastota, N. Y.	220
WJAS	Pittsburgh Radio Supply House	Pittsburgh, Pa.	275	WLBY	John F. Weimer & D. A. Snick	Mansfield, Ohio	231
WJAX	City of Jacksonville	Jacksonville, Fla.	337	WLWB	Petroleum Telephone Co.	Oil City, Pa.	321
WJAY	Cleveland Broadcasting Corp.	Cleveland, O.	436	WLBY	John N. Brahy	Long Island City, N. Y.	231
WJAZ	American Bdcst. Corp.	Mt. Prospect, Ill.	329	WLBY	Aimone Electric	Iron Mountain, Mich.	250
WJBA	D. H. Lentz, Jr.	Joliet, Ill.	207	WLBY	Thompson L. Guernsey	Dover-Foxcroft, Maine	299
WJBB	Financial Journal	St. Petersburg, Fla.	245	WMAC	C. B. Meredith	Casnovia, N. Y.	275
WJBC	Hummer Furniture Co.	LaSalle, Ill.	234	WMAF	Round Hills Radio Corp.	Dartmouth, Mass.	441
WJBI	Robert S. Johnson	Red Bank, N. J.	219	WMAK	Norton Laboratories	Lockport, N. Y.	266
WJBK	E. F. Goodwin	Ypsilanti, Mich.	233	WMAL	M. A. Leese	Washington, D. C.	294
WJBL	Wm. Gushard Dry Goods Co.	Decatur, Ill.	270	WMAN	Haskett Radio Station	Columbus, Ohio	278
WJBO	Valdemar Jensen	New Orleans, La.	268	WMAQ	Chicago Daily News	Chicago, Ill.	447
WJBR	Omro Drug Stores	Omro, Wis.	227	WMAJ	Kingshighway Presbyterian Church	St. Louis, Mo.	248
WJBT	John S. Boyd	Chicago, Ill.	468	WMAZ	Mercer University	Macon, Ga.	261
WJBU	Bucknell University	Lewisburg, Pa.	211	WMBA	LeRoy Joseph Beebe (Portable)	Newport, R. I.	250
WJBW	C. Carlson, Jr.	New Orleans, La.	270	WMBB	American Bond & Mortgage Co.	Chicago, Ill.	250
WJBY	Electric Construction Co.	Gadsden, Ala.	270	WMBG	Michigan Broadcasting Co., Inc.	Detroit, Mich.	256
WJBZ	Roland G. Palmer	Chicago Heights, Ill.	420	WMBP	Peoria Heights Radio Lab.	Peoria Heights, Ill.	279
WJJD	Supreme Lodge, L. O. of Moose	Moosheart, Ill.	370	WMBE	Dr. C. S. Stevens	St. Paul, Minn.	220
WJPW	J. P. Wilson	Ashtabula, Ohio	240	WMBF	Fleetwood Hotel Corp.	Miami Beach, Fla.	384
WJRW	Station WJR, Inc.	Pontiac, Mich.	517	WMBG	Havens & Martin	Richmond, Va.	220
WJUG	U. B. Ross	New York, N. Y.	517	WMBH	Edwin Dudley Aber, Portable	Chicago, Ill.	280
WJY	Radio Corp. of America	New York, N. Y.	405	WMBI	Moody Bible Institute	Chicago, Ill.	288
WJZ	Radio Corp. of America	Bound Brook, N. J.	454	WMBJ	Wm. Roy McShaffrey	Monessen, Pa.	278
WKAF	WKAF Broadcasting Co.	Milwaukee, Wis.	261	WMBK	John C. Slade	Hamilton, Ohio	360
WKAQ	Radio Corp. of Porto Rico	San Juan, P. R.	341	WMBL	Bonford Radio Studios	Lakeland, Fla.	410
WKAQ	Michigan State College	East Lansing, Mich.	286	WMBM	Seventh Day Adventist Church	Memphis, Tenn.	245
WKAQ	Laconia Radio Club	Laconia, N. H.	422	WMBQ	Radio Service Laboratories	Auburn, N. Y.	238
WKBA	Arrow Battery Co.	Chicago, Ill.	210	WMBQ	Paul J. Gollhofer	Brooklyn, N. Y.	210
WKBB	Sanders Bros.	Joliet, Ill.	283	WMBR	Premier Electric Co.	Tampa, Fla.	250
WKBC	H. L. Ansel	Birmingham, Ala.	225	WMBR	Mack's Battery Co.	Harrisburg, Pa.	360
WKBE	K. & D. Electric Co.	Webster, Mass.	270	WMBU	Paul J. Miller	Pittsburgh, Pa.	236
WKBF	N. D. Watson	Indianapolis, Ind.	244	WMBW	Youngstown Bdcst. Co., Inc.	Youngstown, O.	279
WKBG	C. L. Carrell (Portable)	Chicago, Ill.	216	WMBY	Robert A. Isaacs	Bloomington, Ill.	291
WKBH	Callaway Music Co.	LaCrosse, Wis.	250	WMC	Commercial Pub. Co.	Memphis, Tenn.	500
