NEW ENGLAND

RADIO PROGRESS

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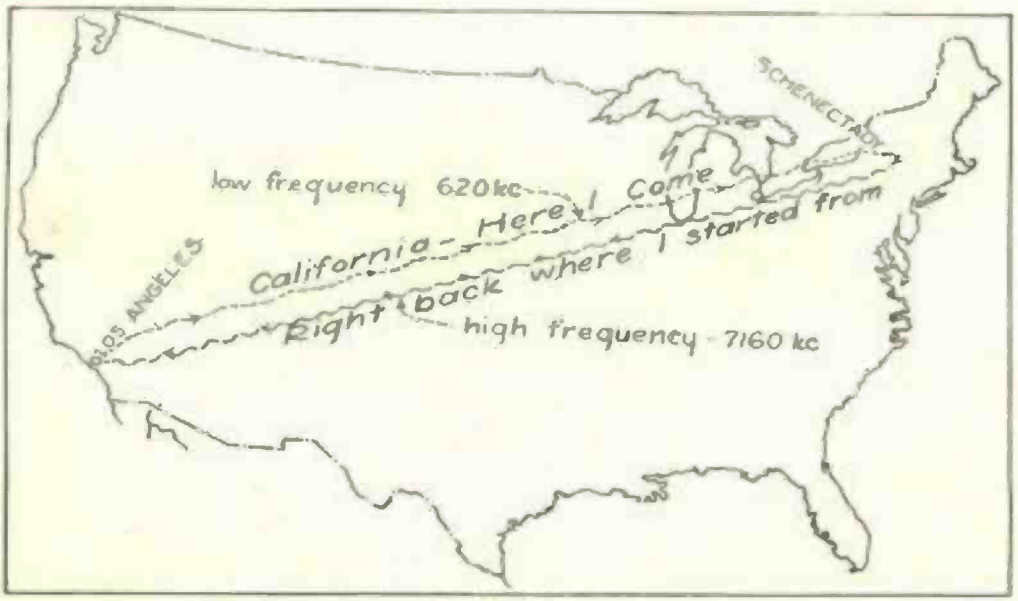
5 C. Per Copy
$1.00 a Year

Acknowledged Authority
and Guide for Radio Fans
in New England

Established March, 1924 FEBRUARY 1, 1926

Published Twice a Month



The Biggest Detour in America. See Page 30.

UNLIKE ANY OTHER RADIO MAGAZINE
"YOU CAN READILY UNDERSTAND IT"

The Two Outstanding Parts In Radio!

Give Low Losses and Amplification Without Distortion to Any Set

QUALITY and distance are what a radio set must give. To insure Quality, amplification without distortion is essential. And to insure Distance, low losses are essential. That is radio in a nutshell.

People in whose sets Acme Transformers are used, are sure of hearing concerts "loud and clear" so a whole roomful of people can enjoy them.

The Acme A-2 Audio Amplifying Transformer is the part that gives quality. It is the result of 5 years of research and experimenting. It gives amplification without distortion to any set. Whether you have a neutrodyne, super-heterodyne, regenerative or reflex, the addition of the Acme A-2 will make it better.

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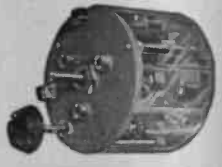
To get the thrill of hearing distant stations loud and clear, your set must have low losses, for it is low losses that give sharp tuning to cut through the locals, and it is low losses that allow the little energy in your antenna to come to the ampifier undiminished. That's what the Acme condenser will do for any set. And it will do it for years, because the ends can't warp, the bearings can't stick and the dust can't get in and drive up the losses several hundred per cent.

The Acme Reflex (trade mark) owes its success and its continued popularity to these two outstanding parts in the radio industry, for low losses and amplification go hand in hand.

Use these two parts in the set you build. Insist on them in the set you buy.

Send 10 cents for 40-page book, "Amplification without Distortion"

WE HAVE prepared a 40-page book called "Amplification without Distortion." It contains 19 valuable wiring diagrams. In clear non-technical language it discusses such subjects as Radio Essentials and Set-building; How to make a loop; Audio frequency amplifying apparatus and circuits; Instructions for constructing and operating Reflex amplifiers; How to operate Reflex receivers; Antenna tuning circuits for Reflex sets; "D" Coil added to Acme four tube reflex; "D" coil tuned R. F. and Reflex diagrams; and several more besides. It will help you build a set or make your present set better. Send us 10 cents with coupon below and we will mail you a copy at once.



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ACME APPARATUS COMPANY

Transformer and Radio Engineers and Manufacturers

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I am enclosing 10 cents (U. S. stamps or coin) for a copy of your book "Amplification without Distortion."

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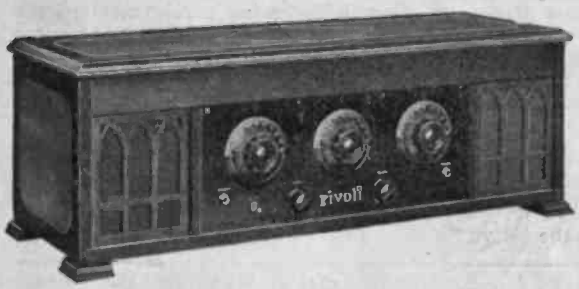
ACME ~ *for amplification*

rivoli

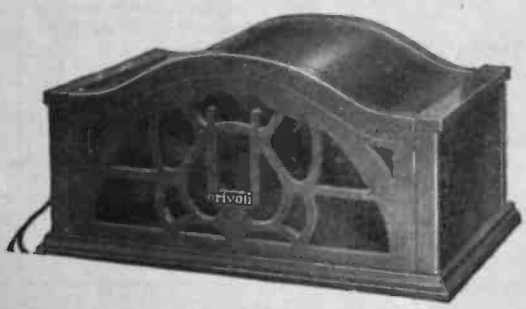
"ALWAYS GOOD COMPANY"

RIVOLI is always good company—good company because it is a thing of beauty and because if there is anything on the air, Rivoli will get it to entertain you. No skill is needed to bring in the broadcast stations.



The Rivoli De Luxe combines all the convenience of a built-in speaker and a built-in battery compartment with the grace and beauty of a finely designed table model radio set. The cabinet is fashioned in two-tone mahogany with panel to match and sunburst dials that lend a pleasingly original touch. Symmetry is retained by the two silk-backed grills. **$75.00**

The Rivoli Junior has been designed for those who must economize in space. In point of quality, the Junior is fully up to Rivoli standards. The cabinet is considerably better and more carefully finished than sets selling at a low price. Finished in mahogany with a generous flare to set off the panel... **$60.00**



The Rivoli Speaker has successfully combined extreme beauty with acoustical perfection. Its tone chamber is constructed entirely of two-tone wood, seasoned by a special process. The front of the Rivoli Speaker is a grill, fashioned in a pleasingly decorative motif. The well known balanced type of unit is used. The Rivoli Speaker always harmonizes perfectly with its surroundings..... **$30.00**

The Rivoli Radio Line is manufactured by the Radio Industries Corp., 131 Duane St., N. Y. City

rivoli

"ALWAYS GOOD COMPANY"

$125.00

The Rivoli Console is a beautiful creation. It is designed in the period of William and Mary, and is constructed of two-tone mahogany. The finely carved legs, the cleanly cut grill which hides the speaker and battery compartments, the metal fittings, all lend an expensive air which seem out of all proportion to the remarkably low price. The built-in speaker is a revelation and recreates the broadcasting artist so clearly that he seems to be standing in the same room.

$50.00

The Rivoli Table is a radical departure in the construction of radio tables. It has ample space for any table type of radio set, either large or small, generous battery compartments for housing A and B batteries and chargers or eliminators, and features a grilled speaker outlet behind which any form of horn or cone can be mounted. Aside from its utility, the Rivoli Table is a beautiful piece of furniture, designed in two-tone mahogany or walnut. It solves the problem of where to put your radio set.

(*Space allowed for radio set is* 36 *in. long x* 11 *in. deep x* 10½ *in. high*)

Write for interesting literature describing the entire Rivoli Radio line.

Radio Industries Corporation, 131 Duane St., New York City

ANNOUNCEMENT

To Radio Advertisers Everywhere and Radio Dealers in New England

A New Policy—Another Progressive Step

A Radical Change to Meet the Demand of These Galloping Radio Times, Giving Advertisers a Concentrated, Controlled, Specialized Circulation of

40,000 Paid Subscribers in NEW ENGLAND

WITH A TIE-UP

With New England Radio Dealers who are the Subscription Agents for
NEW ENGLAND RADIO PROGRESS

The Price has been Reduced from 15c. to 5c. a copy and from $3.00 to $1.00 a year

EFFECTIVE WITH THIS ISSUE

The addition of "New England" to the title and the concentration of the circulation to the New England States—the most fertile, easiest sold, most economical distribution territory in the world—will give advertisers wonderful results.

Our Page Rate Per Thousand Circulation is Very Low Compared with Other Leading Radio Magazines

And We GUARANTEE the Circulation

Don't Scatter Your Sales Efforts. Get Distribution and Sales Volume in New England FIRST. People and Places Are Close Together Here.

The One They All Like!

New England Radio Progress

COR. TEMPLE AND PUBLIC STS., PROVIDENCE, R. I.

Established March, 1924, as Radio Progress

Cold Questions

Which a Radio Manufacturer or his Advertising Agency should ask the publisher of a Radio Magazine.

If 80 per cent. of the answers are satisfactory and true, it will pay that manufacturer to advertise in that magazine

Here are the ANSWERS which NEW ENGLAND RADIO PROGRESS gives:

AND 100 PER CENT. OF OUR ANSWERS ARE TRUE!

How old is it? Two years next March.

What is there about its circulation distinctive or superior to other magazines? It is concentrated in the six New England States, and being "New England's Own Radio Magazine," the readers feel almost an affection for it. Thus, the reader-interest is unusually high.

What is the experience and education of the Editor? His literary and writing experience was acquired at Yale. His technical training came from Massachusetts Institute of Technology, of which he is also a graduate. The Research Laboratory of the Westinghouse Company gave him the practical experience in testing and engineering work which a radio editor needs. While there he was one of the two men who in 1913 first started all radio work of the Westinghouse Company.

What is the subscription price? 5c each; $1.00 a year.

Do you give a premium to subscribers? No.

How often issued? Twice a month.

What advantage is that as compared with a monthly publication? Changes and advances are being made in radio too rapidly to be covered in a monthly. Readers demand such news and descriptions while they are fresh and new.

How do you get circulation? Through radio dealers in New England, who sell yearly subscriptions,—and from news-stand sales.

How much circulation is outside New England? About 10%.

Who is the publisher? The Oxford Press, John F. O'Hara, Proprietor.

Is it connected with any society or association, or the organ of any? No.

Who reads it? Broadcast listeners or "fans."

What distinguishes its reading matter from other magazines? It is written so that anyone may understand it. It is so easy to read, so plainly written, that even the technical terms are clear, and the reader knows exactly what is meant.

How does the advertising rate compare with others? Compared with nine other leading radio magazines, NEW ENGLAND RADIO PROGRESS has a lower rate per page for each one thousand of circulation than six have. It is higher than one, and the same as the other two.

How do you prove circulation? By open books or sworn statement.

Do you guarantee the claimed circulation? Yes, and give a pro rata refund of the advertising rate should there be less than the rate is based on.

How much circulation? 40,000 net paid on all issues after January 1st, 1926.

Why don't you publish more pages of reading matter? Questionnaires to our readers prove that we give them all they want and all they have time to read. "Too much to read" is the kick now-a-days. There is a great waste in this on the part of publishers in this age, and it has to be paid for by the high advertising rates many have to charge.

Do you give write-ups of the products of your advertisers? When there is a news value.

Has NEW ENGLAND RADIO PROGRESS any dealer influence? Yes, a great deal.

Why? Because they sell yearly subscriptions for us and are every day handling our magazine, showing it to prospective subscribers, etc.

Double Barreled Advertising

is what you get in NEW ENGLAND RADIO PROGRESS. The only consumer magazine with a TIE-UP to the dealers in New England, who are our Subscription Agents.

This dealer influence and circulation which you surely get is of great value, yet costs you nothing extra.

NEW ENGLAND RADIO PROGRESS ADVERTISING RATES

Effective January 1, 1926, and for Six Months Only

Per Issue	1 Time	4 Times	12 Times
Full Page	$120.00	$110.00	$100.00
Half Page	60.00	55.00	50.00
Quarter Page	35.00	30.00	27.50
Small space, agate line	.40	.35	.32
Back Cover, 2 colors	200.00	200.00	175.00
Inside Front Cover, 2 colors	150.00	135.00	125.00
Inside Back Cover, 2 colors	150.00	135.00	125.00

Issued on the 1st and 15th of every month. Forms close 10 days earlier.

See Standard Rate and Data Book for further data.

NEW ENGLAND RADIO PROGRESS

HORACE V. S. TAYLOR, EDITOR

Volume 2, Number 22

5c Per Copy, $1.00 Per Y.

Contents for

FEBRUARY 1, 1926

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NEW ENGLAND RADIO PROGRESS is issued on the 1st and 15th of each month by the Oxford Press at 8 Temple Street, Providence, Rhode Island. John F. O'Hara, Publisher. Yearly subscription in U. S. A., $1.00. Outside U. S. A., $1.25. Single copies 5 cents. Entered as second-class matter, April 4, 1924, at the Post Office at Providence, R. I., under the Act of March 3, 1879. Address all communications to NEW ENGLAND RADIO PROGRESS, 8 Temple Street (P. O. Box 728), Providence, R. I. Title registered at United States Patent Office.

The publishers of this magazine disclaim all responsibility for opinions or statements of contributors which may at any time become subject of controversy.

What a Nickel Will Buy For You

The chief trouble with "B" battery eliminators has been that the tubes used were very short lived. Here is a new device which does not need to have parts replaced. See **"This 'B' Eliminator Won't Burn Out."**

With this kind of weather many roads are in poor shape. There has recently been started a radio service which keeps track of bad conditions and detours. It is described by Vance in **"A 3,000-Mile Road Map."**

If you have been reading this magazine during the past year, you will know what most of the improvements in the art have been. Even at that you will be interested in **"What 1925 Did for Radio,"** by Liston.

The most exciting thing which will happen this month will probably be the tests to try to pick up Europe. **"All About International Radio Week"** is a description by Arnold of how to do your part in these experiments.

Did you know that radio was no longer the enemy of the talking machine industry, but was actually lending it a hand? Taylor explains this in **"How Radio Makes Phonograph Records."**

"Make Your Radio Beat Your Friends" is the interesting title under which Rados gives a very good description of how to improve the operation of the ordinary receiver.

Parker, the well known patent attorney, has written a very readable article, **"Making Money on a Radio Patent."** You will want to know about it even if you are not an inventor.

One of the silver tongued announcers has gone off the air. If you want to know about it read **"A Pioneer Broadcaster Shuts Up,"** in the issue of January 15, price five cents.

With this issue, January 1, 1926, the price of Radio Progress has been reduced to

5c

Subscription Price Will Be $1.00 a Year

As a member of the big family of fans who read RADIO PROGRESS, you will be glad to learn that we are still keeping "Abreast of the times," and in this case are way ahead of the field.

THIS REDUCTION IN PRICE will not be accompanied by a decrease in the value and interest of the magazine to you. Instead we are going ahead with plans to give you even a better and bigger periodical than it has ever been before.

The aim will be continued to write especially for those radio fans and broadcast listeners who are intelligent and interested in the art, but who have not had a special education in radio. In other words, we want this to be YOUR MAGAZINE and would like your comments and criticisms.

Watch for the next issue

New England Radio Progress

"ALWAYS ABREAST OF THE TIMES"

Vol. 2, No. 22 FEBRUARY 1, 1926 5c Per Copy, $1.00 a Year

Waves Which Live and Die

Why Some Broadcasters are Very Broad and Others are Not

By Horace V. S. Taylor

DID YOU ever hear a fire engine go whizzing by and jump into your coat and hat and rush out the door and up the street after it? A fire is quite an attraction to most people—unless they happen to be the ones concerned. But a fire at sea is a terrible thing. Did you know that the radio waves sent out from such a disaster (Fig. 1) were different from those transmitted by your favorite broadcasting station.

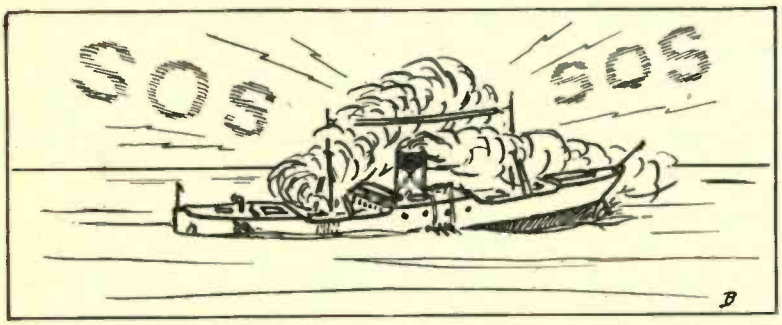

Fig. 1. The Waves Sent Out on an SOS Call Are Not Sharp Tuned Like Those of a Broadcasting Station.

Five Parts of Lying

Yes, there are waves and waves. Of course you well know that they differ in frequency or number of oscillations per second which is the same thing as saying that the length in meters is not always the same. They also differ considerably in loudness. Your local stations are apt to come pounding in so that you may have difficulty in getting rid of them while those elusive English stations which you hunted for during Radio Week required one part of ear phones, four parts of imagination and five of lying to pick them up.

But there is another quality which radio waves possess besides frequency (wave length) and volume. This might be called the pureness of the oscillation. The engineering name for it is "decrement," and means the rate at which a wave dies out.

Then it Dies Away

This idea is easily seen by comparing an organ with a piano. When an organ key is pressed, the note is heard and it will continue a year, if you hold the key down as long as that. When you strike a piano key, you hear the note and it may be even louder than that of the organ, if you thump it hard enough. But as you continue to hold the key down, notice that the tone keeps getting fainter and fainter and finally dies away. You must strike the note again if you want to hear it any more.

If something happens to be wrong with the damper in the piano movement, so that the little felt piece is not raised from the strings when you strike the key, then the note will be heard just as before, but will die away very rapidly indeed—perhaps in half a second. Such a piano has a very large decrement.

Tennis Ball an Alibi

Another illustration of this idea is the bounding of a ball. When you get out your trusty tennis racket in the

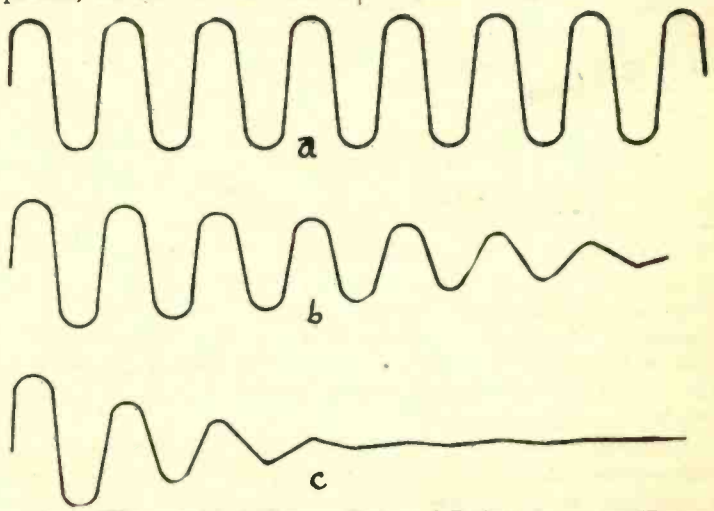

Fig. 2. Three Waves with Different Rates of Dying Away or "Decrement." "a" is Like Organ, "b" is Like Piano.

Spring perhaps you find in the bag a couple of tennis balls of last year's vintage. They look just as good as ever, but will they do for this year's game? Not unless you are looking for an alibi as to why your service is poor. No, it is necessary to go out and buy a

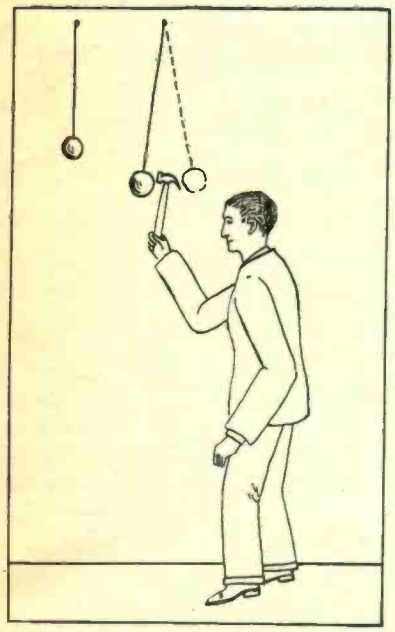

Fig. 3. Light Tapping Sets One Pendulum in Motion, but Not the Other.

new assortment in order to get any fun out of the game.