WKBI	F. L. Schoenwolf	Chicago, Ill.	220	WMCA	Greely Sq. Hotel Co.	Hoboken, N. J.	341
WKBJ	Gospel Tabernacle Inc.	St. Petersburg, Fla.	282	WMHA	Young Men's Hebrew Ass'n	New York, N. Y.	230
WKBL	Monrona Radio Mfg. Co.	Monroe, Mich.	250	WMPC	First Methodist Church	Lapeer, Mich.	202
WKBM	J. W. Jones	Newburgh, N. Y.	285	WMRJ	Peter J. Prinz	Jamaica, N. Y.	227
WKBO	Camith Corporation	Jersey City, N. J.	472	WMRG	Madison Sq. Gard. Bdcst. Corp.	New York, N. Y.	302
WKBP	Enquirer and News	Battle Creek, Mich.	265	WMVN	Edward J. Malone, Jr.	Newark, N. J.	476
WKBO	Starlight Amusement Park	New York, N. Y.	285	WNAB	Shepard Stores	Boston, Mass.	280
WKBS	P. M. Nelson	Galesburg, Ill.	361	WNAC	Shepard Stores	Boston, Mass.	430
WKBT	First Baptist Church	New Orleans, La.	252	WNAD	University of Oklahoma	Norman, Okla.	7254
WKBU	H. K. Armstrong (Portable)	Newcastle, Pa.	238	WNAL	Omaha Central High School	Omaha, Neb.	258
WKBV	Knox Battery and Electric Co.	Brookville, Ind.	236	WNAT	Lenning Brothers Co.	Philadelphia, Pa.	250
WKBW	Churchill Evang. Ass'n	Buffalo, N. Y.	362	WNAX	Dakota Radio Apparatus Co.	Yankton, S. Dak.	244
WKBY	Fernwood Wuick (portable)	Danville, Pa.	220	WNBA	M. T. Rafferty	Forest Park, Ill.	238
WKBZ	K. L. Ashbacher	Ludington, Mich.	256	WNBK	Howitt-Wood Radio Co.	Endicott, N. Y.	205
WKDR	Edward A. Dato	Kenosha, Wis.	428	WNBH	New Bedford Hotel	New Bedford, Mass.	248
WKJC	Kirk Johnson & Co.	Lancaster, Pa.	258	WNBI	Wm. J. Romanouski	Peru, Ill.	357
WKRC	Kodel Radio Corp.	Cincinnati, Ohio	422	WNBJ	Lonsdale Baptist Church	Knoxville, Tenn.	335
WKY	Hull and Richards	Oklahoma City, Okla.	275	WNBK	Barton Electric Co.	LeRoy, N. Y.	354
WLAC	Life & Casualty Ins. Co.	Nashville, Tenn.	226	WNBK	Harvey R. Storm	Bloomington, Ill.	495
WLAL	First Christian Church	Tulsa, Okla.	250	WNBO	John Brownlee Spriggs	Washington, Pa.	215
WLAP	Wm. V. Jordan	Louisville, Ky.	275	WNBR	Popular Radio Shop	Memphis, Tenn.	316
WLB	University of Minnesota	Minneapolis, Minn.	278	WNBP	Gordon P. Brown	Rochester, N. Y.	408
WLBG	D. A. Burton	Muncie, Ind.	224	WNBJ	Herman Lubinsky	Newark, N. J.	505
WLBH	J. H. Fruitman	Brooklyn, N. Y.	231	WNOX	Peoples Tel. & Tel. Co.	Knoxville, Tenn.	268
WLBK	E. L. Dillard	Kansas City, Mo.	211	WNRC	W. B. Nelson	Greensboro, N. C.	224
WLBG	R. A. Gamble	Petersburg, Va.	332	WNYC	Dept. of Plants & Structures	New York, N. Y.	526
WLBH	Joseph J. Lombardi	Farmingdale, N. Y.	230	WOAI	Southern Equipment Co.	San Antonio, Texas	394
WLBK	Aloysius Yare	East Wenona, Ill.	297	WOAN	J. D. Vaughn	Lawrenceburg, Tenn.	356
WLBK	Henry Grossman	Cleveland, Ohio	300	WOAX	Franklyn J. Wolff	Trenton, N. J.	240
WBL	Wisconsin Dept. of Markets	Stevens Point, Wis.	278	WOBG	Longacre Eng. & Const. Co.	Chicago, Ill.	555
WBLM	Browning Drake Corp.	Boston, Mass.	480	WOCB	Orlando Broadcasting Co.	Orlando, Fla.	414
WBLN	William Evert Hiler (Portable)	Chicago, Ill.	225	WOC	Palmer School of Chiropractic	Davenport, Iowa	414
WLBQ	Frederick A. Tribbe, Jr.	Galesburg, Ill.	243	WOCL	A. D. Newton	Jamestown, N. Y.	414
WLBQ	E. Dale Trout	Atwood, Ill.	233	WODA	O'Dea Temple of Music	Paterson, N. J.	414