What is the best way to test out these spheres? Find a nice concrete walk and drop the new and old ball side by side from the same height. The good ball if dropped from your hand four feet above the ground will bound back two feet then on the next rebound one foot, then six inches, etc. The decrepit one springs up only one foot, then three inches and the like.

A Ratio of One-Quarter

Notice how these figures run. In the first case we have heights of 4, 2, 1, 1/2, 1/4. Each figure is evidently half the one before it. That is the law of such bounding bodies. The ratio between one rebound and the next is a constant. In the second instance above, the aged ball ran 4, 1, 1/4. Here the ratio is 1/4. If the condition of the rubber had been unusually poor this figure might have been 1/10 or even less. The decrement of the first ball is then 50 per cent., while that of the second is 75 per cent., since 3/4 is wasted only 1/4 being retained.

If you want to see a vibration which has quite a low decrement, select some time when the lady of the house is not in, and proceed to the bathroom with a few steel ball bearings. Drop these one by one into the center of the bathtub. You will find that they rebound almost as high as the distance you dropped them and will continue to vibrate for a long while. We recommend having the stopper in the drain pipe unless you like to talk to the plumber. The decrement of the steel balls may be as low as 10 per cent.

Keep Right on Bounding

What would happen if in some way this figure should be decreased to zero? That would mean that each rebound was just as high as the one before. In such a case we should see the balls continue to rise and fall indefinitely without dying away at all. Such a condition of course cannot occur unless there is some way of maintaining the vibrations by supplying power from some outside source. The organ note which was referred to keeps vibrating at the same loudness because it gets its power from the air pipe which is kept filled with compressed air by the blower which is driven by an electric motor.

We have the same thing applying in radio. Fig. 2 shows the curves of similar waves in the ether. At A is seen a continuous vibration which is put out by a vacuum tube. This corresponds to the organ, and has a decrement of zero. B is the curve obtained from a spark gap in a radiating system. Notice that the wave starts big and keeps decreasing in volume for each loop. As shown here, each loop is about three-quarters as high as the one just before it. This represents a wave with a moderate decrement (1/4), and corresponds to a piano note. At C is seen the curve of a spark gap with a lot of resistance in the circuit. Here it dies out quite rapidly—in fact, each loop is only half as big as the one before. Such a big decrement is like the piano with the damping out of order.

Taps with Tack Hammer

A wave like A, which is the style sent out by broadcasting stations, is easily tuned. The one at B is harder to adjust, for while that at C is more like the shock of static and cannot be successfully tuned out. The same thing would occur in Fig. 3. Here we have two weights suspended from the ceiling on pieces of clothesline. The one at the left is short and so the frequency is high—it swings back and forth at a rapid rate. At the right is a long line which gives a low frequency or a slow swing. The man standing nearby has a light tack hammer in his hand and he taps the weights with it in time.

As it is rather early in the morning, he has not yet worked up very much enthusiasm, and so he swings his arm with rather a slow motion. The suspended weight, let us say, is quite heavy, and a blow or two with his tiny hammer is not enough to have much effect on it. But as he continues to deliver blow after blow at the slow rate at which it swings of its own free will, you will realize that quite a vibration is worked up by the time he has hit it a few dozen times.

Swings Out of Time

Then he tries the same thing on the

Fig. 4. A Heavy Blow Like Static Sets Both Weights Swinging.

weight at the left. However, owing to the shortness of the rope, it swings rapidly and although the first blow or two starts it moving very slightly, it is only a short time before it gets out of

step with his strokes and it comes back thump, right at him just as he is taking another blow. As a result of the lack of proper timing, it happens that a few blows of the hammer will get the weight swinging, and the next few strokes will quiet it down again. This is owing to its being out of tune.

By afternoon our blacksmith has worked up a lot of energy, and instead

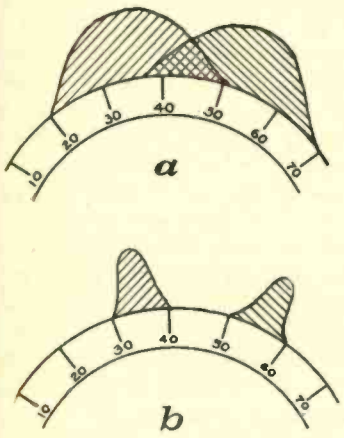

Fig. 5. The Ordinary Set Hears Two Locals Over-Lapping, but the Sharp Tuned One Separates Them.

of a light hammer he uses a heavy iron mallet, Fig. 4. He decides no longer to administer a series of gentle taps, but makes a wild swing and with a crash sets the pendulum oscillating with the first whack. This is true of the long pendulum at the right. When he uses similar cave man tactics on the short left hand pendulum, what is the result? Unlike Fig. 3, the short pendulum is also set swaying just as hard as the long one, but of course at a much higher rate of vibration.

Waves Tap Tuning Coil

How does this apply to radio? Fig. 3 stands for the broadcasting waves which come down your aerial and gently tap your coil and condenser so that it sets the electricity swinging back and forth inside the tuned circuit. But if the circuit is not tuned for the particular wave which is trying to do the tapping, it will happen that every third or fourth oscillation from the aerial will kill off the tiny vibration which the earlier energy has built up in the tuner. The result is that while the wave which you are tuning for is heard in loud volume, all other frequencies are suppressed.

Fig. 4 represents the effect of static. Instead of a large number of gentle taps with the tack hammer, Old Man Static gets out his heavy hammer, then strikes a single blow on your aerial which sets your tuner into electric oscillations, no matter what the dial setting may be. That is why you are unable to tune out such noises. Just like the pendulums of Fig. 4, the oscillating circuit is set into vibrations which are equally loud whether the condenser is set for high or low frequency.

Are Not so Very Sharp

There are other sources of sounds like static which do not come from the clouds. As has been often told such devices as vibrating rectifiers, X-ray machines, sparking motors, and leaky power line insulators all cause waves which resemble in effect Fig. 4, and which look like Fig. 2 in their wave shape. None of these can be tuned out very completely. Of course most of them have some one value of tuner setting for which they are loudest, but the adjustments are far from being sharp.

Thus in Fig. 5A, we have two sending stations on the air at once. Both may be broadcasters or one or both may be static generators as just described. However, neither one is at all sharp tuning. You can see that you start hearing the lower one at 20 on the dial, and it is loudest at around 35. It dies out again at 50. The other station is heard from 40 to 70 with a peak at 55. All the way from 40 to 50 both waves are heard together with varying degrees of loudness. This condition often holds for two local broadcasting stations where one may easily find a position on the dial where both come in at about the same loudness. Of course it is not a desirable set to have which will not separate them.

A Single Static Hammer

Fig. 5B shows the same two stations or noises as they are resolved by a sharp tuned set. Instead of extending over 30 divisions on the condenser each one is cut down to 10. That means that whereas the broad tuned set has the space from 40 to 50 where *both* stations come in, the better receiver on the contrary will pick up neither station between these settings. If the sending stations are at fault for sending out poor waves, at least the radio has partially corrected the trouble by being sharp tuned. Even with the sharpest of sets, however, a *single* hammer blow of static cannot be tuned out.

There is another trouble which much broadcasting suffers from. The ordinary sending stations do not use the style of transmitting apparatus which results in waves petering out as we saw in Fig. 2C. Instead they have a continuous vibration like Fig. 2A. Even at that some waves are not easy to tune out as compared with other senders having the same amount of power. What is the difference? A glance at Fig. 6 will show the reason. At first we have a smooth uniform wave put out by the transmitter working normally with the rated plate voltage and about, say six amperes, in the aerial.

A Change at Point X

Now suppose that the station wants

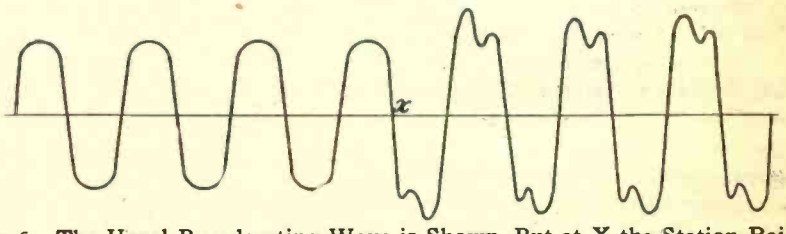

Fig. 6. The Usual Broadcasting Wave is Shown, But at X the Station Raises Its Power.

to extend its range as far as possible for a short time, as for instance, in International Radio Week. This may be done by increasing the voltages on the tubes with the result that the aerial current jumps up from six to perhaps eight or nine amperes. That increases the range perhaps by several hundred miles. But notice at the point X in Fig. 6, there is another change in the wave besides that of height or loudness. The spacing or distance apart from peak to peak is of course no greater, as if that should vary it would mean that the frequency or wave had shifted and of

course that would throw the station off its assigned band.

But while the first curves of Fig. 6 were smooth and regular, notice that the latter part have a number of ripples or harmonics which interfere with the uniformity of the waves. These harmonics may be 2, 3, 4, or any whole numbers of times faster than the regular or fundamental frequency. They are caused by the straining of the apparatus particularly the tubes.

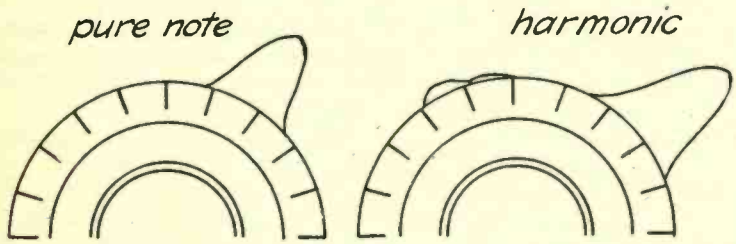

Fig. 7. A Pure Note is Heard in Only One Place on the Dials, But if Station Sends Out Harmonics, it Appears in Other Spots.

Washing Machine Makes Noises

In that respect it is much like any machine. If you have an electric washer in your cellar and the motor turns the pulley at the proper speed everything will work smoothly. But if you should change the gearing so that the washing machine turned over twice as fast as it was designed to do, you would hear a terrible lot of noise and high frequency vibrations which were largely missing when the device operated at the rated revolutions.

Such a wave which has two or more *different* frequencies is much harder to lose in your radio set. Fig. 7 shows a dial with the tuning of a pure note. Notice the hump which represents the loudness appears at only one spot on the dial and is rather narrow or peaked. Of course this is what you want as it means that a few degrees on the condenser will completely cut out that particular local station and so it will be easy to get through it to pick out distant DX stations.

Flock of Uninvited Guests

That curve represented the ordinary operation of the set. Now along comes Radio Week, as mentioned, and the sending station increases its tube voltages to get the distance and in comes a flock of uninvited guests—the harmonics. They certainly ring your doorbell to let you know that they are there by being heard at several other points on your dial as shown in Fig. 7. You must realize that they do not appear like harmonics on a violin say, for the following reason:

When a violin plays a fundamental note like middle C, that tone itself if all alone would sound somewhat flat. This particular musical instrument, however, carries with the fundamental the second harmonic which is C, an octave higher then the G above that, which is the third harmonic, the next C (fourth) then E (fifth), G (sixth), etc., up the scale in decreasing amounts through the ninth or tenth harmonic. A skilled musical ear is able to pick out at least some of these notes and recognize that they are *not* the main tone.

Why You Can't Hear Them

However, on this broadcasting wave which we are discussing remember that it is the *radio frequency* which has the harmonics. No human ear can hear such a high rate of vibration so of course you cannot listen to these extra waves. But your detector has its ears tuned to those very frequencies and so by ordinary detector action makes music of them by changing them into audio frequency. The latter speed of vibration depends only on the note which is being played in the studio at the instant. That is why both fundamental and harmonic radio waves are converted to exactly the same tone and you pick up the sending station at several places on the dial (Fig. 7) instead of at the single point as with a pure note.

How can you tell that it is the fault of the sending station transmitting harmonics which cause the broadness of the tuning? There is no direct way. Of course the fault may lie in your set. However, this may be proved by tuning to some other station at about the same wave and seeing if it too is picked up in more than one spot. If you find that almost all these stations have only one tuning position, whereas one or two have two peaks as appear in Fig. 7, you will know it cannot be your set at fault, but the broadcaster.

They Want a Pure Tone

Even when sending under normal conditions the wave of a transmitter is usually not quite as pure as appears at the left of Fig. 6. It is desirable to send out such a vibration and so many of the sending stations are adopting what is called a "harmonic suppressor." This device consists of a coil and condenser which are connected together to form a filler.

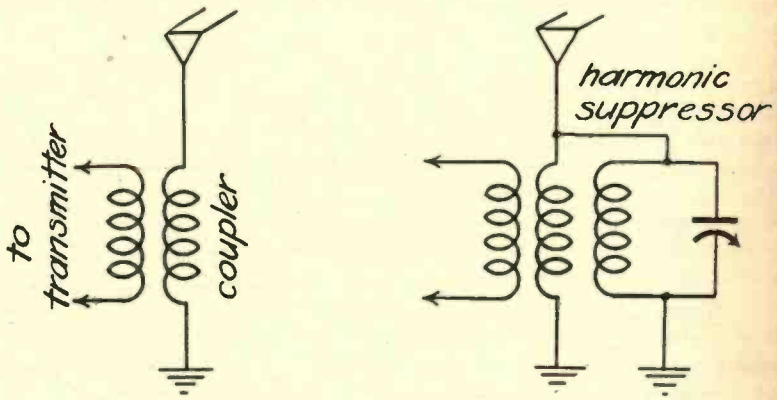

Fig. 8. The Usual Aerial and Coupler of a Transmitting Set May be Modified to Prevent Broadcasting Harmonics.

Such a possible combination is shown in diagram form by Fig. 8. Here the harmonic suppressor is tuned to block

Continued on Page 34

The Latest Marcodyne Circuit

An RF Set With Condenser-Controlled Tickler Action

By P. L. PENDLETON

OF course you have seen plenty of sets with regeneration controlled by a variable feed back, the latter taking the form of a tickler coil which you can turn by a dial. Are you as familiar with a tickler which does not turn?

This article will describe a radio circuit which tunes sharply in comparison with the best known hook-ups of the present day, far sharper than many super-heterodynes,—more selective than many sets using loop aerials. The technical reasons for its efficiency are simple. Loose coupling is used in the radio frequency transformer; the natural resistance of the instrument is kept low and changeable primary windings are used to provide for the varying plate current produced by different tubes. Peculiar as it may seem, these simple features are enough to make the Marcodyne circuit a radical change from previous hook-ups both in design and performance.

Fitting Coil to Your Tubes

The idea of building a radio frequency transformer with separate primary windings for use with dry-cell or storage battery tubes is the outstanding constructional change of the present season. Hundreds of thousands of sets have been built in which no change of this kind is possible. In the future this principle will probably be quite often applied as soon as the benefits resulting from its application have become generally known.

No set involving radio frequency amplification will work equally well with all types of tubes without substantial changes along the lines laid out in this article. Proof of this statement is furnished in the performance of the Marcodyne circuit, developed by the Martin-Copeland Company of Providence, R. I., which is apparently the first commercial application of these new principles of design.

PARTS NEEDED

1 24 x 7 x 3/16 Bakelite Panel.
24 No. 6 x ¾ Wood Screws.
1 Cabinet.
2 .0005 Variable Condensers.
1 .00025 Variable Condenser.
2 Vernier Dials. (For Above.)
1 Large Knob. (For Above).
3 30-Ohm Rheostats.
1 Switch.
10 Binding Posts.
1 Baseboard 23½ x 6 13/16 x ¾.
Wire, solder, flux, terminals, etc.
4 Sockets.
4 Tubes, 199 or 201A.
2 45-Volt B Batteries.
2 4½-Volt C Batteries.
1 A Battery (to suit tube).
2 Audio Transformers.
1 Double Circuit Jack.
1 Single Circuit Filament Control Jack.
1 Grid Leak (5 to 9 Megohms).
1 .00025 Fixed Condenser.
1 .0001 Fixed Condenser.

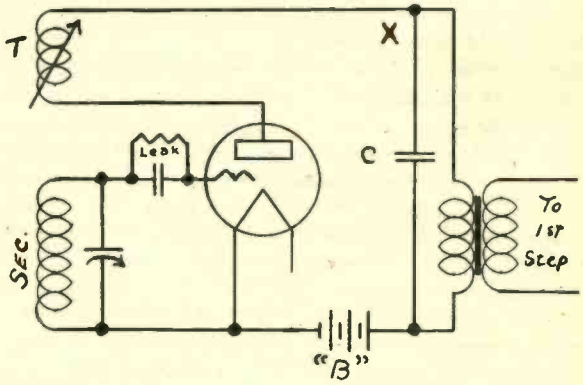

Fig. 1. This is the Usual Way of Controlling Feed Back by Turning the Tickler Coil, T.

A brief description of the theory involved will be of general interest. Dry cell tubes pass approximately half the plate current of the storage battery types under normal operating conditions. As the plate current from either style passes thru the primary winding of a radio frequency transformer it affects the energy transferred by the coupling between primary and secondary and the output of the combination. A 50% reduction in plate or primary current caused by the installation of dry cell tubes in a set designed for the storage battery type reduces both the transfer and output.

Capacity feedback is also reduced causing an apparent increase in resistance and a decrease in signal strength except on the high frequency (short) waves. In fact, the common complaint of those attempting to use dry cell tubes in the ordinary radio frequency set is a lack of volume. Conversely, a circuit arranged to work well on dry cell tubes suffers 100% or more increase in plate current with a change to UV-201A's. Coupled power and capacity are immediately increased to a point where RF. oscillations are almost uncontrollable particularly on the fast waves. Consideration of these familiar facts makes it evident that a radio frequency transformer cannot operate to full efficiency with any tube passing either more or less

plate current than the one it was designed for. To expect efficiency after upsetting the correct plate current by a change in tubes is to invite disappointment.

How Problem Was Solved

To compensate for the condition outlined above and to produce a transformer equally efficient with varying amounts of plate current was an interesting problem. As the change in coupled power due to current variation was the greatest variable factor resulting under ordinary conditions, it was decided to adopt a degree of coupling under which the circuit in question would operate to full efficiency and to keep this coupling correct for all tubes by varying the number of turns on the primary winding inversely according to the normal plate current for each type. It was known that the coupling varied with the strength of field surrounding the primary coil and that this field could be produced by any number of combinations of current and turns as with any field.

This experiment was most successful. With a "fixed coupling," primary turns were varied inversely according to the D. C. output of tubes. Limit on turns in each case was measured by a condition of generally similar operating characteristics for the entire circuit. In other words, by holding the distance in inches between primary and secondary to a common measurement in each case and by varying the primary turns it was possible to make this circuit function in practically the same way for each type of tube.

Two Inches is Right

It was impossible to get the same results from the use of a common primary. It was equally impossible to get absolutely the same action in each case due to varying grid-to-filament resistance and variations in the natural period of the RF. plate coil. It was satisfactorily proved, however, that varying the primary turns to fit the tube had a tremendous influence on the efficiency of the set. At a linear distance of two inches UV-201A tubes required a primary of 25 turns. UV-199 tubes required 50 turns at the same distance in order for the circuit to function equally well.

This loose coupling naturally gave a remarkable degree of selectivity. Compare these figures with the ordinary radio frequency transformer primary of 8 to 10 turns offered for use with any tube and it can be readily surmised that there has been much laxity in specifications for windings of this nature.

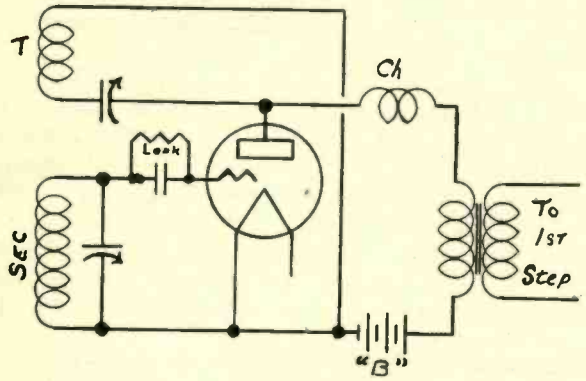

Fig. 2. In This New Set, the Tickler is Solid, and Cannot be Turned. Instead, the Adjustable Condenser Controls the Regeneration.