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WOK	Neutrowound Radio Mfg. Co.	Homewood, Ill.	410	WRSC	The Radio Shop	Chelsea, Mass.	270
WOKO	Harold E. Smith	Peekskill, N. Y.	232	WRST	Radiotel Mfg. Co., Inc.	Bay Shore, N. Y.	216
WOKT	Titus-Ers Corporation	Rochester, N. Y.	340	WRVA	Larus & Brother Co., Inc.	Richmond, Va.	256
WOMT	Mikado Theater	Manitowoc, Wis.	254	WSAI	United States Playing Card Co.	Cincinnati, Ohio	326
WOO	John Wanamaker	Philadelphia, Pa.	508	WSAJ	Grove City College	Grove City, Pa.	229
WOOD	Grand Rapids Radio Co.	Fernwood, Mich.	242	WSAN	Allentown Call Publishing Co. Inc.	Allentown, Pa.	229
WOO	Unity School	Kansas City, Mo.	278	WSAR	Daughy & Welch Electrical Co.	Fall River, Mass.	322
WOR	L. Bamberger and Co.	Newark, N. J.	405	WSAV	Clifford W. Vick	Houston, Tex.	248
WORD	People's Pulpit Assn	Batavia, Ill.	275	WSAX	Zenith Radio Corp. (Portable)	Chicago, Ill.	268
WOS	State Market Bureau	Jefferson City, Mo.	441	WSAZ	Chase Electric Shop	Pomeroey, Ohio	244
WOW	Woodman of the World	Omaha, Nebr.	526	WSB	Atlanta Journal	Atlanta, Ga.	428
WOWO	Main Auto Supply Co.	Fort Wayne, Ind.	227	WSBC	World Battery Co.	Chicago, Ill.	288
WPAB	Radio Corp. of Virginia	Norfolk, Va.	319	WSBF	Stix Baer & Fuller	St. Louis, Mo.	273
WPAC	N. D. Ag. College	Agricultural College, N. D.	275	WSBT	South Bend Tribune	South Bend, Ind.	316
WPAP	(See WQAO)	Cliffside, N. J.	361	WSDA	Seventh Day Adventist Church	New York, N. Y.	261
WPCC	North Shore Cong. Church	Chicago, Ill.	258	WSEA	Virginia Beach Broadcasting Co.	Virginia Beach, Va.	517
WPCH	Concourse Radio Corp.	New York, N. Y.	273	WSIX	638 Tire & Vulc. Co.	Springfield, Tenn.	250
WPDO	H. L. Turner	Buffalo, N. Y.	205	WSKG	World's Star Knitting Co.	Bay City, Mich.	263
WPFP	Maurice Mayer	Waukegan, Ill.	213	WSM	Nashville Life & Accident Ins. Co.	Nashville, Tenn.	283
WPG	The Municipality of Atlantic City	Atlantic City, N. J.	300	WSMB	Saenger Amuse. Co.	New Orleans, La.	319
WPRC	Wilson Printing & Radio Co.	Harrisburg, Pa.	216	WSMH	Shattuck Music House	Owosso, Mich.	240
WPSC	Pennsylvania State College	State College, Pa.	261	WSMK	S. M. K. Radio Corp.	Dayton, Ohio	275
WPSW	Philadelphia School of Wireless Tel.	Philadelphia, Pa.	236	WSOE	School of Engineering	Milwaukee, Wis.	246
WQAA	Horace A. Beale, Jr.	Parkersburg, Pa.	220	WSOM	Union Course Laboratories	Woodhaven, N. Y.	288