Gives Still Greater Volume

For those who wish to build a circuit embodying these new principles we are describing the Marcodyne arrangement by courtesy of the Martin-Copeland Company, who are responsible for its design. For those who have experienced difficulty in obtaining satisfactory volume, distance, and selectivity with dry-cell tubes we recommend this circuit although it works equally to advantage and gives greater volume with storage battery types.

No departure should be made from the dimensions furnished herewith for the general assembly. The distance between coils must be accurately held, the number of turns, size of wire and size of tubing must be correct. Choice of apparatus is left entirely to the discretion of the builder who can probably use much material that he already has on hand. The efficiency of this circuit is due to the scientific design of the radio frequency transformer, the wiring and the mechanical disposition of the parts. We wish to emphasize that there is nothing freakish about it and that anyone can build it and expect good results.

Low and High Together

Just a word may be of interest here in the method of controlling the feed back. Fig. 1 shows the customary arrangement of a detector tube with its tuning and feed back controls. The secondary of the tuner (primary not shown) is adjusted for wave frequencies by the tuning condenser as usual. The grid leak is also standard. The output from the plate which consists of vibrations of both low speed audio and high speed radio are conducted first to the tickler coil and then at the point X they divide. The audio oscillations thread the primary of the audio transformer and then return through the "B" battery to the filament.

The high frequency waves which are the ones operating the feed back through tickler coil T find difficulty in passing through such a large coil (big inductance) as the primary of the audio transformer. To accommodate them a by-pass condenser C is bridged around the primary and while this is too small to permit any loss of audio waves, it still allows the radio frequency a free passage back to the filament. Of course, the amount of regeneration is controlled by turning tickler T which is mounted so that it rotates on a shaft.

Why the Tickler Varies

The radio frequency vibration, however, can pass through the adjustable air condenser and then it runs on through the tickler coil back to the filament. When this condenser is set with the plates way in mesh the capacity is high enough so that the entire vibration can react on the tuner to give regeneration. But when the plates are out of mesh (dial at 0) the capacity is then so low that only a small fraction of the radio frequency can get through to work the tickler. In this condition the regeneration is at its lower limit.

As mentioned above the audio fre-

quency transformer has such a big coil that it is desirable in Fig 1 to use a by-pass condenser C to allow the full volume of the waves to pass. However, in Fig. 2 although this coil is not a very good conductor for high frequency, it still is not a very good insulator at least in many makes of audio transformers. But notice that if much of the radio vibration energy is able to pass this coil it acts as a drain on the feedback which should go to the left instead of to the right. To prevent this waste of the high speed waves, a choke coil is used as shown to make the waves stay in their own yard. Some audio transformers which are designed with this in mind offer enough of an obstacle to the RF waves so that the choke coil, Ch, is unnecessary.

Combining Choke and Transformer

The first stage audio transformer should be a low ratio instrument like a Mar-co, General Radio 231A or 285 (2 to 1) or Rauland Lyric. Any one of these instruments has the necessary choke coil action in its primary as just described, in addition to being efficient audio transformers. The first stage of audio amplification should be transformer coupled although additional stages may be resistance coupled if desired.

The wiring lay-out, Fig. 3 shows connections for straight UV-199 or UV-201A tubes. UX tubes can be used with the proper sockets. We do not recommend employing adapters if it can possibly be avoided. The new UX power tubes can be used provided additional "B" and "C" battery lines are installed to take care of their special requirements as listed on the circular accompanying the tubes. The correct installation of these power tubes slightly changes the wiring diagram and complicates the assembly. Plenty of amplification can be obtained without their use and we recommend that the circuit be first built and operated without them as it is less expensive.

Tubes Not to be Matched

We advise having all tubes tested before attempting to use them in this circuit. Most dealers have tube testing outfits and will be glad to do this for you. Do not ask that they be "matched." Tubes should show plate current readings according to the following tables, those passing more than the amount of current listed to be chosen in preference to those passing less.

Type of Tube.	Negative Grid Bias	Plate Voltage	(Miliamp.) Plate Current
UX or UV-199	4½	90	2
UX or UV-201A	4½	90	5
UX-112	6	90	2.4
UX-120	22½	135	6

Why Not Matched Tubes?

Variation in plate current readings between different tubes of the same type is of no moment provided that they equal or exceed the above normal value. It is often desirable to have a set of tubes with slightly differing characteristics in order that they may be moved around in the circuit to compensate for other electrical inequalities. That is why it is foolish as well as unnecessary to ask that the various tubes be matched.

Details of the coil windings appear below: See Fig. 4.

Coil	For 201A Tube
L-1 3"-tube	46 turns No. 20 DCC
L-2 3"-tube	25 turns No. 20 DCC
L-3 3¼"-tube	45 turns No. 20 DCC
L-4 3¼"-tube	20 turns No. 28 DCC

Coil	For 199 Tube
L-1 3"-tube	46 turns No. 20 DCC
L-2 3"-tube	50 turns No. 32 DCC
L-3 3¼"-tube	45 turns No. 20 DCC
L-4 3¼"-tube	20 turns No. 29 DCC

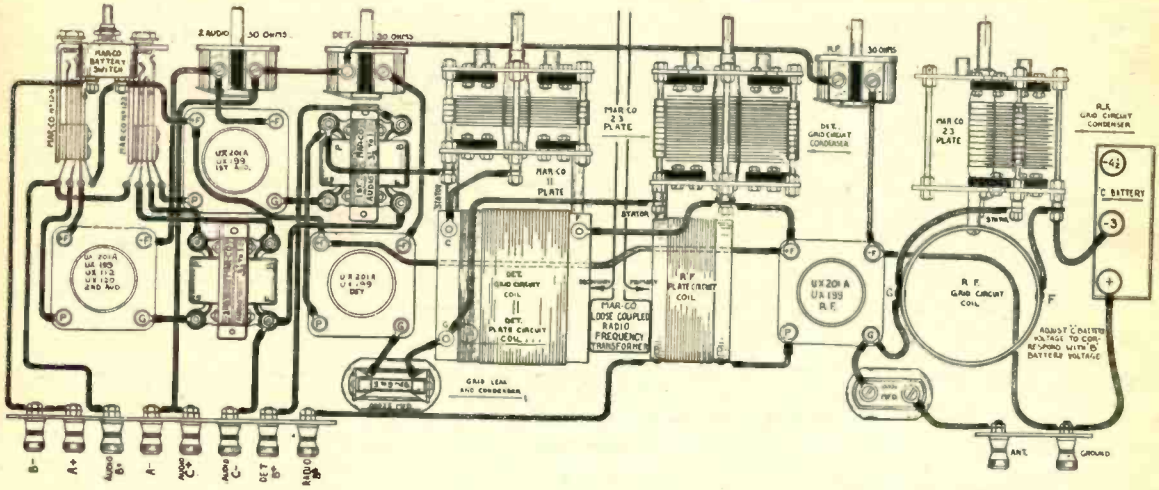

Fig. 3. Here We See the Layout of all the Apparatus. It is Compact, But the High Frequency Leads Are Spaced Far Enough Apart to Avoid Interference.

Mounted in the Rear

The plate coil of the radio tube which is the smallest one in the picture requires a special winding according to the type of tube to be used. All other coils are the same for any tube. We do not recommend other tubes than the UV-UX-199 or UV-UX-201A in the radio frequency socket. Follow the diagram closely in regard to the spacing of the coils and all other details of their construction. Coils may be mounted on the baseboard or on condensers. Place them as far toward the rear of the set as the depth of the cabinet will allow.

The baseboard and panel type of assembly has been chosen as the easiest for the builder. This assembly can be easily arranged on a 24 x 7 panel for installation in a cabinet seven inches deep.

Binding posts can be mounted on small shelves carried on posts or on the rear of the cabinet. The accessories for this circuit are shown in box at the head of this article.

Don't Solder in a Corner

After the accessories have been obtained lay out and drill the panel following the general idea of the diagram, which shows the recommended position for the panel mounted instruments. Individual layouts for mounting screws will vary according to different makes of apparatus. Mount all parts on the panel and wire so far as possible before attaching the baseboard. The first audio socket and transformer can also be partly wired before installing the rest of the apparatus. This will save trying to solder in awkward places. Follow the connections shown on the diagram exactly, checking off each connection as completed. As there are no tee or cross connections in this layout it is easy to follow with reasonable care.

The Mar-codyne circuit will work on any conceivable kind of an aerial long or short, inside or out, bedsprings, piano frames, telephone plates, lighting circuit plugs or no aerial at all. Nevertheless there is a certain type of aerial for every location which can be considered the best. The length of the aerial affects the selectivity of the set, the sensitivity at the end of the dial scales, and the calibration of the dials. With an aerial from ten to twenty feet long the circuit is extremely selective and sensitive to the faster broadcasting waves.

How to Get Control

Tuning may become critical but it should always be possible to stop excessive squealing by turning down the RF tube. When this does not produce the desired stability increase the "C" battery voltage or decrease the plate voltage on the RF tube until oscillation is entirely under the control of the .00025 variable condenser. The detector circuits should oscillate under normal conditions with this condenser one-third to half-way meshed. When oscillations occur with this condenser at zero setting turn down the RF tube until the desired control is secured. Once the set is properly balanced for the lower end of the dials no change in connections is necessary for operation thruout the 1300-550 kilocycle range. The slower waves (longer wave-lengths) will be received more clearly at a distance with an increase in the length of the aerial but there will be a slight decrease in selectivity and a change in the setting of the first dial.

For general reception in congested districts we recommend an inside or outside aerial 30 to 40 feet long with a short ground connection if possible. Where the utmost selectivity is not required, increasing the length of the aerial to 75 or 100 feet will aid in the reception of the middle to slow waves. In many cases satisfactory reception may be had by simply attaching a ground wire to the antenna binding post.

Hunting for a Whistle

After the assembly has been completed test the filament lines before adding the plate battery voltage. Complete the plate battery wiring carefully to avoid burnt-out tubes from improper connections. Be sure that the "A," "B" and "C" batteries are in accordance with the specifications on the circular accompanying the tubes. Select a time for the first test when the nearest powerful broadcasting station is in operation. Set the tuning condenser dials at approximately the same position from 20 to 50 and turn the knob on the .00025 condenser until the plates are about half meshed. Vary the tuning dials until a whistle is heard; then set them at the point where the whistle seems loudest. Then turn the .00025 condenser towards its zero setting and slightly readjust the tuning dials for clear reception. The .00025 condenser is the main oscillation control. At any time when adjustment of this condenser will not stop the whistles and clear up the signal turn down the radio frequency rheostat. The other rheostats are not critical and do not require careful setting.

After this circuit has been worked for a little while the proper manner of operation will become self evident. It is possible for a novice to get loud signals but for long distance reception under severe conditions some degree of experience is the best asset.

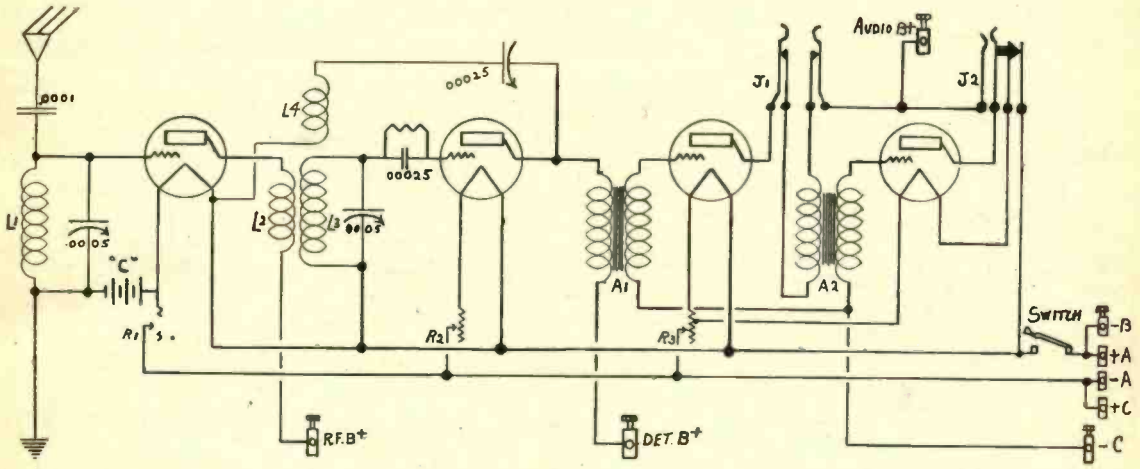

Fig. 4. The Hook-up Shows a Substantial Scheme of Connections, With Modification Made in the Interest of Selectivity

Radio Serves You Through Farmer

These New Broadcasting Ideas Will be of Help to Agriculture

By VANCE

"WHEN do we eat?" How often this is asked. If you have eyer asked the question you know how dependent you are on the farmers—the men who invented that question.

Most of the large broadcasting stations are naturally located in the big cities and so are not in a territory which has much to do with farming. You know how the average city chap thinks about the folks back in the country—that they are worthy people and very necessary and all that, but that they are perhaps a trifle behind the times. This opinion is probably shared by some of the broadcasting heads and for that reason the number of stations catering to the farmers is comparatively small.

Satisfy Citizens of Soil

But let us tell you about one broadcaster who is devoting all his energy to satisfying these people of the soil. The station is located right near the heart of the rich agricultural section of our country—at Chicago. Such is the new WLS of the Sears-Roebuck Agricultural Foundation which replaces the old studio and old station, although the latter in the past held a place of high esteem in the minds of radio listeners throughout the country.

Mechanical perfection is not the monopoly of the new WLS, but the perfect combination of science and art found here is a fact so unusual that folks who have seen it in operation sit up nights talking about it. The interpretation of those vibrant, mysterious life currents flowing hither and yon upon the air is the decorative motif with which Alphonso Iannelli, interior decorator of world repute, endowed this most unique of all radio studios.

Magic Sounds on Walls

By unusual adaptation of color, that most eloquent mode of expression, he has produced sound waves on the walls and ceilings of the studios. The magic illusion of radio forms the compelling motif throughout.

From this scene in the New Hotel Sherman Annex, Chicago, WLS programs are relayed by specially made, leased telephone wires to the new station at Crete, Illinois, thirty miles away. Here the walls, fast moving lines traveling over the rugs, even the ribbed glass over the lights, all help to develop the idea of motion. And the organ grille, as well as the grille through which heat enters the room, produce a similar effect.

The result of Mr. Iannelli's radio inspiration is the most unique looking

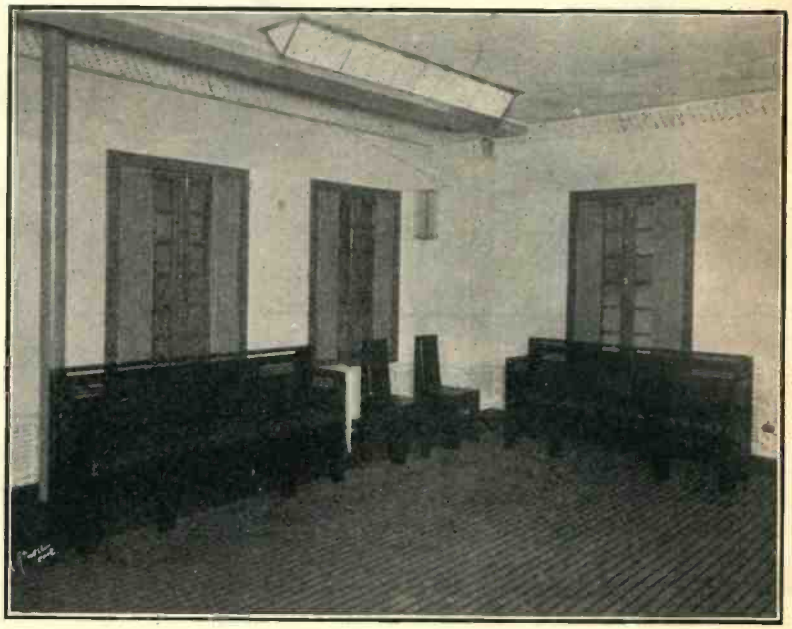

Fig. 1. In This Broadcasting Studio There Are no Wall Hangings. The Decorations all Imply Radio. Notice the Ribbed Glass Ware.

has been erected on a two and a half acre landscaped plot, one of the newest and most up-to-date super-power transmitting stations, which the radio wizards say is the last word in transmission.

Of the new studio, Fig 1, Mr. Iannelli has this to say:

Rubbed Glass for Motion

"The walls, the lighting fixtures, the furniture and even the rugs were designed to express the power, the speed, the majestic wonder of the radio. The blue and white wave motion painted on and ultra-modern studio in existence. It is safe to say that he need not give a credit line to any known school of art or aesthetics. Every detail is designed to suggest the speed, the intensity and the universality of the mysterious forces of the air.

Energy Captured by Brush

Black, red and silver is the color scheme employed. On entering the reception room ethereal energy and motion, captured by the painter's brush, greet the eye.

Representation of sound waves on the walls and ceilings give the visitor the impression that he has fallen suddenly into an Einstein dream. The lightning finger of radio speeding through the dark of night is expressed in the blackwood work touched with lines of silver and white. Even the red chenille carpeting has black lines, giving an intense direct effect, but creating a sort of instructive "interference" in the sensitive soul who attempts to cross the room at right angles.

Where Are Wall Hangings?

Walls are sound proof, of specially prepared and extra thick plaster. The wall hangings so customary in most radio studios are missing, rendered unnecessary by the sound proof walls. The window hangings are of a neutral casement, banded with Chinese red. Heavy ribbed glass in an inverted trough formation, give direct lighting and tend further to carry out the artist's impression of a room surcharged with radio activity.

The furnishings and even the broadcasting equipment are severely designed to be in harmony with the swift lines of the radio motif. Each of the several rooms has a different stencilled border, a dot-dash pattern of Morse code origin, flanks in unbroken waves, and similar designs. Not a curve can be found in the entire establishment.

Smallest Theater in World

Aside from the artistic ideas in this studio there are many points of general structure worthy of duplication. Twin rooms have been provided, the larger of which is used for broadcasting by orchestras, bands and dramatic productions; the smaller for soloists and small groups. Adjoining the larger studio, but separated from it by a plate glass window, is the "smallest theater" (Fig. 2) in the world. It will accommodate fifty persons, enabling them to watch the artists perform while listening to the program through a loud speaker.

Besides the broadcasting rooms and the little theatre, there are the general offices, the operating and the battery rooms, the chamber for the pipes of the famous Barton organ, Fig 3, and a reception room.

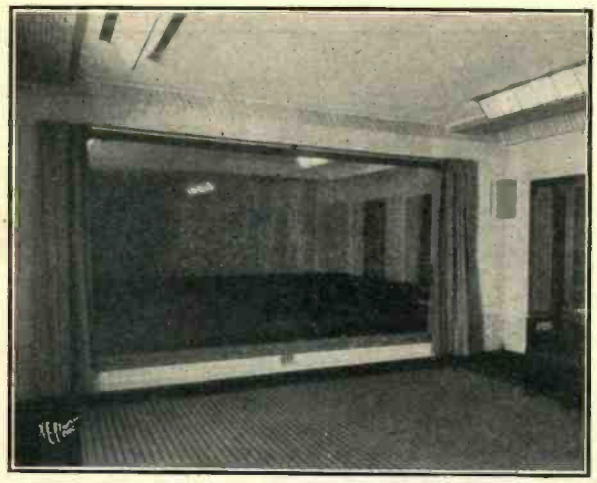

Fig. 2. The "Smallest Theater in the World," But Fully Equipped For Audience of Fifty

Mountain, Sea, City, Farm

WLS, with its daily market reports to farmers, its radio farm advisor, and its newly inaugurated Radio School of Agriculture, is known to the radio world as the "voice of the farm." Appropriately, therefore, this vestibule through which the visitor enters the studio chambers, has been dedicated to the serious purpose for which the station was founded. On the first wall, as you enter, is found the symbol of the Sower, "the virile man of the earth, sowing seeds;" on the second wall is pictured a typical American City; on a third is the sea, on the fourth, the mountains. Mountain, sea, city, farm: they represent the scene of human life.

Over telephone wires direct from Hotel Sherman the daily program goes to the Crete, Ill., station, where the sound is raised in volume, regulated and broadcast upon the world.