WQAE	Moore Radio News Station	Springfield, Vt.	246	WSRO	Harry W. Fahrlander	Hamilton, Ohio	252
WQAM	Electrical Equipment Co.	Miami, Fla.	285	WSSH	Tremont Temple Bap. Church	Boston, Mass.	261
WQAN	Scranton Times	Scranton, Pa.	250	WSUI	State University of Iowa	Iowa City, Iowa	484
WQAO	Calvary Baptist Church	Cliffside, N. J.	361	WSVS	Seneca Vocational School	Buffalo, N. Y.	219
WQJ	Calumet Rainbo Broadcasting Co.	Chicago, Ill.	444	WSYR	Clive B. Meredith	Syracuse, N. Y.	353
WRAF	The Radio Club (Inc.)	LaPorte, Ind.	227	WTAD	Ill. Stock Medicine Corp.	Quincy, Ill.	236
WRAH	S. N. Read	Providence, R. I.	235	WTAG	Worcester Telegram	Worcester, Mass.	545
WRAK	Economy Light Co.	Escanaba, Mich.	256	WTAL	Toledo Broadcasting Co.	Toledo, Ohio	252
WRAM	Lombard College	Galesburg, Ill.	244	WTAM	Willard Storage Battery Co.	Cleveland, Ohio	389
WRAV	Antioch College	Yellow Springs, Ohio	263	WTAO	C. S. Van Gordon	Eau Claire, Wis.	254
WRAW	Avenue Radio & Electric Shop	Reading, Pa.	238	WTAR	Reliance Electric Co.	Norfolk, Va.	261
WRAX	Beracah Church, Inc.	Philadelphia, Pa.	268	WTAS	Richmond Harris & Co.	Batavia, Ill.	275
WRBC	Immanuel Lutheran Church	Valparaiso, Ind.	278	WTAW	A. & M. Coll. of Texas	College Star, Texas	270
WRC	Radio Corp. of America	Washington, D. C.	468	WTAX	Williams Hardware Co.	Streator, Ill.	331
WRCO	Wayne Radio Co.	Raleigh, N. C.	252	WTAZ	Thomas J. McGuire	Lambertville, N. J.	261
WREC	Wooten's Radio Shop	Whitehaven, Tenn.	254	WTHO	W. J. Thomas Radio Co.	Ferdale, Mich.	407
WREO	Reo Motor Car Co.	Lansing, Mich.	285	WTIC	Travelers Insurance Co.	Hartford, Conn.	476
WRES	H. L. Sawyer	Wolaston, Mass.	300	WTRG	20th Dist. Republican Club	New York, N. Y.	240
WRHF	Wash. Radio Hospital Fund	Washington, D. C.	256	WTRL	Technical Radio Laboratory	Midland Park, N. J.	280
WRHM	Rosedale Hospital, Inc.	Minneapolis, Minn.	252	WWAE	L. J. Crowley	Chicago, Ill.	342
WRK	Doron Bros.	Hamilton, Ohio	270	WWJ	Evening News Assn.	Detroit, Mich.	253
WRM	University of Illinois	Urbana, Ill.	273	WWL	Loyola University	New Orleans, La.	275
WRMU	A. H. Grebe & Co., Inc.	Motor Yacht "MU-1"	236	WWNC	Chamber of Commerce	Asheville, N. C.	254
WRNY	Experimenter Publishing Co.	Coyetsville, N. Y.	374	WWRL	W. H. Rouman	Woodside, N. Y.	258
WRR	City of Dallas	Dallas, Tex.	246	WWVA	John C. Stroebel, Jr.	Wheeling, W. Va.	349