Here two huge self-support steel towers, each 200 feet high, have been erected, paralleling the Dixie Highway, to support the antenna. These towers are easily visible from the Indiana state line. An attractive brick building of unusual design houses the apparatus near one of the towers. Special high tension wires have been constructed to supply the station with necessary power.

Plowing 15 Miles of Wire

The two and a half acre plot is landscaped and beautified with hedges and creeping bent grass lawns. Drives and parking space for visitors are provided. Fifteen miles of wire were plowed under the lawn, very much as a farmer plants potatoes; this net work serves as the ground.

Utility and beauty have been combined in the building which is now completed. It contains an extra large operating room, an office, an attractive reception room for visitors, the generator and battery rooms, switch closets and an entrance hall. The most up-to-date construction has been employed throughout with extreme emphasis on furnishing perfect transmission. The metal lath, for example, is joined together to make a perfect circuit which will insure against interference in case it should ever become necessary to get down to lower frequencies. An elaborate hot water heating system has been installed to prevent freezing of the water in cooling tubes.

Broadcasting the Daily School

WLS retains its old wave length, 870 kilocycles, or 344.6 meters. The Army experimental call letters will be AZ3. A radio school of agriculture was lately established at this station. The sessions of the school start promptly at 6 o'clock and continue for one hour. Pupils have been enrolled from among the farm listeners to this short course in agriculture just as they are in a regular college or university, and their attendance via the air will be expected at the same hour every day except Saturday and Sunday.

The course in agriculture is divided into three branches as follows:

1—Practical Farming.
2—Practical Marketing.
3—Rural Life.

Noted agricultural college professors and other prominent and practical farm leaders prepare the daily lessons for the benefit of the farm radio audience. These lectures are broadcast every evening from Monday to Friday, inclusive, under the direction of the Foundation's agricultural experts in charge of each of the three divisions of the school.

Farm Adviser is Dean

E. B. Heaton, Farm Advisor of the Foundation, is Dean of the School of Agriculture and has direct charge of the course in practical farming. Fred L. Petty, WLS farm market expert, who fills the chair of agriculture, also supervises the course in practical marketing, and Mr. Guard directs the lectures on Rural Life. The registrar of the school, in charge of the enrollment of students, is E. J. Condon, secretary of the Foundation.

Pupils of the school are invited to send in discussions concerning their individual problems and ideas which they may have for the improvement of agriculture in any of its phases. A special period has been set aside each week for the broadcasting of these discussions. This is known as "Recitation Period."

Radio Lessons Are Printed

"It is the aim of this School of Agriculture," said Mr. Guard, "to give the farmers of the country a short course in agriculture which will be of value to them in practical production and marketing. We aim to teach methods for getting the maximum of profit from farm products. The best agricultural minds in America are reflected in these courses. The lessons as given over the radio are then printed and sent to every enrolled student of the school."

These sessions, held daily except Saturday and Sunday, will continue for a period of twelve weeks, closing Friday, April 2nd. The curriculum as outlined will include a series of 180 lectures, covering the most important phases of agriculture which will be of the greatest practical value to the farmer.

Fig. 3. This is the Organ Console. Observe the Lines in the Floor. They Are Supposed to Show the Speed and Straightness of the Waves.

Dainty Damsels Dance

However, you must not think that it is all lectures and no play. On the contrary, the folks on the prairie are just as anxious to have a good time as those who live on crowded city streets. They like to dance, too. Don't you remember that in the fairy story it is always the country girl who with her dainty dancing captivates the heart of the confirmed city night club man. The studio director knows this too, and serves an ample seasoning of music as a sauce for the plainer lectures.

Also in line with the idea of entertainment is the radio play contest closing February 1st. For the purpose of securing better radio programs, what is perhaps the first national radio play contest ever held was launched through the joint efforts of the Drama League of America and this station.

A Prize of $500

Judging from the number and excellence of the manuscripts received it will be some time before the judges are able to announce the lucky winners. To the victor in the contest (when he has been selected) will be given $500 in cash and a silver loving cup, in addition to winning national fame as the writer of the best radio play and the distinction of having assisted in producing better programs for the millions of the country's air audience. A second prize of $200 will be awarded to the runner-up and for the third best $100 will be given.

As soon as the committee of judges chosen by the Drama League have made their decisions, preparations will be immediately started to produce the prize-winning play, to be broadcast from WLS and many other stations of the country by a special company under the direction of the league. The rehearsals will be so timed that the nation's best radio play will be produced for the benefit of the air audience during National Drama Week, February 14 to 20.

New Kind of Writing

In announcing the plans of the contest Mr. Junkin declared that radio play production would present a new art, requiring a new kind of presentation of

Continued on Next Page

How Busy Are Broadcasters?

Report of Hours, Artists, Studio Time and SOS Calls

PERHAPS you may wonder how many hours a day a sending station is usually on the air. Here are a few figures from one of the stations which, owing to its relaying, is very popular throughout the East—WEAF of New York.

It has just been reported that this station has been on the air approximately 245 hours each month, or an average of slightly in excess of eight hours each day. During one month's time last year, 454 features consisting of either individuals or groups appeared before the microphone in the studio at 195 Broadway. Of this average of 454 numbers, almost 300 were classed as "regulars," that is program features which are heard each week at a definite time, with the remaining 157 "occasional" program features. Of the 297 regular features, 85 were of the "Good Will Publicity" type sponsored by some national advertiser or manufacturer engaging the facilities and the remaining 212 were termed "sustaining program" type, Fig. 1.

Over One Thousand Artists

In a recent estimate of artists appearing before WEAF's microphone, it was found that on an average 1015 individual artists entertained WEAF's invisible audience from the 195 Broadway studios alone.

During the period from January 1 to November 30, inclusive, WEAF was on the air almost 2,800 hours; the Plant Department, or technical delays caused by unavoidable equipment trouble in this time totalling slightly in excess of five hours, (Fig. 2); the studio delays or time lost between program presentations, 12 hours. It is not reported, but doubtless a large part of this was caused by performers not showing up at the time they promised. If it were not for the home talent in every station and the versatile announcers, this item would be considerably larger.

Seventeen Hours of SOS

Another point of interest is that the station was off the air for 17 hours during this period because of SOS distress calls from ships at sea. Maybe you did not realize that all the big stations within striking distance of the coast maintain a man on duty all the time during broadcasting to listen for such signals, and at the first sound of trouble, off goes the entertainment program.

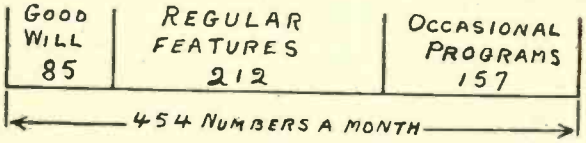

Fig. 1. The Division of Time is Illustrated Here for One Month's Broadcasting

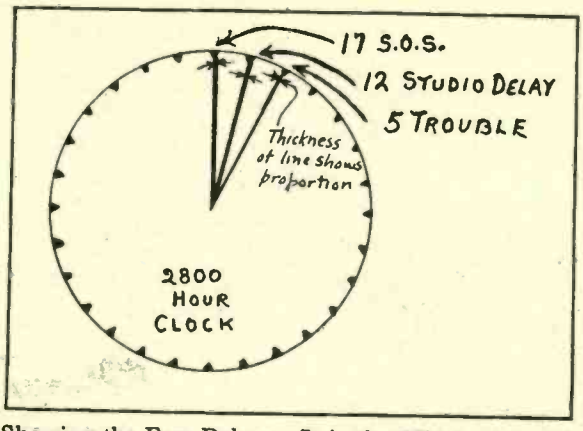

Fig. 2. Showing the Few Delays. It is the Width of the Black Line Which Counts.

RADIO SERVES YOU

Continued from Previous Page

the drama and a new art of writing it.

"Radio will not allow any sly stage business," said Mr. Junkin. "Glances, asides and business with props cannot be put over, to the radio audience. Entrances and exits must in some way be told in the action of the play. Just as the movies brought about the new drama and a new way of presenting it, so will radio. Sounds will be the principal vehicle. Bells of all sorts, church, dinner, telephone, house and others can be used to advantage. Rain, storms, musical backgrounds, horses, airplanes, automobiles, all have sounds which can be duplicated and will lend life to the words and action of the radio play."

Rules for the Prizes

Some of the rules which guided the contestants in writing their radio plays are as follows:

Any play submitted must be original and not have been printed.

Original one-act plays, eighteen to twenty-five minutes in length.

Few characters—maximum, five principals.

Accompany action with appropriate sounds.

Farce, comedy, drama, melodrama, tragedy and mystery plays.

Plays must be clean, wholesome material.

Write plays as though they were to be produced for the blind.

Radio Movies Up to Date

Seeing by Radio is Apparently Coming Nearer and Nearer

An Interview by C. FRANCIS JENKINS, Washington, D. C.

"OH, SEE how sharp the alligator's teeth are." This exclamation does not mean that the speaker is down in the tropics or even that he is inspecting the live stock on his newly bought Florida building lot.

No, it is the remark of a person who, within perhaps a short time, will be found tuning in on the waves of a "See-station," which is showing all its followers how life looks in the tropics. Indeed it may not be so long until regular stations may dot the map with programs appealing to the eye as well as the ear.

See Everything But Reason

That radio fans may see the next Olympic games, as well as hear the cheering, is the prediction of Mr. C. Francis Jenkins, Fig. 1. He also promises that the stay-at-homes may observe presidential inaugural ceremonies from their own fireside; see a distant football, polo or baseball game as it is happening; a regatta, mardi gras, flower festival or baby parade, while these things are actually happening.

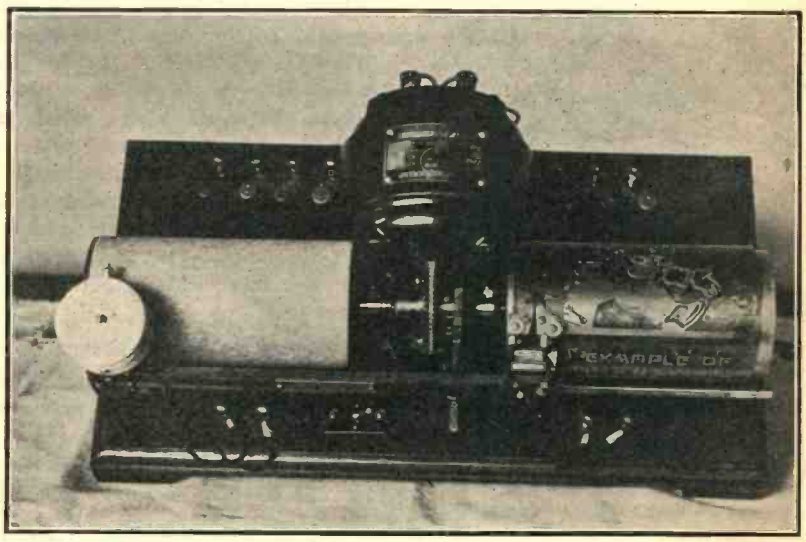

Fig. 2. A Sending and Receiving Device Which Transmits Pictures and Writing Very Rapidly

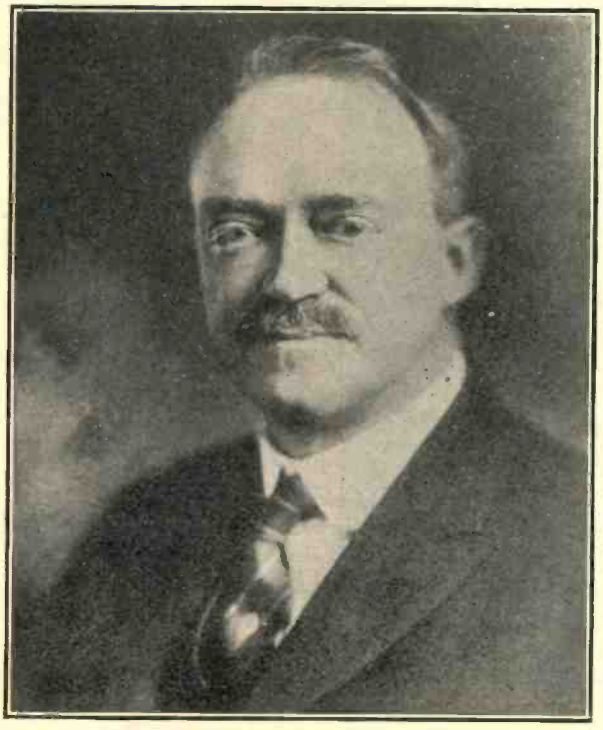

Fig. 1. The Inventor of This System, C. Francis Jenkins, of Washington

More essentially applied, the extension work of the great universities can be more vividly and more retentively brought to the distant farm boy and girl by radio than in any other manner, for the teacher can illustrate his audible instruction to the student in the most inaccessible place.

In military work the chiefs of Army and Navy may see at headquarters all that a lens looks upon as it is carried aloft in a scouting airplane.

A Question of Speed

Indeed, *still* pictures are already excellently done both by radio and by wire, and that as the speed of the apparatus is the only difference between stills and movies, the public may confidently expect radio movies soon. It is now a daily laboratory demonstration.

Sending pictures through the air riding on an invisible radio wave seems very spectacular and mysterious; but

it really is very simple in principle and accomplished in the main with every day apparatus. There lacked only one new device which had to be invented because nothing like it could be found in science and engineering; this is the prismatic ring, a new contribution to optical science.

A Pencil and a Penny

By means of this prism a tiny point

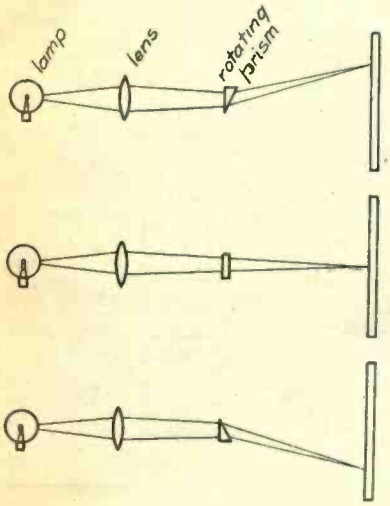

Fig. 3. The Rotating Prism Changes Its Shape as Shown, and so Shifts to Light

of light is made to travel across a photographic plate in a succession of parallel adjacent lines, the strength of the light constantly changing by reason of the varying strength of the incoming radio signals. The process is very much like that with which our mothers used to entertain the youngsters when she laid a piece of white paper over a penny and rubbing over it with a dull pencil made a picture of the Indian appear.

To get an idea of how the scheme works, let us start one of the more easily understood features of the process. Fig. 2 shows a simple machine which can be used either to send or to receive drawings, maps, photographs and the like. In this case a zinc cut or etching is made of the picture to be transmitted. Such a cut can be directly engraved on the zinc plate or by photographing the illustration on the plate and then immersing it in acid, a raised image is made such as appears on the right hand cylinder of Fig. 2.

Fingers All But Touch

If you look carefully you will see here a cartoon of a man with his left hand extended. The figure including the hand stands out about 1/32 of an inch higher than the background. Of course this curved plate must be prepared beforehand. At the left hand front corner of this cylinder, notice two binding posts with fingers projecting to the rear. These two fingers carry contacts at their tips, which are spaced just as close together as possible without actually touching.

When the cylinder with the zinc plate figure on it is rotated underneath these contacts, the metal where raised will bridge the two fingers and allow an electric current to pass. An instant later when part of the background reaches the fingers, the cut away metal no longer allows the flow of electricity from one finger to another and so the current is interrupted.

Screw for Feeding Fingers

As this drum continues to rotate, the pair of fingers is fed along it by a screw just in the same manner as the feed of an old style cylinder phonograph record. From this you will see that there are a series of dots and dashes separated by periods of silence exactly corresponding to the raised parts of the picture to be transmitted.

The receiving end of the device appears in the left hand end of our figure. Here is an exactly similar cylinder and feed motion which is timed just like the sending end. However, instead of a zinc plate we have a piece of white paper. A fountain pen with special ink reservoir takes the place of the two contacts. This pen is operated by a little magnet in such a way that when the current flows through the winding, the nib touches the paper and an ink line results.

Cut with Close Lines

By hooking up the transmitter and receiver it is easy to understand that wherever there is a raised part of the original cut, there will be a line of black produced at the receiver. By having the thread of the screw which advances both contacts and fountain pen made of small pitch, the various lines composing the reproduced cut may be made as close together as you wish. Such a close spacing gives a good appearance to the finished figure.

You may wonder why there are *two* contacts close together at the sending end. Could not the zinc cylinder be used as one contact and so save the need of one of the pair which is shown As a matter of fact, such an arrangement will work just as well as the one described when using a zinc plate. However, a further development of the process allows you to send without going to the expense of making an etched zinc plate. A line drawing on paper using special carbon ink which is conducting will work just as well. But in such a case notice the paper on which the draw-

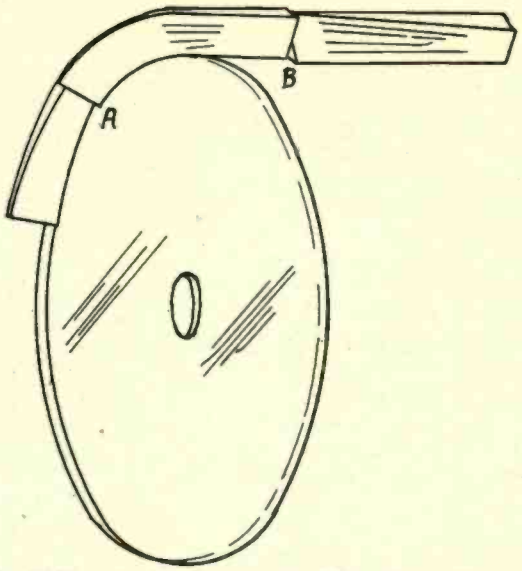

Fig. 4. If You Could Unwrap the Rim of the Glass Dish It Would Look Something Like This

ing is made, unlike the zinc is an insulator. That is why two contacts must be used which will be bridged by the conducting material.

A Funny Face in Mirror

The next step is to use longer wires between the sending and the receiving end. These in Fig. 2 are only a few

Fig. 5. The Character of the Pictures as Received Appears Here

inches long. But why could they not be several feet or even several miles long? There is only one difficulty and that is that the sending and receiving drums must keep exactly in step. If this is not done, the finished picture would be smeared out or distorted to look like your reflection in one of those funny Coney Island curved mirrors.

There are two methods of keeping the sending and receiving cylinders rotating together which work well in practice. One of these is by means of driving motors whose speeds are regulated by tuning forks. When a violinist wants to get an exact pitch for adjusting the strings of his instrument, you know he often uses a tuning fork as it holds its speed of vibration constant from year to year. By using two forks which give the same note and hooking them up through a series of relays, it is possible to govern the motor speeds at both ends of such a picture transmitting system and thus keep them alike.

Clock Without Balance Wheel

Such a method must be used where the source of supply is direct current (DC). However, most cities in the United States have the usual service on alternating current (AC), and this usually has the frequency of 60 cycles or alternations per second. Many motors (called the Synchronous motors) are made so that they keep exact step with the alternating supply. By using this style, one at each end, it is possible to keep the two rotating drums right together for hours at a time. Indeed, the timing is so accurate that on many of the larger systems special Synchronous driven clocks are used which run from the central station power lines and have no inside mechanism (like a pendulum or balance wheel) at all.

The next step towards radio movies came in eliminating the contacts and special sending cylinder of Fig. 2 as being too slow and clumsy. We can't afford to take time for mechanical methods, but must use light itself to transmit our results. This method of the rotating cylinder and advancing screw also is too dilatory for us. How can it be improved on? Here is where the special invention of the prismatic rings come in.

Light Slow in Glass

Way back in our high school days we learned from the physics class that a wedge shaped piece of glass would bend light rays. The general idea is that a beam cannot travel through glass nearly as fast as through air, and so the edge of a ray which travels through the thick part of the wedge is retarded more than the edge crossing the thin part. This bends the ray round towards the thick side of the glass.

Suppose then that we wished to make a spotlight travel back and forth in a straight line. Fig. 3 shows a light bulb whose rays are concentrated by an ordinary magnifying glass upon a glass prism. In the upper view the thick edge of the prism is up and this deflects the beam of light in an upward direction as illustrated. When the glass has parallel sides (center picture), the pencil of light goes straight through and strikes the screen without any bending. Below is seen the case where the spot is dropped on the screen using a prism with the thick edge down.