Dominion of Canada

CFAC	Calgary Herald	Calgary, Alta.	434	CJCL	A. Couture	Montreal, Que.	279
CFCa	Toronto Star Pub. & Prtg. Co.	Toronto, Ont.	356	CJGG	London Free Press	London, Ont.	329
CFCE	Marconi Wireless Teleg. Co., (Ltd.)	Ca. Mont., Que.	411	CKAC	La Presse	Montreal, Que.	411
CFCH	Abitibi Power & Paper Co. (Ltd.)	Iroquois Falls, Ont.	500	CKGD	Vancouver Daily Province	Vancouver, B. C.	397
CFCK	Radio Supply Co.	Edmonton, Alta.	517	CKCK	Leader Pub. Co.	Regina, Sask.	476
CFGN	W. W. Grant (Ltd.)	Calgary, Alta.	434	CKCL	Dominion Battery Co.	Toronto	357
CFGR	Laurentide Air Service	Sudbury, Ont.	410	CKCO	Ottawa Radio Association	Ottawa, Ont.	434
CFGT	Victoria City Temple	Victoria, B. C.	329	CKCX	Int'l Bible Students Ass'n	Toronto	291
CFGU	The Jack Elliott (Ltd.)	Hamilton, Ont.	341	CKFC	First Congregational Church	Vancouver, B. C.	411
CFHG	Henry Birks & Sons	Calgary, Alta.	434	CKLG	Wilkinson Electric Co. (Ltd.)	Calgary, Alta.	434
CFKQ	Thorold Radio Supply	Thorold, Ont.	248	CKNC	Canadian National Carbon Co.	Toronto, Ont.	357
CFQG	The Electric Shop (Ltd.)	Saskatoon, Sask.	329	CKOC	Wentworth Radio Supply Co.	Hamilton, Ont.	341
CFRG	Queens University	Kingston, Ont.	450	CKY	Manitoba Tel. System	Winnipeg, Man.	384
CFXC	Westminster Trust Co.	Westminster, B. C.	291	CNRA	Canadian National Railways	Moncton, N. B.	322
CFYC	Commercial Radio (Ltd.)	Vancouver, B. C.	411	CNRC	Canadian National Railways	Calgary, Alta.	435
CHBC	The Calgary Albertan	Calgary, Alta.	434	CNRE	Canadian National Railways	Edmonton, Alta.	517
CHCM	Riley & McCormack (Ltd.)	Calgary, Alta.	434	CNRM	Canadian National Railways	Montreal, Que.	411
CHCS	The Hamilton Spectator	Hamilton, Ont.	341	CNRO	Canadian National Railways	Ottawa, Ont.	435
CHIC	Northern Electric Co.	Toronto, Ont.	357	CNRR	Canadian National Railways	Regina, Sask.	476
CHNC	Toronto Radio Research Society	Toronto, Ont.	357	CNRS	Canadian National Railways	Saskatoon, Sask.	429
CHUC	International Bible Ass'n	Saskatoon, Sask.	329	CNRT	Canadian National Railways	Toronto, Ont.	357
CHXC	R. Booth, Jr.	Ottawa, Ont.	434	CNRV	Canadian National Railways	Vancouver, B. C.	397
CHYC	Northern Electric Co.	Montreal, Que.	411	CNRW	Canadian National Railways	Winnipeg, Man.	384
CJCA	Edmonton Journal	Edmonton, Alta.	511				

Republic of Mexico

CYB	Mexico City	380	CYL	Mexico City	400	CZE	Mexico City	358
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Ancient Wooden Clock Still Keeps Excellent Time



Carved by hand out of wood, this strange clock of ancient origin is keeping very good time for its owner, Hans A. Bergstrand, of St. Paul, Minn. The "works" are composed of four wooden wheels and the pendulum is at the top of the timepiece, or perhaps, more properly should be called the governor of the clock. Small metal pins driven into the wheels constitute the escapement action. The clock has only the hour hand, the spaces between the numbers being divided into quarter hours. The timepiece is motivated by a weight which is lifted once every 24 hours. Photo shows Mr. Bergstrand with his ancient clock

Hissing Sounds Made By Northern Lights

HUNTERS and others who frequent the northern forests of Canada have often reported hearing hissing or crackling sounds accompanying the Aurora Borealis or Northern Lights. Scientists have been skeptical of these reports, for the aurora is known to be an electrical discharge high up in the air; never less than fifty miles above the ground and usually higher. Even if the aurora does produce a noise, which is doubtful, the sound could not reach the earth from so great a height. Nevertheless, the controversy now appears to be settled in favor of the unscientific observers, who reported merely what they heard. A scientist of distinction, the Norwegian meteorologist, Dr. Hans Jelstrup, has heard the sound himself. On the night of October 15, 1926, Dr. Jelstrup and an assistant were observing the aurora from a hill-top near the city of Oslo. Suddenly the often-described hissing sound was noticed. It seemed to rise and fall

in intensity, keeping time with the changes of intensity in the light of the aurora.

Inexpensive Eliminator For Home Constructor

(Continued from page 6)

to forestall rapid evaporation it is a good idea to pour a layer of paraffin oil over the surface of the liquid in each cell, to a depth of about one-quarter inch.

It sometimes happens that when a chemical rectifier is first attached to a receiving set, rectification will not immediately take place. This is because the plates of the rectifier have not had a chance to form which usually takes several minutes. Do not become alarmed if this should happen but lift the electrodes up out of the jars and then immerse them again slowly. This operation will enable the necessary film to form more quickly on the aluminum plates and when this is accomplished the cells will function properly and further attention will be unnecessary.

The various voltages necessary to take care of the average receiving set are obtained by the use of variable resistances, as illustrated. While the approximate output of the described eliminator is forty milliamperes at 150 volts, a greater output can be readily obtained by increasing the depth of the electrodes in the rectifying solution and increasing the capacities of condensers C-1 and C-2. Do not, however, cut down on the specified capacities of either the condensers or choke coils shown if you expect secure satisfactory results.

Before closing this article it would perhaps be well to call the reader's attention to the fact that while the grid leak used in the average receiving set functions quite efficiently when regular "B" batteries are used, it will usually be found too high in value when an eliminator is employed to furnish plate current and produces a hum in the loud speaker unit. This condition can be easily remedied by inserting a leak of lower value, or what will prove more satisfactory, a variable leak, which can be accurately adjusted until all trace of hum is eliminated. When the proper value is once determined further adjusting will be unnecessary.

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How long have you postponed making that favorite hookup of yours because you couldn't find reliable and clear diagrams? We have laid aside a limited number of back issues of RADIO AGE for your use. Below are listed hookups and diagrams to be found in them. Select the ones you want and enclose 30 cents in stamps for each one desired.

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- A Real Low Loss Set.
- Blueprints of a 3-tube Reflex.

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- A 5-Tube R. F. Receiver.
- How to Wind Low Loss Coils.
- A Short Wave Receiver.
- Blueprints of a Two-Tube Ultra Audion and Regenerative Reflex.

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- A Unique Super-Het and an Improved Reinsert.
- A Six-Tube Portable Receiver Illustrated with Blueprints.

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- Shielded Golden Rule Set.

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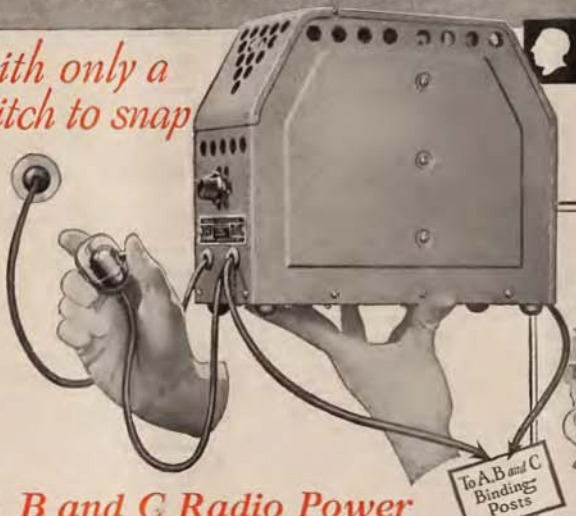
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