No India Rubber Glass

All we need, to get a uniform travel of the light in the line back and forth is to use a glass prism made of India rubber which can be stretched back and forth. Unfortunately there is no such animal and we must use some other method. The rotating prism disc is the answer. It is hard to convey this idea

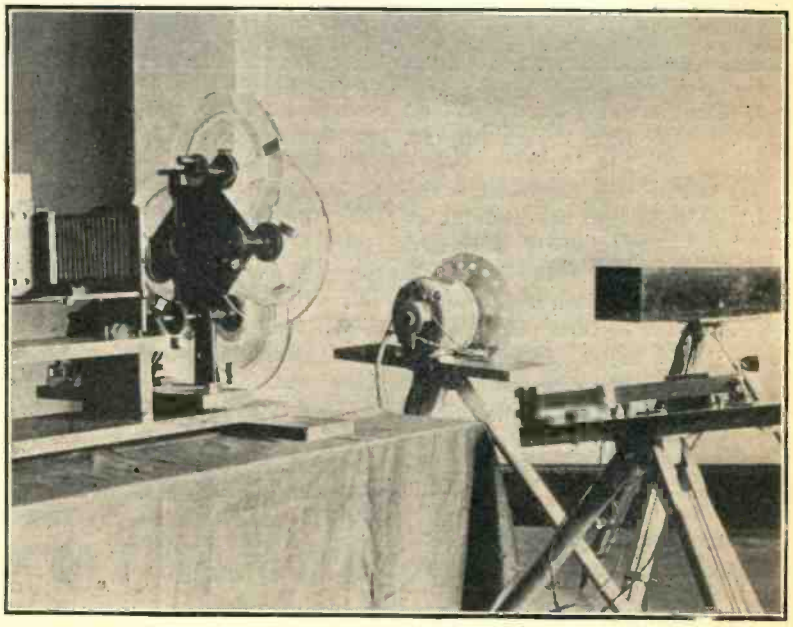

Fig. 6. When You Want to Transmit a Picture You Use This Layout. The Four Rotating Prism Rings Are Shown at the Left.

in a complete sketch so Fig. 4 may give a better understanding. A glass disc is shown but the rim is unwrapped a bit so as to indicate how the wedge is built. Of course in practice it could not possibly be unwrapped, since the entire wheel is a single piece of solid glass ground to proper shape.

Looking again at Fig. 4, notice that both outer and inner edge of the wedge shape rim change in thickness, but while one increases, the other diminishes. Looking through this rim as you look through an ordinary window pane, you will find that at one part the outside edge was thicker than the inside, which would bend light rays *out* while at another part conditions would be reversed causing the beam to bend *in*. In the sketch we have shown the crystal coming to a point at two or three places, merely to make it easy to see. In actual practice it takes one complete revolution of the ring to make a change from thick to thin. Then with sharp walls it jumps instantly back again to the original condition.

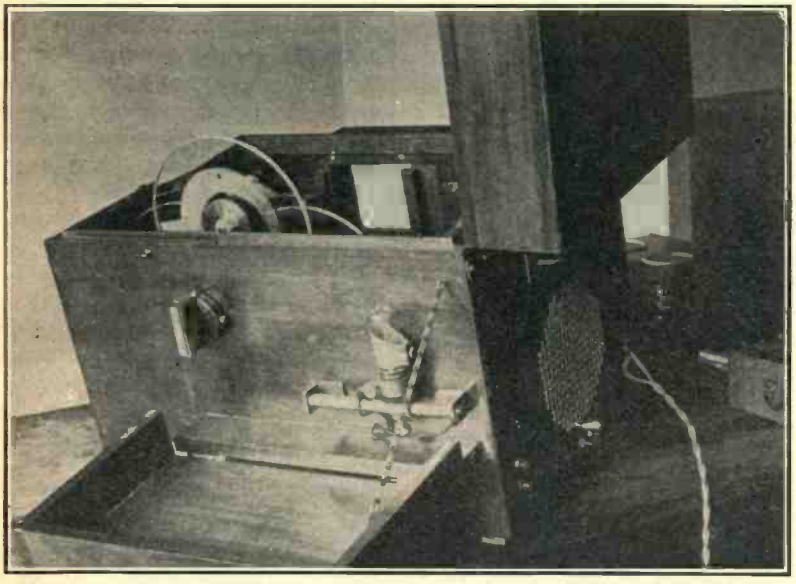

Fig. 7. The Receiving Part Also Uses Four Prism Rings and a Special Lamp Bulb Which Appears Just Behing the Chain

Cheap Pair of Opera Glasses

By rotating such a ring in a path of a beam of light, we get the effect of the changeable crystal shown in Fig. 3. The light rays slowly sweep down across the screen as the prism ring is turned and then suddenly snap up again when the edge of the wedge comes into the light. However, using a single wheel like this causes some distortion, something like the coloring which you see around the edges of the view seen through a cheap pair of opera glasses. By using two such wheels, one above the other, the distortion from one is cured by the other and the result is a clear cut pencil of light which travels slowly and steadily down the screen and in an instant snaps up again to repeat its motion.

We say "travel *slowly*." Of course by speeding up the rotation we can make the pencil of light move as fast as we like. By increasing the rate of rotation to a high enough figure we can make the path of light look like a straight line without any motion just as in a movie the scenery around the actors looks absolutely steady, although we know that it is composed of thousands of small photographs.

Perhaps you do not realize that almost all illustrations which you see in magazines and newspapers these days are actually made up of either broken lines or fine dots. Of course there are some cuts made up of solid lines like Figs. 3 and 4 in this article. The rest of them, however, are called "half-tones," and consist of thousands of tiny dots which can be observed only by close examination.

Coarser Than the Newspapers

It has been found that by the method of transmitting pictures just described good results are obtained with fifty lines per inch. This is slightly coarser than newspaper cuts which have a standard of 60 lines per inch. Our photographs, Figs. 1 and 2 have 120 dots per inch. When it comes to reproducing one of these cuts by a printing press, it is hard to give an exact idea.

For instance, Fig. 5 shows a portrait which has been sent by Jenkin's method. Originally the lines ran horizontally and were spaced 50 to the inch. In making a photo engraving of the portrait, you will see that it does not look very different from Fig. 1, which was made from an ordinary photographic print. However, the original picture of Fig. 5 was not quite as good as that of Fig. 1, since the latter suffered more in printing in this magazine. But you can readily see that a reproduction like that of this girl (who happens to be Mr. Jenkin's secretary) is quite satisfactory and shows how far these devices have been developed.

Lenses Like Screw Thread

Now let us take a look at the actual sending apparatus used for broadcasting a picture. In Fig. 6 there appears at the left a battery of four rotating prism discs. Two of them are employed (one to correct the other) to give the shifting of the line of light so that it works like a pencil traveling across the picture. The other two are just like the first except that they give the spacing of one-fiftieth of an inch between lines. To obtain this motion, they are geared down in the proper ratio so that every time the spot of light moves back and forth once, it advances crosswise 1/50th of an inch. You see this corresponds to the screw thread which moves the pair of contacts in our old friend, Fig. 2.

A little way in front of the rotating rings of Fig. 6 you will see a motor driving a wheel with a series of round holes near the edge. This acts as a shutter to allow the light to pass at the proper time and then cut it off while the pencil of rays is being jerked back again. Of course this motion must keep exact step with the one on the left, but this is accomplished by driving them both

from the same supply of alternating current.

Winking at the Right Time

The light rays next enter the long black box at the right. This contains a photo electric cell such as was described a month ago in this magazine. When light falls on such a tube it passes a current of electricity but in darkness the current is suppressed. The electric eye might then be said to wink in time to the rotating discs.

We now have a series of electric impulses coming from the output of the tube which correspond exactly to the tones of light and shade of the original picture being broadcast. These electric waves are impressed on the microphone circuit of a broadcasting station and go out into the air in the usual way. Of course the microphone of the studio itself is omitted, but its place in the circuit is supplied by the apparatus just described.

A Chinese Peace Conference

"If such a picture is broadcast, how does it sound?" you may reasonably ask. It may be described as a peace conference in Chinese disturbed by static. But here is an interesting point. During a test in the Jenkins' Laboratory, several photographs were to be transmitted by way of test before a committee of experts. Of course, the laboratory assistants practiced on these pictures over and over again the day before the demonstration. They found that by listening in they could get some idea of whether the currents were strong enough for good results.

On the day of the test one of the photographs was picked out at random in another room for transmitting. "I wonder what picture this is going to be," said the engineer. And immediately the laboratory assistant replied, "It sounds like cut No. 15." And sure enough it was—he had heard this particular combination of noises often enough the day before so that he was able to recognize it. But naturally no one hearing such a jumble for the first time could possible have the faintest idea what sort of illustration was coming through.

Rays Are Brightened Up

Now we get to the receiving end of the new device. Fig. 7 shows what it looks like. Our customary four rotating prisms can just be seen over the edge of the box. They are needed to redistribute the spot of light in the same way it was originally done. The current impulses coming in from the receiving aerial are translated by a lamp just outside the near edge of the box (center of picture) into beams of light which are alternately brighter and darker. When the rays at the sending end strike a light portion of the original picture at the same instant the rays in the receiving set are brightened up and so reproduce the same intensity of light.

While a lamp as just described will work well in slow speed copying by the above method, it will not do at all when we increase the velocity of the light spot. The trouble is that the filament in the bulb cannot change its temperature fast enough to keep up with the procession. Some other method of regulating light must be found. The answer was discovered in a gas tube lamp.

Glows After Shutting Off

Of course you have seen in photographers windows and other places the long greenish glow of a mercury arc lamp. Such a light works on account of the illumination given off by the glowing gas. In the case of an ordinary incandescent light the filament although very tiny still requires considerable time when measured in millionths of a second before it gets hot enough to give out much light, and in the same way when the current is shut off, the rays continue to emerge from the filament for a small fraction of a second after the current ceases to flow.

With the gas lamp, however, there is this big difference. Instead of the current making heat which makes light, we have the current giving out light itself without the need of any material to get hot. For this reason the light exists only with the current. It does not persist even for 1/1,000,000 of a second after the current stops. Such a bulb would be very suitable for this use except that it does not start easily and is too long.

Spells Out a Word

Another type of gas tube which uses the rare gas helium is much better for the purpose. It gives out an orange glow and is often used in advertising novelties in a store window. Perhaps you have seen a glass tube bent into the form of letters spelling out the word "RADIO" which in the evening glows with a bright light. Such a tube may be used for printing a picture on a sensitive photographic film. As the light goes up and down depending on the strength of the radio waves from the sending end, the rotating prisms distribute the rays to the proper place on the film.

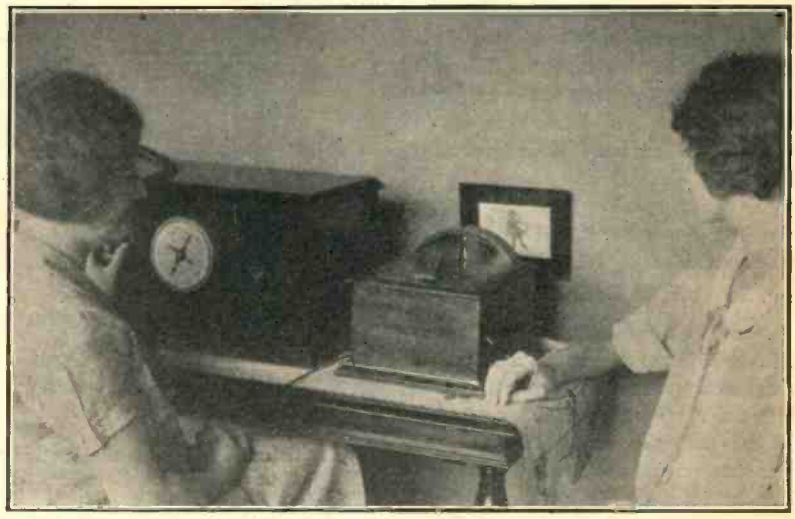

Fig. 8. Here is a Movie Actually Being Received. The Dancing Girl on the Small Screen is Alive.

We now have all the elements necessary for having a radio movie except one —speed. In order to accomplish satisfactory results and make a continuous motion picture which will not show roughness of movement or flickering, it is thought that about 25 lines to the inch will be needed. Such a picture in

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How to Clean Your Radio

Of Interest to Housewife and Also to Radio Fan

By STUART STANDIFORD

THERE is a good deal of difference in the cleansing process between "cleaning up a fortune" and "sweeping the room with a glance." There is almost as much difference in the methods of various fans in getting the dust and dirt out of their radio equipment.

But maybe you do not think that your receiving set needs to be given any attention in this matter. There it sits on your living room table and perhaps the women folk have been cowed into letting it severely alone on their dusting trips through the room. To be sure the loud speaker has got rather hoarse, but you never lay it to the fact that the radio needs attention.

Recruits to Radio Ranks

However, the radio set like all other machines, requires a certain amount of cleaning every season, in order to bring in broadcast programs clearly and give the least amount of trouble to its owner. As there are many amateurs constantly joining the ranks of radio fans, the following pointers on taking care of a radio receiver will probably be of interest and, if followed, will enable you to obtain the utmost enjoyment from it.

Dust, corroded wire joints in a set or out of it and also soot on the antenna, all cause the incoming signal to be weakened in its volume or perhaps fail in being received at all. It is characteristic of electricity that it will take an easy short-cut to the ground rather than go through all instruments. The regular rule for the division of current in two paths is quite simple. If the resistance of the main road is 1 ohm and that of a detour is 9, then of the total of 10, one has 1/10 of the resistance and the other 9/10ths. The current will then divide so that 9/10 goes along the easy path (1 ohm) and 1/10 along the detour (9 ohms).

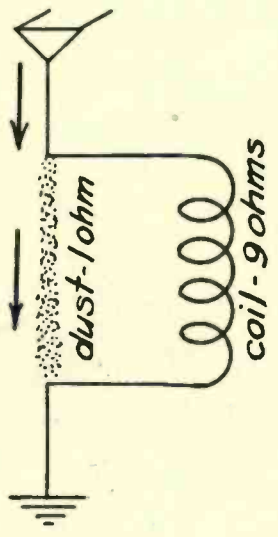

Fig. 1. If Tuning Coil and Dust Have Resistance as Shown, Set Gets Only Ten Per Cent.

Detours Don't Delight Current

But suppose now that the main road is rather winding like a coil and that we cut a new roadway which is straight and easy and has considerably less resistance than the route we want to be followed. The same law will apply and the bulk of the current will then be lost in the short circuit of dust (Fig. 1) while only a small part threads through the coil and is useful. In using direct current like the "A" battery, it is the resistance only that counts. But for high frequency alternating current like radio there is another item called the inductance or electrical weight in ohms of the resistance and inductance which must be counted. However, the same idea holds.

Would you mind much if you spilled a pint of water? It all depends on how much there was to start with. If the container was a quart bottle, then half of it would be gone. But if it were a watering cart, a pint would never be

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RADIO MOVIES UP-TO-DATE

Continued from Previous Page

still life would be very coarse and crude used for printing a picture on a sensitive photographic film. As the light goes up as it has been found as noted above, that a minimum of 60 is required even for newspaper work. But moving pictures are different from stationary ones and the coarser spacing does not hurt the results very much when the characters are in motion.

Smooth as in a Palace

At the present time, Mr. Jenkins has developed his apparatus far enough so that it gives nearly half the desired spacing. This in itself is a wonderful achievement and gives movies that really move, although not as smoothly as is hoped for later on. It looks now as if by developing photo electric cells that are a little faster than the best now obtained and by gearing up the whole mechanism, it is well within the bounds of reason that we shall shortly have movies which show as great smoothness as those shown in a movie palace.

Fig. 8 gives an illustration of the way such a device now looks. Of course any radio set tuned to the particular wave frequency sent out will pick up the radiation. In this case a superheterodyne is the radio employed. The little box at the right contains the rotating prisms and the vacuum bulb for varying the light. The picture appears on a small white screen just behind the prisms.

On the whole it may be said that while radio movies have not yet become a commercial possibility, still they look a lot more promising than radio itself did a few years ago.

HOW TO CLEAN RADIO

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missed. So a tiny current lost from a power house is completely overlooked, but when you have almost zero current brought in by the aerial, if you loose a tiny amount of electricity, you have none left.

Attractions for the Amps

So owing to the extremely low voltage and high frequency of a broadcast current, it is necessary that connecting wires have perfect joints, and also that all dust be kept away from parts to the utmost possible extent, as such dust allows moisture to collect on the wires and other apparatus, thus forming an attractive path for the current to get to the ground instead of going through the various instruments

Many novices do not seem to realize the importance of the above facts; in order that the broadcast waves from a distant station should be heard to their loudest possible extent, it is necessary that a set work at its greatest efficiency Of course the more sensitive any outfit is, the better it will perform in DX (long distance) reception which is so much desired by radio fans nowadays.

Greatest Difficulty Now

Owing to the lower efficiency in our outfits as contrasted to what they may be in years to come, we have to take advantage of every little thing to obtain selectivity, clearness of programs and loudness of signals; these should be combined with ease of operation. The great difficulty in all sets of whatever construction, at the present time, exists in the small amount of electrical power which is picked up by the antenna. On this account we must construct and keep all parts such as coils, condensers, transformers and wire joints in good condition so that they will have the lowest possible resistance that can be obtained. The insulation should be as perfect as we can make it so as to prevent energy losses, dust interfering largely with good operation of a set.

When it is remembered that this tiny amount of current from a distant station, after going through the proper instruments, finally emerges in such volume as to be heard all over a large room, it will readily be seen that a receiver has to be in good condition to produce such a result.

Makes That Scratching Noise

Many radio sets are laid away and not used by their owners during the four summer months, owing to there being so much "static" in the air. When brought out for use, all parts are found to be covered with dust, to a greater or less extent. The radio amateur who is comparatively new to the game, wipes off the outside and lets it go at that. Then he tunes in his favorite stations and finds out that his set behaves in a different manner contrasted with when it was used last. Indistinct speeches, programs coming in an uneven manner, scratching noises and perhaps different dial settings, all combine to take the pleasure out of radio entertainment. Should his outfit happen to be bought from a manufacturer, the blame is placed upon the latter for marketing inferior apparatus, when as a matter of fact, it is entirely his own fault.

If you have an electric vacuum cleaner in your home, with its extra attachments, you can use some of the latter to advantage in removing dust from a set's interior. Disconnect all batteries so as to avoid short-circuits with the metal parts of the vacuum cleaner, also remove tubes so as to make cleaning easier; then use the appliance carefully, Fig. 2.

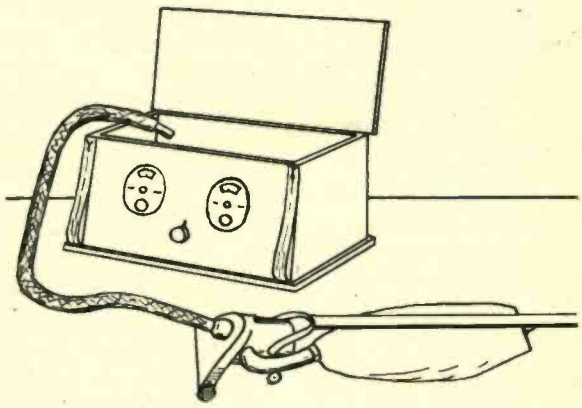


Fig. 2. If Your Wife Will Lend the Old Family Vacuum, This is the Quickest Way to Clean the Radio

Let Them Man the Pump

Those not having electricity in their homes can use an automobile or bicycle tire pump, Fig. 3, fitted with a long piece of rubber tubing, to blow the dust out from between the leaves of rotary condensers and other parts of a receiver. Get a member of the family or a friend to operate the pump. Pipe cleaners, which can be bought cheaply in any cigar store, are excellent for removing dirt from between the leaves of a condenser, Fig. 4, and from other hard-to-get-at places in your outfit, if you do not happen to possess a bicycle or motor car.

Dust on tube sockets, baseboard and panel may cut down volume and range to such an extent that a 1,200 mile station will not be heard, while the volume of a 100-mile one will be weak.

Watch the Flux Drippings

After the dust is removed from all instruments in the cabinet, examine all wire connections to see if any have become unsoldered. If so, use a rosin-core solder, taking care not to get any metal or flux drippings on other parts to cause a short circuit. Supposing that everything is all right in your set, next examine the ground connection. If it is found to be loose, it must be attended to.

Most people use a ground clamp for fastening the wire to the pipe. This has the advantage of being easy to install. However, as it is usually down on the floor of the cellar, it is in a very damp spot, and so is likely to become impaired through corrosion. If you are using such a ground clamp, it is well at least once a year to remove it and sandpaper the water pipe well before replacing.

When the Pipe is Full

Even this method is not as good and sure as to solder the wire directly to the pipe. The reason this is not done more often is because it is a difficult

matter to solder to a pipe containing water since the heat is conducted away too fast. It does no good to turn off the water unless the pipe is empty. This takes time and is a bother. If you have a very hot soldering iron, it is possible to solder a wire to a clean pipe even with the water inside. It takes considerable skill, however.

Next inspect the aerial. The insulators and its wires will be found coated with dirt and soot, and in places with a film of corrosion. Since a high frequency current travels almost entirely on the

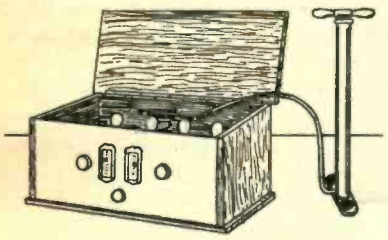


Fig. 3. Lacking an Electric Cleaner, a Foot Pump Will Give Good Service

surface, this film of dirt and soot reduces the efficiency of an antenna. On this account, clean your aerial whenever it needs it. Those who do not like to bother cleaning aerials will find that the use of a cable composed of a number of enameled wires will give excellent service without any cleaning. The enamel on each wire in a cable serves as a spacer and permits the radio waves to reach the various wires alike from all sides. It also prevents corrosion and so preserves a thin layer of metal free from dirt, next to the surface, for the electric current to travel upon.

When Your Battery is Idle

Storage batteries should be taken to a battery service station once a year, and have all sediment washed out from the cells, new solution added, and the terminals and tops cleaned thoroughly from all dirt. This prevents short-circuits or a leakage of electricity even when the battery is idle, which causes a battery gradually to lose its charge. Storage "A" batteries are in extensive use for radio work, being far superior in many ways to dry batteries. Some people think it will only be a question of time before wet "B" batteries will replace dry ones.

This superiority is due to the fact that on discharge the voltage holds pretty constant with the storage battery, but not with the dry cell. The curve of Fig. 5 displays this characteristic. At the bottom are the figures showing the ampere hours which is a measure of the output from the device. The height up and down gives the pressure of the cells in volts after the output as shown has been used.

Almost Every Evening

Observe that the storage battery starts slightly above 6 volts and drops off pretty fast to just 6 volts. Then it holds this value practically constant up to about 90 ampere hours. From there the fall is quite rapid. However, there is a long stretch of more than 80 ampere hours when the potential varies only a small percentage. The dry cell, on the other hand, starts new at 1½ and falls

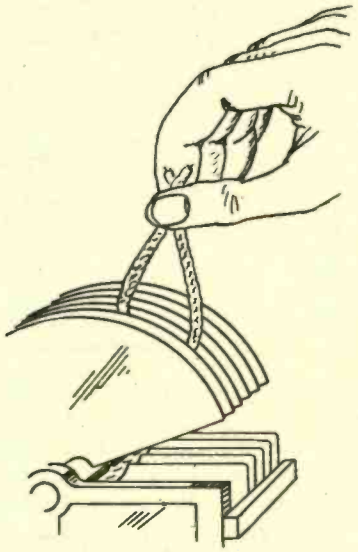


Fig. 4. A Pipe Cleaner Will Track the Lurking Dust to its Lair in the Condenser Plates.

off pretty uniformly until at around 18 ampere hours it must be discarded. That is why the rheostats of a 199 or WD-12 tube set must be adjusted almost every evening, while a storage battery set using 201A tubes will work well perhaps for weeks, without shifting the rheostat.

There are three kinds of storage battery jars on the market. Some are made of glass and others of hard rubber, while a new kind does not use individual jars at all, but the case is built of molded material (usually called rubber, although containing other ingredients too) molded into three separate compartments, all in one piece. The latter type while superior is apt to cost more. Should your glass jars get cracked, paint the crack over with asphaltum varnish or automobile tire patching cement, and the acid solution will not work through. Wooden battery boxes ought to have a coat of asphaltum varnish put on the outside once every year. The hard rubber cells are the commonest containers for holding battery elements. It sometimes happens that a rubber jar gets cracked, and so is rendered useless and has to be thrown away.

A Record for Breaks

The writer has found out that such a course is not necessary, as a repair job can be done that will be found satisfactory. Proceed as follows: Take a three-cornered file and file the crack to a V-shape, having the large opening face towards the inside of the jar. Next, get an old-style Edison wax cylinder phonograph record and cut a stick lengthwise out of it. Take your hot soldering iron, place box on its side, and holding the wax against the crack, run it into the fracture. The hot iron operates nicely, allowing neat work to be done. Upon cooling the break is repaired.

Should one of these old-style records be unobtainable, a filling mixture can be made by melting together 50 per cent. paraffine wax, 25 per cent. beeswax, 20 per cent. rosin and 5 per cent. of sulphur. Stir while it is melting so as to have all ingredients well mixed. The above composition gives good insulating and sealing results and withstands acids.

Make the Crack Bigger

If a person does not care to mix up the formula outlined and wants to use something simpler, some of the automobile tire cement used for patches, as well as a rubber dough which comes in small cans and is used for tire cuts, will be found to do pretty well. It is best in all cases to widen the crack on one side so as to get a lot of cement in; as it holds better while the battery is in use. Fig. 6 shows a cracked storage battery rubber jar, with the crack filed out ready to receive the filling composition. It is a top view of the container.

Dry "B" bateries should be tested for voltage, if they have been used several months, as most likely, they will be found to be in bad condition. To obtain

a true reading on your voltmeter, they should be tested after being in use two or three hours. An old 45-volt battery may register 35 or less volts. If much less, discard it. If 35 volts is indicated, use for several evenings and test after using. Its registration should be 35 volts or above it.

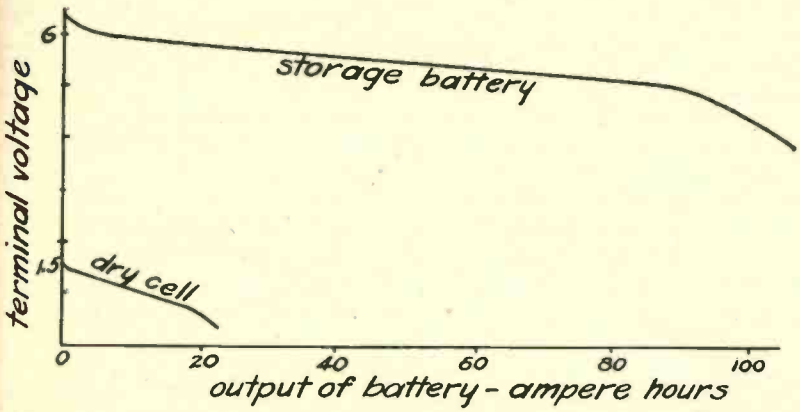


Fig. 5. Curves of Voltage Show Why Storage Battery Needs Little Rheostat Adjustments

Are Often Disappointed

Tubes of the 199 or 201A varieties which have had 1200 or more hours of use, may need balancing and reactivating. If you do not own a rejuvenating device, take the tube to a dealer who will do this work for you. However, many people are disappointed in their tubes after such treatment, as it does not always do much good. It depends entirely on the condition of the filament in the individual tube. The only way to tell whether it will help or not it to try it.

Examine your rheostats and potentiometers carefully and see that the contact arm presses firmly on the wire coils. If there is any looseness here vibration is apt to cause a slight chattering which will be used as an excuse for "static" by the radio set.

Shake it Out the Window

For cleaning the rest of the set use a dry soft cloth (cheesecloth is excellent) to wipe off the parts, shaking the rag frequently out of a window to remove all dust. Use light pressure and a slow moving cloth—to avoid frictional electricity, as the latter will cause the dust to cling persistently on the panel, etc. Should the springs in the tube sockets have the least amount of corroded surface, scrape them bright with a knife blade or a screw driver, and bend them up slightly to make sure of a good contact with the tube pins.

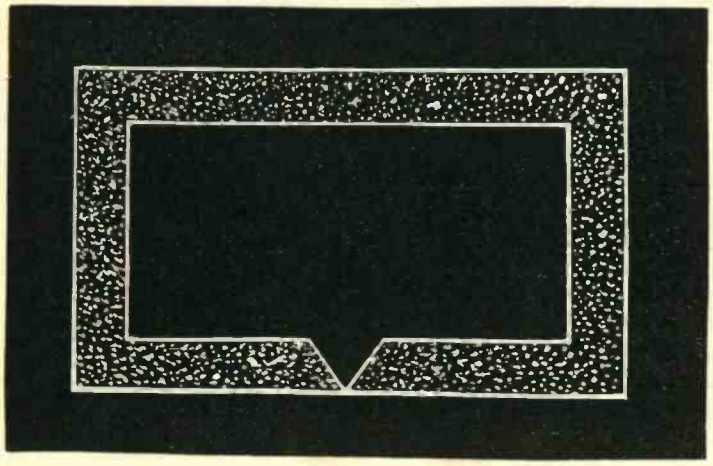


Fig. 6. A Cracked Battery Jar Should Have Groove Cut as Shown and Then Cemented as Described.

Fixed condensers ought to be cleaned carefully, as a little dust on their terminal connections results in a loss of current. Dust on panels, tube socket bases, baseboard and jacks is responsible for most of the leakage of broadcast current that pulls down DX volume and range.

By cleaning your radio outfit carefully as described, whenever it needs it, you will obtain the utmost enjoyment, as programs will come in good and strong, provided of course that all the other instruments in the set are in fine condition. Whatever you do, don't blame the manufacturer of your outfit if anything goes wrong, but look to see if you are at fault by failure to keep your receiver clean and in good shape.

FOOLING THE CALENDAR

Did you know that radio recently mixed up the calendar? Not alone was there trouble between one day and another, but between one year and its neighbor. Thus we had Londoners dancing in 1925 to music played in Berlin in 1926 — fox-trotting in 1926 to tunes played in America in 1925—and then listening to their own music coming back from New York via the ether. These were some of the unparallelled thrills made possible by radio to open the new year, not to speak of the transoceanic and transcontinental reception of the golden voices of McCormack and Bori.

PARADE MARCHES TO RADIO

This parade had no band, yet marched along to band music.

A large National Exposition at Chicago, introduced itself to the city by an open air parade starting from the Drake Hotel and marching to the Furniture Mart on the Lake Front, without the customary band. Instead, the music was furnished by KYW, from its Hearst Square Studio. The parade carried with it a number of powerful radio receivers, all tuned in on this station.

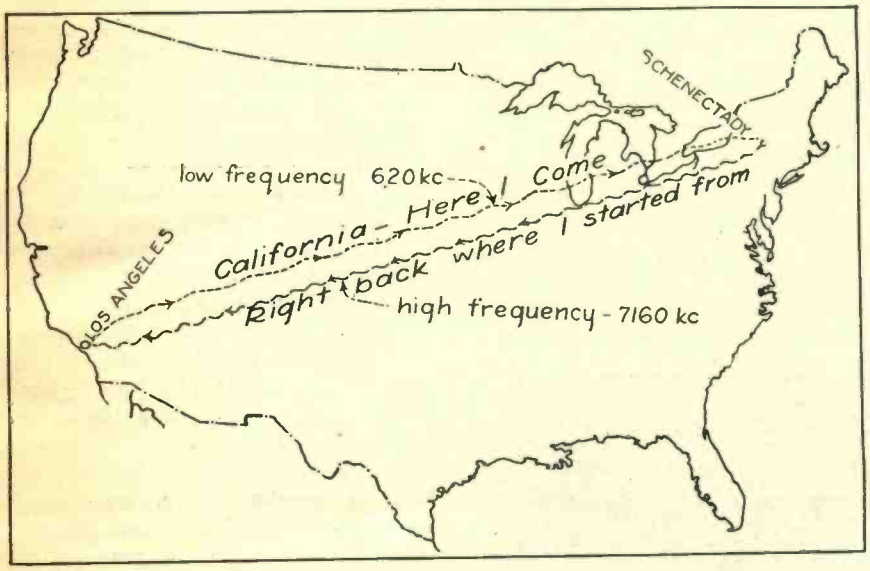
This is the first time in radio history that an open air parade marched to the cadence of radio music.

Here's the Biggest Detour

Don't Call Us a Liar for This Story is Really True

IT'S not much fun is it, to come on a signboard in the middle of the road with an arrow pointing down a muddy lane. But suppose you took a long detour and found it brought you back to the same city, then what would you say?

Here is the champion story of a round trip of 4,000 miles taken by radio waves to go about four miles. In California a radio fan tuning in on the high frequency (short length) wave from WGY, heard a dance program which was being played in Los Angeles a few miles away.



Like a California Story

And one of the startling points of this tale is that the first piece our fan picked up was "California, Here I Come, Right Back Where I Started From." This seems like too big a story to believe, but by looking at the map Fig. 1, you will see the course of the radio waves and how true the song fitted the case. The ordinary broadcast waves from KFI at 620 kc. (485 meters) carried the song from California to Station WGY (after a relay through KOA, KFKX and WOC), where the music was picked up and again put on the air at the high frequency, 7160 kc. (41 meters). These waves found their way back again to Los Angeles and were picked up on that frequency by our hero.

This rebroadcast achievement is believed to be a radio record. England was rebroadcast by WGY a year ago, but there was no information that the return program had been heard at the source. Music has been relayed from the eastern to the western coast, but there is no previous record of a relay of a western coast program to the Atlantic side of the continent and its reception again on the Pacific shore.

New Jersey Broadcasts England

One New Year's night, as part of an elaborate program marking the opening of the Bound Brook super-power transmitter of WJZ, a special program was sent out from London by way of 5XX, at Daventry, England.

This powerful station of the British Broadcasting Company transmitted on 187 kc. (1,600 meters). This wave was picked up by R. C. A. engineers at Belfast, Me., and relayed to WJZ in New York. From WJZ, the English signal was carried by wire to WGY and then by another radio relay from the Schenectady station to WFBL, in Syracuse, and WHAM in Rochester. WGY broadcast the English signal on 790 kc. (379.5 meters) wavelength and also on 7,160 kc. It was the signals on the latter wave that carried the music and speech back to the home of their origin in England.

CITY STARTS TO ADVERTISE

Perhaps you thought that the only places to boost themselves were Florida and Los Angeles. But now others are stepping into the ring.

Wednesday, heretofore, a silent night for WGY, has become one of the biggest nights for the station, and it is sure to gain in popularity with the listeners. That evening is given over, practically entirely, to Rochester, N. Y., and that city has thus far provided several outstanding programs.

The symphony orchestra of the Eastman Theatre is heard at 6:45 o'clock, and this is followed at eight o'clock by a program by pupils of the Eastman School of Music, by the Little Symphony Orchestra, the Rochester Symphony Orchestra or other Rochester talent. WHAM of Rochester broadcasts all Rochester simultaneously with WGY.

GRAVITY BATTERIES. Tested by Bureau of Standards. Runs ¼ amp. tube for 2400-3200 hrs. No acid, sulphating or weekly attention. Price $6.60 for 6, size 6x8, 3-lb. zincs, &c., 6.36 volts in series. Extra zincs, 6 for $2.65. Blue vitriol, 25 lbs., $2.65 (3-lb. per cell). Shpg. wght. crated 75 lbs.

BALLOON AERIAL for best DX. London-Paris with 1 tube. Write for literature. Hydrogen procured in tanks or made in jug. Price $5 plus pstg. (5-lb). large reel, gas fixtures, extra antenna wire, instructions, 3 30-in. balloons, etc. Satisfaction assured.

CHIMNEY AERIAL. Protected by asbestos, large 6-in. cage construction. Inconspicuous, chimney high and super-sensitive as an inside aerial. Price $2, plus pstg. (3 lb.), 75 ft. heavy gauge coil antenna. Just drop it down chimney.

INSULATED RIBBON WIRE. To be wound edgewise for maximum inductance in making radio coils. Equivalent to No. 24 round wire. $4.50 per lb.

EVERETT SCANLON, RADIO SPECIALTIES, LAKEWOOD, RHODE ISLAND.

an antenna full of screams and screeches, they gave up the attempt as a bad job and tuned to a little slower wave which was coming in from KDKA. Owing to the lack of advertising of this particular frequency the air was clear, and so KGO was able to rebroadcast a program from East Pittsburgh.

So the next time you're bothered by screaming sets, don't feel that your own outfit or skill is to blame but remember how the pride of the Pacific was put out of business by the same troublesome squeal.

And if your radio is a regenerative type, take this lesson to heart and be careful not to run your tickler turned up so high that the set oscillates.

YOU SEEM TO LIKE IT

When we made the experiment of reducing the price of this magazine from 15 to 5c many people were much surprised. They thought that we would have done a wiser thing to put the figure at 10c if we intended to drop the price.

However, this reduction seems to have made a decided hit with almost all our readers. Subscriptions are coming in fast and the newstands in many localities are reporting that their regular allotment is sold out very early and they need more copies. This naturally makes us feel good as we are depending on you and your friends to make up in increased circulation what we lose in subscription price.

One little incident that perhaps shows which way the wind blows was reported by one of our readers as follows:

"I saw a college play Saturday in Boston which had already run 300 nights in New York,—'The Poor Nut.' The newsstand in a book store in the first act was right out in the front of the stage, and there were five magazines hanging on the lower part of it. What do you think they were? The very first one was 'New England Radio Progress' then came the 'Literary Digest' and then 'Liberty.' The other two could not be recognized. Pretty good for your magazine."

We will admit that this letter gave us the thrill that comes once in a lifetime. It seems to show that we are pleasing our readers, and, of course, it is you who must be satisfied if we are continue as a success.

MIDNIGHT BOW-WOWS

This is Kay Nyne and Big Barker, who entertain on the special program every Thursday midnight from Station WLW, Cincinnati. This program has proved to be one of radio's howling successes. Rin Tin Kan is another entertainer of this unique nocturnal broadcasting feature.

CALLING CALL LETTERS

That's what they're for—to be called by the announcers so that you can understand them. But how many studio directors seem to be aware of that fact?

Owing to the fact that B and C and V besides several others sound so much alike, it is of great advantage to the far-away listener to have the name of the city announced as well as the letters themselves. So if a far-away voice says, "this is station WEAE, Washington, D. C." you know it must really have been WCAP.

That is why many fans are condemning those stations which announce the letters without giving any city. Then there are others which have in the past offended by saying WBZ, New England, and WDWF, U. S. A. If you got any one of the call letters wrong in either of these announcements you would not be able to look up the city and so correct your first impression.

Another point that we have often wondered about is why many of the studio men take the time to say "After the next number we will announce who we are." Why do not they say instead, "This is WXYZ of Boston." It would not take any longer and would tell us what we want to know instead of keeping us on the waiting list. Do any of our readers know why this practice has been started?

Do It Every Day

One of the pleasing features of the International Radio Week which showed careful planning was the provision that the stations should tell who they were every few minutes. By doing this they enabled distant dial turners to tell who was coming in without wasting ten or fifteen minutes valuable time waiting for the announcement. The idea was so good it seems as if it might be extended to ordinary occasions. The general objection to it on the part of the announcers is that it takes too much time. However, if they would cut down on the amount of effort they use sending out slogans of their own station and the like and merely repeat their letters and city, say every five or ten minutes, we think every listener would be better pleased.

We shall welcome your comments on this matter. Just drop a line to the editor.

American Radio Relay League

BOOSTS RADIO TESTS

Here is the telegram that amateurs have been sending all over the United States to the Mayors of all large cities and towns in the country:

"The International Radio Week Committee sends you greetings via Amateur radio through the courtesy of the American Radio Relay League. Will you issue proclamation setting aside the week of January 24 to 30 as Radio Week in your city in accord with the international plan, which makes this Radio Week in more than fifteen countries.

All American broadcasting stations will be silent one hour each night to permit listeners in this country hearing overseas stations in special international programs while in the hour preceding, foreign stations all over the world will be silent so that their listeners may hear special messages from North America. Radio, as the greatest force in America, invites all the world to enjoy the entertainment available for rich and poor which this great force has made so easily in the reach of every citizen.

The International Radio Week Committee,

Powel Crosley, Jr., Chairman.

WHICH WAY DID THEY GO?

Radio communication 8,000 miles by daylight (unless the waves travelled 17,000 miles through darkness) is the distance record achieved by a California radio amateur, member of the American Radio Relay League. Brandon Wentworth, noted as the man who established communication with Santa Barbara after that city was hit by the earthquake last spring, established two-way communication with British amateur radio station 2SZ, owned and operated by W. H. Brown, Mill Hill School, London.

While Wentworth's station, 6-OI was piling up records, a fellow member of the League, Colonel Clair Foster of Carmel, Cal., was putting his signals over the same route and copying British messages with a regularity that has decided him to try working England on a regular schedule.

By a peculiar coincidence, the signals of each California station furnish a check for the other, Wentworth accomplished his first two-way contact at about 7:45 a. m., the same time that Col. Foster was sending. The distance eastward is about 8,000 miles and this is all through daylight at that time of day. The westward distance is in the vicinity of 17,000 miles, partly through daylight and partly through darkness. In either direction the distance is record breaking.

This "Symphonette Ensemble" delights the listeners of WTIC, Hartford. It is unusual because of its instrumentation, being composed of flutes, clarinets, oboe, English horn, French horn, bassoon, tuba, timpani and harp.

HE SURELY SPOILED THE MAP

Distinction, radio-wise, has been granted to Dartmouth, N. S., by the accomplishments of Joseph Fassett, owner of radio station 1AR and a prominent member of the Maritime Division of the American Radio Relay League.

Mr. Fassett has amassed a record of stations heard and stations worked in the field of amateur radio telegraph that has made him the receipient of the Murphy Radio Cup for 1925. This prize is offered by Former Mayor Murphy of Halifax for the transmitting radio amateur who does the most useful work in putting the names of the Maritime Provinces before the rest of the world.

The award of Mr. Fassett is simply explained by a glance at a map of the world with the usual pins denoting locations of radio stations with which he has talked.

Aside from working the United States, 1AR has established communication with Argentina, Bermuda, Brazil, Cuba, Czechoslovakia, Denmark, France, Great Britain, Greenland, Finland, Holland, Italy, Irag, New Zealand, South Africa and Australia. With this short Atlas index as a starter, Mr. Fassett is striving this winter to round out his record of achievement by contacting all of those civilized lands where the signal from 1AR is still unknown.

Based upon the amount of work he has undertaken in the past in the way of developing his transmitting and receiving units, in building the components of them and in placing the entire apparatus into operation, Mr. Fassett promises to realize almost his whole ambition before summer static once more blankets the northern hemisphere.

WAVES WHICH LIVE AND DIE

Continued from Page 12

off only the wave which the broadcasting station is supposed to radiate. All other frequencies can get through. Observe that this suppressor is hooked up directly from the aerial to ground so that it short circuits the coupler of the antenna system. Any waves which may be harmonics are thus led harmlessly direct to earth, *except* the particular frequency (wave length) which is supposed to be radiated from the aerial. This vibration, as already mentioned, cannot pass through the suppressor, owing to its tuning and so it goes out on the air just as usual.

Here is the List

The Department of Commerce has just issued a list of stations which have been equipped with this apparatus so that they do not radiate anything but a pure wave. See if your favorites are included:

KDKA	East Pittsburgh, Pa.
KFDM	Beaumont, Texas
KFJF	Oklahoma, Okla.
KOB	State College, N. Mex.
KPRC	Houston, Tex.
KTHS	Hot Springs, Ark.
KWWG	Brownsville, Tex.
WABX	Mount Clemens, Mich.
WAHG	Richmond Hill, N. Y.
WAPI	Auburn, Fla.
WBAL	Baltimore, Md.
WBAP	Fort Worth, Tex.
WBAX	Wilkes-Barre, Pa.
WBBR	Rossville, N. Y.
WBDC	Grand Rapids, Mich.
WCAE	Pittsburgh, Pa.
WCAP	Washington, D. C.
WCAR	San Antonio, Tex.
WCAU	Philadelphia, Pa.
WCX	Pontiac, Mich.
WEAF	New York, N. Y.
WEBK	Grand Rapids, Mich.
WFAA	Dallas, Tex.
WFDF	Flint, Mich.
WFI	Philadelphia, Pa.
WGBS	New York, N. Y.
WGBU	Fulford-by-the-Sea, Fla.
WHAP	New York, N. Y.
WHAR	Atlantic City, N. J.
WJAD	Waco, Tex.
WJR	Pontiac, Mich.
WKAR	East Lansing, Mich.
WLW	Harrison, Ohio
WLWL	New York, N. Y.
WOAI	San Antonio. Tex.
WOR	Newark, N. J.
WPG	Atlantic City, N. J.
WRC	Washington, D. C.
WRNY	New York, N. Y.
WRR	Dallas, Tex.
WRVA	Ruchmond, Va.
WSAI	Mason, Ohio
WSB	Atlanta, Ga.
WSM	Nashville, Tenn.
WSMB	New Orleans, La.
WTAM	Cleveland, Ohio
WWJ	Detroit, Mich.

Costs a Cool Thousand

You may wonder why more stations do not install this device. The one answer is that of cost. A sending station may pay as much as a thousand dollars for the labor and material of correcting its wave by the harmonic suppressor. Stations that cannot afford this sum continue to put out broadly tuned waves.

Getting back an instant to Fig. 1, we mentioned that the oscillations radiated from a ship in distress were different from those of a good broadcasting station. We are now in a position to see why. The broadcaster wants a radiation which will reach the radios tuned especially to him. He does not want to gain the ill will of broadcast listeners by interfering with receiving sets which may be tuned to some other station. So he will use all means possible to make his waves sharp.

To Tell the World

The sinking vessel, on the other hand, does not want to reach you or me or John Smith alone—it wants to be heard by everyone within a range of several hundred miles. The operator on shipboard cannot waste precious seconds by tuning his transmitter first to one wave speed and then to another. So if he uses a wave with a fairly high decrement and with harmonics so that he can be picked up by any steamer within range, no matter what the tuning of the latter, he has so much more chance of being heard and rescued. That is why apparatus with a high decrement which would not be tolerated by a modern broadcasting station is welcomed by seagoing vessels.

Fone Fun For Fans

A Sneaking Draft

Jack—"You've got a bad cold, Pete."

Pete—"Yeh."

Jack—"How'd you get it?"

Pete—"I slept in a field last night and someone left the gate open."—Boy's Life.

A Warm Reception

A contributor writes: "A batch of jokes I sent to the editor were rejected as not causing a laugh, but when I threw them in the stove the fire just roared."—Boston Transcript.

She's the oo

Hub—"I just heard the new girl singing in the kitchen. She's a cuckoo."

Wife—"She may be a cuckoo, but she's no cook."—Boston Transcript.

Then He Woke Up, Too

"Yes John, Alice said that last night she dreamed she was dancing with you."

"You thrill me all to pieces."

"—and then she woke up to find her kid brother pounding her feet with a flat-iron."—The Sun Dial.

No Lessons Needed

A man fell and injured his hand.

"When this hand of mine gets well, shall I be able to play the banjo?" he asked the doctor.

"Certainly."

"Thanks; you're a wonder. I never could before."—Good Hardware.

Bible Class Note

Guide (at ancient castle)—"This is the moat. Are there any questions you would like to ask?"

American—"Yes. How could a fellow possibly get one of those in his eye?"—Life.

Those Are the Locals

Lives of broadcasters remind us
We can say good night and quit,
And departing leave behind us
Listeners quite glad of it.—Life.

Linguistic Item

Teacher—"Willie, what is zinc?"

Willie—"That's the French pronunciation for think."—Good Hardware.

Rx DR RADIO PRESCRIBES.

NOTE: In this section the Technical Editor will answer questions of general interest on any radio matter. Any of our readers may ask not more than two questions, and if the subjects are of importance to most radio fans they will be answered free of charge in the magazine. If they are of special interest to the questioner alone, or if a personal answer is desired, a charge of fifty cents will be made for each answer. This will entitle the questioner to a personal answer by letter. However, if the question requires considerable experimental work, higher rates will be charged.

Question. In many radio frequency transformers for tuned RF the coil is wound of white wire with some green wire in the center. Why is this?

Answer. The white wire forms a winding of around 50 or 60 turns and is the secondary of the unit. One end of this coil connects to the grid of the next tube and the other end to the "A" minus or, if used, the "C" minus. The green wire will have 5 to 15 turns depending on what style of tube and what position in a set is to be supplied. This is wound frequently of green wire as you state. The reason for the color is merely to serve as a mark of identification so that the constructor of the set will know which wires are which.

The terminals of this coil run to the "B" minus and to the plate of the previous tube. The reason the number of turns is small is to get a step up ratio of 4 or 5 to the transformer. This primary winding is often spaced in the center of the secondary for the reason that it is thought to make a better balance in that position.

Question. Is the flat window lead-in thought to be good practice for entering a building?

Answer. When well made it is a good piece of appparatus. It consists of a flat strip of copper with insulation over the center part where it is likely to touch the woodwork of the window. It is made quite flat and thin so that it will go in the crack which usually exists between the sash and the window frame. This may be either at the top or botton of the window.

In dry weather the wood of the frame is itself a good insulator and so the covering of the copper does not make much difference. However, after a rain when the surrounding wood becomes water-soaked, it is no longer an insulator, but would allow a considerable part of the faint radio waves to leak off and be lost. At such a time it is imperative that you have some kind of insulation which will not become water logged. One method of accomplishing this is to use a fabric covering which has been dipped into paraffin and so impregnated that it is impervious to moisture.

Question. My aerial is located inside the building, in the attic, but goes out through the window and down the side of the house before entering the living room downstairs. Is this all right?

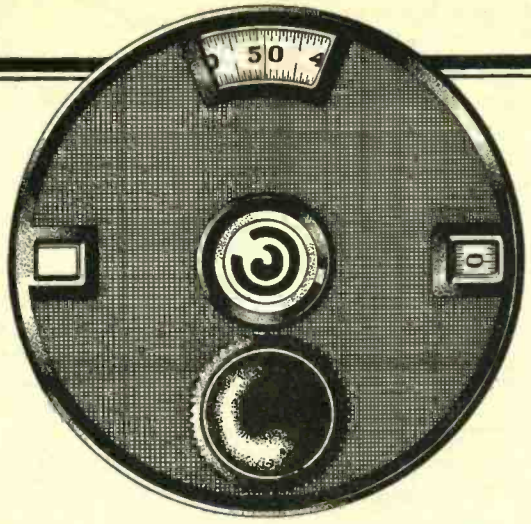
Answer. The big advantage of an outside aerial is that there is usually more room outdoors, and so such an antenna is of much larger size than one which can be installed in a house of ordinary dimensions. If the outside aerial is no larger or higher than what might go under your own roof, there is no advantage in having it out in the rain.

If you have an inside aerial in your garret it will collect the same amount of radio waves whether the lead-in runs down within or outside of the walls. If it is easier to bring it down outside, it is quite satisfactory to do so. There are however, two slight disadvantages of this location. In the first place, since it is out in the weather you must use a better grade of insulators to prevent leakage during rainstorms, and this insulation must also include two places where the wire goes through the side of the building. Besides that the requirements of the Fire Insurance Underwriters are, that whenever any part of the aerial or lead-in is located outdoors, it is necessary to use a lightning arrestor. This additional device must then be added to your set.

Question. What do the curves which often accompany advertisements of audio transformers mean?

Answer. Such curves are plotted on ruled paper with the up and down heights or ordinates as they are called, representing loudness or volume, and the horizontal distances meaning the different note frequencies. They assume that the same loudness or volume of audio frequency energy is supplied to the primary in each case. If a transformer were perfect in its operation, we should get a straight horizontal line parallel to the base. This would indicate that the amplification was 3½ on every note of the piano towards the lowest bass up to the highest treble. Of course this figure might be 5 or 10, or whatever value the transformer ratio was designed for. The point is it should be straight and horizontal.

No transformer is ever built with an absolutely straight line. By using enough iron and copper such a result could be approximated as closely as desired, but the unit would be very heavy and expensive. The tendency of transformer manufacturers is to make a device which is small and light and sells for a reasonable figure, but approaches the straight line as closely as possible. In this some of them have been quite successful.



Jot down the call letters in the handy slots, right on the dial itself. Then, as each station swings in, its letters flash into sight

Your set should have this new-day tuning

Sweeping the country in a wave of well-deserved success—MAR-CO dials have already replaced old-type tuning on over 100,000 sets.

Your own set needs them too. It needs the hair-trigger response—the micrometer-precision, the smooth, easy vernier action, these tuning controls alone, provide.

Foremost authorities, writing in Radio Broadcast, Radio News, Popular Radio, Radio Digest, Radio Age, Radio in the Home, and other technical magazines, have made MAR-CO dials the standard for this season's most advanced circuit designs.

But you need not wait till you build a new set. Put MAR-CO dials on your present set—to-night—and discover what a difference a dial can make!

Made by Martin Copeland Company, Providence, R. I.

Nickel-plate $2.50
Gold-plate $3.00
Scales reading either 0-100, or 100-0, as desired.

MAR·CO DIALS

The 1926 model tuning control

In 15 Minutes I Will Give You the Secret of a Perfect Memory

I Guarantee to Increase Your Memory 100% In 10 Days

Not by any abstract, tiresome, difficult-to-master method; not by the old system of association of ideas or thoughts. Not by hard study, rotation exercises or repetition of words or sounds. It is not a book. There is nothing to study—nothing to repeat. It is by far the newest, best simplest method ever devised. I will give you a memory in one week's time that will surprise you. In one month things that occurred 30 days ago will be as fresh and clear in your mind as if they happened yesterday.

GEO. J. SPINNER
Author and Educator

My Secret for 30 Years

I have given my secret to thousands. I have used it myself for more than 30 years. It enabled me to rise to my present position as an educator in professional and scientific circles; it gave me a good vocabulary, developed my powers of perception and analysis and fitted me to write on a hundred subjects.

Command Success

My VI-FLECT method of memory-building is for those who are ambitious to improve their business, professional, social or financial condition. VI-FLECT will develop your brain-power—your ability—lift you out of the rut; you will no longer stumble, mumble, nor grope for words with which to express yourself. You will be surprised how easily you can remember names, faces, dates, figures, appointments, duties, etc. It will enhance your importance as an employer, your value as a manager or employee, increase your worth, your ability, expertness, raise your salary, help you in business, professionally, socially, politically—in every way.

Learn My Secret

I prefer to place my secret within the easy reach of everyone. Therefore, the price I am going to ask for VI-FLECT—my wonderful method of memory-building, which I have developed and perfected during my 30 years of constant study and application is ONLY $5.00.

Let nothing stand between you and a successful, happy, prosperous future. If it is not convenient to enclose the money, or if you prefer, I will mail your copy of VI-FLECT and you can hand the small amount to your postman when he delivers the package. The important thing is—SEND NOW.

COUPON

Geo. J. Spinner,
416 S. Dearborn St., MB738
Chicago, Ill.

Dear Sir: Please send me my copy of VI-FLECT for which I enclose $5.00. I will try your VI-FLECT method of memory-building for 10 days, and if it does not increase my memory 100% I am to return it and you are to give me my money back without argument.

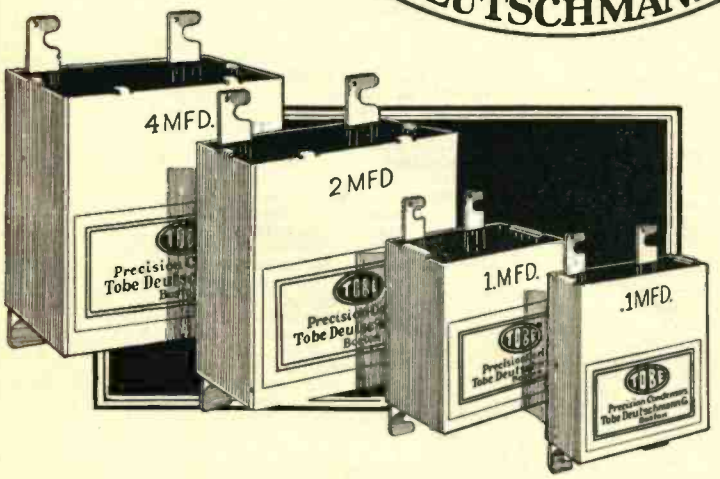
Name .....

Address .....

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

Fine Radio **TOBE** *Apparatus*

DEUTSCHMANN



PRECISION FILTER and BI-PASS CONDENSERS

THE *standard* smoothing condensers for use in A and B Eliminators, for by-pass condensers in all radio sets, and for coupling condensers in resistance and impedance coupled audio amplifiers.

Accurate to within 5% of rating.
700-volt high-tension insulation.
Long life.
Unaffected by extreme heat or cold.
Shielded metal cases with beautiful matt silver finish.
Packed in the new and distinctive silver cartons.

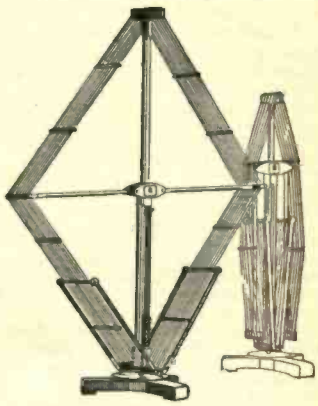
These are the reasons TOBE CONDENSERS are pre-eminent in Radio and allied electrical fields.

For the Raytheon Plate Supply Unit, Use
2 type 705—0.1 Mfd., Price $0.60
1 type 707—0.5 Mfd., Price $0.75
2 type 709—2.0 Mfd., Price $1.75
2 type 711—4.0 Mfd., Price $3.00

TOBE CONDENSERS are specified by Horace V. S. Taylor in this issue of NEW ENGLAND RADIO PROGRESS, by Edwin E. Turner in RADIO for November, 1925,—by Gerald M. Best in RADIO for December, 1925,—Roland M. Beers in RADIO BROADCAST for December, 1925,—and by Laurence M. Cockaday in POPULAR RADIO, November, 1925... Write for Blueprints of circuits—Free.

"THE BETTER CONDENSER"

The TOBE DEUTSCHMANN Line Also Includes Transmitting Condensers and Transmitting Tubes. Send for Circulars.



West of the Rockies
PRICE
$26.50

TOBE DTW LOOP

(*collapsible*)

Supreme for all loop operated circuits. The one loop in all America chosen by McLaughlin for his single control set. Has 27-inch sides. Genuine Litz wires. Graduated base for compass settings.

Made to laboratory standards for a lifetime of efficient use

Tobe Condensers May be Obtained from the Following New England Jobbers

BOSTON, MASS.
Atlantic Radio Co., 727 Boylston St.
Dalton Light and Fixture Co., 141 Pearl St.
Lewis Electric Supply Co., 117 Federal St.
H. Jappe, 46 Cornhill.
F. D. Pitts Co., 219 Columbus Ave.
Sager Electric Supply Co., 117 Federal St.

WORCESTER, MASS.
Waite Hardware Co., 185 Front St.

PROVIDENCE, R. I.
B. & H. Supply Co., 116 Mathewson St.

HARTFORD, CONN.
H. Jappe Co., 252 Asylum St.
New England Radio Corp.
Stern & Co. Inc., 308 Asylum Street.

Tobe Deutschmann Co.

CORNHILL BOSTON MASS.

UNITED STATES BROADCASTING STATIONS ARRANGED ALPHABETICALLY BY CALL LETTERS

Abbreviations: W.L., wave length in meters; K.C., frequencies in kilocycles; W.P., wattpower of station.

	K.C.	W.L.	W.P.
KDKA—Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.	970-	309-	var.
KDZB—Frank E. Siefert, Bakersfield, Cal.	1430-	210-	100
KFAB—Nebraska Buick Auto Co., Lincoln, Neb.	880-	341-	1000
KFAD—McArthur Bros. Mercantile Co., Phoenix, Ariz.	1100-	273-	100
KFAJ—University of Colorado, Boulder, Colo.	1150-	261-	100
*KFAU—Independent School Dist. of Boise, Boise, Idaho.	1070-	280-	750
KFBK—Kimball Upson Co., Sacramento, Cal.	1210-	248-	100
KFBL—Leese Brothers, Everett, Wash.	1340-	224-	100
KFBU—Bishop N. S. Thomas, Laramie, Wyo.	1110-	270-	500
KFCB—Nielsen Radio Supply Co, Phoenix, Ariz.	1260-	238-	100
KFDM—Magnolia Petroleum Co., Beaumont, Tex.	950-	316-	500
KFDX—First Baptist Church, Shreveport, La.	1200-	250-	100
KFDY—S. Dak. Ste. Col. Ag. & Mech. Arts, Br'kngs., S. D.	1100-	273-	100
KFEQ—Scroggin, & Co. Bank, Oak, Nebr.	1120-	268-	500
KFGH—Leland Stanford Junior Univ., Stanford Univ., Cal.	1110-	270-	500
KFI—Earl C. Anthony, Los Angeles, Cal.	640-	469-	3000
*KFIO—North Central High School, Spokane, Wash.	1130-	265-	100
KFJF—National Radio Mfg. Co., Oklanoma, Okla.	1150-	261-	500
KFKU—University of Kansas, Lawrence, Kans.	1090-	275-	500
KFKX—Westinghouse Elec. & Mfg. Co., Hastings, Neb.	1040-	288-	5000
KFLR—University of New Mexico, Albuquerque, N. Mex.	1180-	254-	100
KFLV—Swedish Evangalical Mission Church, Rockford, Ill.	1310-	229-	100
KFLZ—Atlantic Automobile Co., Atlantic, Iowa.	1100-	273-	100
KFMQ—University of Arkansas, Fayetteville, Ark.	1000-	300-	750
KFMR—Morningside College, Sioux City, Iowa.	1150-	261-	100
KFMX—Carleton College, Northfield, Minn.	890-	337-	500
KFNF—Henry Field Seed Co., Shenandoah, Iowa.	1140-	263-	500
KFOA—Rhodes Dept. Store, Seattle, Wash.	660-	454-	1000
KFON—Echophone Radio Shop, Long Beach, Cal.	1290-	233-	500
KFOO—Latter Day Saints Univ., Salt Lake City, Utah.	1270-	236-	250
KFOR—David City Tire & Electric Co., David City, Neb.	1330-	226-	100
KFOX—Technical High School, Omaha, Nebr.	1210-	248-	100
KFPR—Los Angeles County Forestry, Los Angeles, Cal.	1300-	231-	500
KFPY—Symons Investment Co., Spokane, Wash.	1130-	266-	100
KFQA—The Principia, St. Louis, Mo.	1150-	261-	100
*KFQB—Searchlight Publishing Co., Fort Worth, Texas.	1140-	263-	1000
*KFQD—Chorin Supply Co., Anchorage, Alaska.	1320-	227-	100
KFQU—W. E. Riker, Alma (Holy City), Calif.	1380-	217-	100
KFRB—Hall Bros., Beeville, Texas.	1210-	248-	250
KFRU—Stephens College, Columbia, Mo.	600-	500-	500
KFSG—Echo Park Evangelistic Asso., Los Angeles, Cal.	1090-	275-	500
KFUO—Concordia Seminary, St. Louis, Mo.	550-	545-	500
KFUT—University of Utah, Salt Lake City, Utah.	1150-	261-	100
KFVE—Film Corporation of America, St. Louis, Mo.	1250-	240-	500
KFVW—Airfan Radio Corporation, San Diego, Cal.	1220-	246-	500
KFWA—Browning Bros. Co., Ogden, Utah.	1150-	261-	500
KFWB—Warner Bros. Pictures, Inc., Hollywood, Cal.	1190-	252-	500
KFWH—F. Wellington Morse, Jr., Chico, Cal.	1180-	254-	100
KFWI—Radio Entertainments, Inc., So. San Fran., Cal.	1330-	226-	500
KFWM—Oakland Educational Society, Oakland, Cal.	1430-	207-	500
KFWO—Lawrence Mott, Avalon, California.	1420-	211-	250
KFWU—Loulsiana College, Pineville, La.	1260-	238-	100
KFXB—Bertram O. Heller, Big Bear Lake, Cal.	1480-	202-	500
KFXF—Pikes Peak Broad. Co., Colorado Springs, Col.	1200-	250-	500
KFYD—N. Baker, Muscatine, Iowa.	1170-	256-	250
*KGO—General Electric Co., Oakland, Cal.	830-	361-	4000
KGU—Marion A. Mulrony, Honolulu, Hawaii.	1110-	270-	500
KGW—Portland Morning Oregonian, Portland, Ore.	610-	491-	500
KHJ—Times-Mirror Co., Los Angeles, Cal.	740-	405-	500
KHQ—Louis Wasmer, Spokane, Wash.	1100-	273-	500
KJR—Northwest Radio Service Co., Seattle, Wash.	780-	384-	1000
KLDS—R. Ch. Jesus Christ, L. D. Sts., Independence, Mo.	680-	441-	1000
KLS—Warner Bros. Radio Supplies Co., Oakland, Cal.	1200-	252-	250
KLX—Tribune Publishing Co., Oakland, Cal.	590-	508-	500
KLZ—Reynolds Radio Co., Denver, Colo.	1130-	266-	250
KMA—May Seed & Nursery Co., Shenandoah, Iowa.	1190-	252-	500
*KMMJ—M. M. Johnson Co., Clay Center, Neb.	1310-	229-	500
KMTR—K. M. Turner Radio Corp., Los Angeles, Cal.	1260-	238-	500
KNRC—Clarence B. Juneau, Los Angeles, Cal.	1440-	208-	250
KNX—Los Angeles Express, Los Angeles, Cal.	890-	337-	500
KOA—General Electric Co., Denver, Colo.	930-	322-	5000
*KOAC—Oregon Agricultural College, Corvallis, Ore.	1070-	280-	500
KOB—New Mexico Col. of Agriculture, State Col., N. Mex.	860-	349-	1000
KOCH—Omaha Central H. School, Omaha, Neb.	1160-	258-	250
KOCW—Oklahoma College for Women, Chickasha, Okla.	1190-	252-	200
KOIL—Monarch Manufacturing Co., Council Bluffs, Ia.	1080-	278-	500
*KOWW—Blue Mt. Radio Asso., Walla Walla, Wash.	1170-	256-	500
KPO—Hale Bros., San Francisco, Cal.	700-	428-	1000
KPRC—Houston Printing Co., Houston, Texas.	1010-	297-	500
KPSN—Pasadena Star-News, Pasadena, Cal.	950-	316-	1000
KOP—H. B. Read, Portland, Ore.	1410-	213-	500
KQV—Double-Hill Electric Co., Pittsburg, Pa.	1090-	275-	500
KQW—First Baptist Church, San Jose, Cal.	1330-	231-	500
KRE—Berkeley Daily Gazette, Berkeley, Cal.	1170-	256-	100
KSAC—Kansas State Agric. College.	880-	341-	500
KSD—Post-Dispatch, St. Louis, Mo.	550-	545-	500
KSL—The Radio Service Corp., Salt Lake City, Utah.	1000-	300-	1000
KSO—A. A. Berry Seed Co., Clarinda, Iowa.	1240-	242-	500
KTAB—Tenth Ave. Baptist Church, Oakland, Cal.	900-	333-	1000
KTBI—Bible Institute of Los Angeles, Los Angeles, Cal.	1020-	294-	750
KTCL—American Radio Tel. Co., Inc., Seattle, Wash.	980-	310-	1000
KTHS—New Arlington Hotel Co., Hot Springs, Ark.	800-	375-	500
KTNT—Norman Baker, Muscatine, Iowa.	1170-	256-	500
KTW—First Presbyterian Church, Seattle, Wash.	660-	454-	1000
KUO—Examiner Printing Co., San Francisco, Cal.	1200-	250-	150
KUSD—University of South Dakota, Vermillion, S. D.	1080-	278-	100
KUOM—State Univ. of Montana, Missoula, Mont.	1230-	244-	250
KUT—University of Texas, Austin, Texas.	1300-	231-	500
KVOO—Voice of Oklahoma, Bristow, Okla.	800-	375-	500
KWCR—H. F. Paav, Cedar Rapids, Iowa.	1080-	278-	500
KWKC—Wilson Duncan Studios, Kansas City, Mo.	1270-	236-	100
KWKH—W. G. Paterson, Kennonwood, La.	1150-	261-	500
KWSC—State College of Washington, Pullman, Wash.	860-	349-	500
KWWG—City of Brownsville, Brownsville, Texas.	1080-	278-	500
*KYW—Westinghouse Elec. & Mfg. Co., Chicago, Ill.	560-	535-	5000
KZKZ—Electrical Supply Co., Manlla, P. I.	1110-	270-	100
KZM—Preston D. Allen, Oakland, Cal.	1250-	240-	100
KZRQ—Far Eastern Radio, Manila, P. I.	1350-	222-	500
KZUY—F. Johnson, Elser, Baguio, P. I.	833-	360-	500
NAA—United States Navy, Arlington, Va.	690-	435-	1000
WAAF—Chicago Daily Drovers Journal, Chicago, Ill.	1080-	278-	200
WAAW—Omaha Graln Exchange, Omaha, Neb.	1080-	278-	500
WABI—First Universalist Church, Bangor, Me.	1250-	240-	100
WABO—Lake Avenue Baptist Church, Rochester, N. Y.	1080-	278-	100
WABQ—Haverford College Radio Club, Haverford, Pa.	1150-	261-	100
WABX—Henry B. Joy, Mount Clemens, Mich.	1220-	246-	500
WADC—Allen Theatre, Akron, O.	1160-	258-	500
WAFD—Albert B. Parfet Co., Port Huron, Mich.	1090-	275-	500
WAHG—A. H. Grebe Co., Richmond Hill, N. Y.	950-	316-	500
WAIU—American Insurance Union, Cloumbus, O.	1020-	294-	500
WAMD—Hubbard & Co., Minneapolis, Minn.	1230-	244-	500
WAPI—Alabama Polytechnic Institute, Auburn, Ala.	1210-	248-	500
WARC—Am. Rad. & Research Corp., Medf'd H'lsde, Mass.	1150-	261-	100
WBAA—Purdue University, West Lafayette, Ind.	1100-	273-	250
WBAK—Pennsylvania State Police, Harrisburg, Pa.	1090-	275-	500
†WBAL—Consolidated Gas, Elec. Lgt. & Pr. Co., Balt., Md.	1220-	245-	1000
WBAO—James Millikin University, Decatur, Ill.	1110-	270-	100
WBAP—Wortham-Carter Publishing Co., Fort Worth, Tex.	630-	476-	1500
WBBL—Grace Covenant Church, Richmond, Va.	1310-	229-	100
WBBR—People's Pulpit Assoc., Rossville, N. Y.	1100-	273-	500
WBCN—Foster & McDonnell, Chicago, Ill.	1130-	266-	500
WBES—Bliss Electrical School, Takoma Park, Md.	1350-	222-	100
WBNY—Shirley Katz, New York, N. Y.	1430-	210-	500
WBOQ—A. H. Grebe Co., Richmond Hill, N. Y.	1270-	236-	100
*WBPI—I. R. Nelson Co., Newark, N. J.	1140-	263-	500
WBRE—Baltimore Radio Exchange, Baltimore, Md.	1300-	231-	100
WBT—Charlotte Chamber of Commerce, Charlotte, N. C.	1090-	275-	250
WBZ—Westinghouse Elec. & Mfg. Co., Springfield, Mass.	900-	331-	2000
WBZA—Westinghouse Elec. & Mfg. Co., Boston, Mass.	1240-	242-	250
WCAC—Connecticut Agric. College, Mansfield, Conn.	1090-	275-	500
WCAD—St. Lawrence University, Canton, N. Y.	1140-	263-	250
WCAE—Kaufmann & Baer Co., Pittsburg, Pa.	650-	461-	500
WCAJ—Nebraska Wesleyan Univ., Univ. Place, Nebr.	1180-	254-	500
WCAL—St. Olaf College, Northfield, Minn.	890-	337-	500
WCAO—A. A. & A. S. Brager, Baltimore, Md.	1090-	275-	100
WCAP—Cheaspeake & Potomac Tel. Co., Wash., D. C.	640-	469-	500
WCAR—Southern Radio Corp. of Texas, San Antonio, Tex.	1140-	263-	500
WCAU—Durham & Co., Philadelphia, Pa.	1080-	278-	500
WCAX—University of Vermont, Burlington, Vt.	1200-	250-	100
WCBD—Wilbur G. Voliva, Zion, Ill.	870-	345-	5000
WCBQ—First Baptist Church, Nashville, Tenn.	1270-	236-	100
WCCO—Washburn Crosby Co., Minneapolis, Minn.	720-	416-	5000
WCEE—Liberty Weekly, Elgin, Ill.	1090-	275-	1000
WCLS—H. M. Couch, Joliet, Ill.	1400-	214-	150
WCSH—Congress Square Hotel Co., Portland, Me.	1170-	256-	500
WCWS—Charles W. Selen, Providence, R. I. (Portable)	1430-	210-	100
WCX and WJR—The Detroit Free Press and Jewett Radio and Phonograph Co., Pontiac, Mich., (operating jointly).	580-	517-	2500
WDAD—Dad's Auto Accessories, Inc., Nashville, Tenn.	1330-	226-	150
WDAE—Tampa Daily News, Tampa, Fla.	1100-	273-	250
WDAF—Kansas City Star, Kansas City, Mo.	820-	366-	500
WDAG—J. Laurence Martin, Amarillo, Tex.	1140-	263-	100
WDBE—Gilham-Schoen Electric Co., Atlanta, Ga.	1110-	270-	100
WDBK—M. F. Broz Radio Store, Cleveland, O.	1320-	227-	100
WDBO—Rollins Garage, Winter Park, Fla.	1250-	240-	500
WDCH—Dartmouth College, Hanover, N. H.	1170-	256-	100
WDOD—Chattanooga Radio Co., Inc., Chattanooga, Ill.	1170-	256-	500
WDWF—Dutee W. Flint, Cranston, R. I.	680-	441-	500
WEAF—American Tel. & Tel. Co., New York, N. Y.	610-	492-	5000
WEAI—Cornell University, Ithaca, N. Y.	1180-	254-	500
WEAM—Borough of North Plainfield, N. Plainfield, N. J.	1150-	261-	250
WEAN—Shepard Co., Providence, R. I.	1110-	270-	500
WEAO—Ohio State University, Columbia, Ohio.	1020-	294-	500
WEAR—Goodyear Tire & Rubber Co., Cleveland, Ohio.	770-	389-	750
WEAU—Davidson Bros. Co., Sioux City, Iowa.	1090-	275-	100

The Heart of Your Radio Set

A Grid Leak is essential on every set. There are few sets made which wouldn't be improved by the use of a Variable Grid Leak.

Even the set makers admit that.

But those makers say—"Show us a **good** Variable Grid Leak,"—because they know that most of the variables on the market have been a failure.

Right now -- we're showing them

Buy It

Volt-X Ball-Bearing Variable Grid Leak

Try It

If you are not satisfied, return it and get your money back

This GRID LEAK is made by an organization which has been handling delicate electrical instruments for years. We know what it means to build accurately and substantially. We KNOW that this GRID LEAK is as nearly perfect as human hands and precise machinery can make it —we're glad to have you try it with the knowledge that if it doesn't do what we claim for it, your money will be refunded.

Clip the coupon, and send it in with $1.00—a grid leak will be mailed at once.

BURTON & ROGERS MFG. CO.

755 Boylston St. Boston, Mass.

Please send me one of your VOLT-X VARIABLE GRID LEAKS.

I enclose $1.00 with the understanding that this merchandise is guaranteed to give satisfaction, or may be returned.

NAME. . . . . .

ADDRESS. . . . . .

	K.C.	W.L.	W.P.
WEBC—Walter C. Bridges, Superior, Wis.	1240-	242-	100
WEBH—Edgewater Beach Hotel Co., Chicago, Ill.	810-	370-	1500
WEBJ—Third Avenue Railway Co., New York, N. Y.	1100-	273-	500
WEBL—Radio Corp. of America, United States (portable)	1330-	226-	100
WEBM—Radio Corp. of America, United States (portable)	1330-	226-	100
WEBW—Beloit College, Beloit, Wis.	1120-	268-	500
WEEI—Edison Electric Illuminating Co., Boston, Mass.	630-	476-	500
WEMC—Emmanuel Missionary Col., Berrien Springs, Mich.	1050-	286-	500
WENR—All-American Radio Corp., Chicago, Ill.	1130-	266-	1000
WEW—St. Louis University, St. Louis, Mo.	1210-	248-	100
WFAA—Dallas News & Dallas Journal, Dallas, Tex.	630-	476-	500
WFAV—University of Nebraska, Lincoln, Neb.	1090-	275-	500
WFBG—William F. Gable Co., Altoona, Pa.	1080-	278-	100
WFBH—Concourse Radio Corp., New York, N. Y.	1100-	273-	500
WFBI—Galvin Radio Supply Co., Camden, N. J.	1270-	236-	250
WFBJ—St. John's University, Collegeville, Minn.	1270-	236-	100
WFBL—Onondoga Hotel, Syracuse, N. Y.	1190-	252-	100
WFBM—Merchant Heat & Light Co., Indianapolis, Ind.	1120-	268-	250
WFBR—Fifth Infantry, Maryland N. G., Baltimore, Md.	1180-	254-	100
WFDF—Frank D. Fallain, Flint, Mich.	1280-	234-	100
WFI—Strawbridge & Clothier, Philadelphia, Pa.	760-	395-	500
WFKB—Francis K. Bridgman, Chicago, Ill.	1380-	217-	500
WFRL—Robert Morrison Lacey, Brooklyn, N. Y.	1460-	205-	100
WGBB—Harry H. Carman, Freeport, N. Y.	1230-	244-	100
WGBF—Finke Furniture Co., Evansville, Ill.	1270-	236-	100
WGBS—Gimbel Bros., New York	950-	316-	500
WGBU—Florida Cities Fin. Co., Fulford By-The-Sea, Fla.	1080-	278-	500
WGBX—University of Maine, Orono, Me.	1190-	252-	100
WGCP—D. W. May, Newark, N. J.	1190-	252-	500
WGES—Coyne Electrical School, Oak Park, Ill.	1200-	250-	500
WGHB—Geo. H. Bowles Developments, Clearwater Fla.	1130-	266-	500
WGHP—Geo. H. Phelps, Inc., Detroit, Mich.	1110-	270-	1500
WGMU—A.H.Grebe&Co.,Inc.(portable),Richmond Hill,N.Y.	1270-	236-	100
*WGN—The Tribune, Chicago, Ill.	990-	302-	1000
WGR—Federal Telephone Mfg. Corp., Buffalo, N. Y.	940-	319-	750
WGST—Georgia School of Technology, Atlanta, Ga.	1110-	270-	500
WGY—General Electric Co., Schenectady, N. Y.	790-	380-	5000
WHA—University of Wisconsin, Madison, Wis.	560-	535-	750
WHAD—Marquette Univ. and Mil. Jour., Mil., Wis.	1090-	275-	500
WHAM—University of Rochester, Rochester, N. Y.	1080-	278-	100
WHAP—Wm. H. Taylor Finance Corp., New York, N. Y.	1250-	250-	500
WHAR—Seaside Hotel, Atlantic City, N. J.	1090-	275-	500
WHAS—Courier Journal & Louisville Times	750-	400-	500
WHAT—George W. Young, Minneapolis, Minn.	1140-	263-	500
WHAV—Wilmington Elec. Specity Co., Wilmington, Del.	1130-	266-	100
WHAZ—Rensselaer Polytechnic Institute, Troy, N. Y.	790-	380-	1000
WHB—Sweeney School Co., Kansas City, Mo.	820-	366-	500
WHBF—Beardsley Specialty Co., Rock Island, Ill.	1350-	222-	100
WHBH—Culver Military Academy, Culver, Ind.	1350-	222-	100
WHBP—Johnstown Automobile Co., Johnstown, Pa.	1170-	256-	100
WHBW—D. R. Kienzle, Philadelphia, Pa.	1390-	216-	100
WHDI—Wm. Hood Dunwoody I. Inst., Minneapolis, Minn.	1080-	278-	500
WHEC—Hickson Electric Co., Inc., Rochester, N. Y.	1160-	258-	100
WHK—Radio Air Service Corp., Cleveland, O.	1100-	273-	250
WHN—George Schubel, New York, N. Y.	830-	361-	500
WHO—Bankers Life Co., Des Moines, Iowa	570-	526-	5000
WHT—Radiophone Broadcasting Corporation, Deerfield, Ill.	1260-	238-	2500
WIAD—Howard R. Miller, Philadelphia, Pa.	1200-	250-	100
WIAS—Home Electric Co., Burlington, Iowa	1180-	254-	100
WIBA—The Capital Times Studio, Madison, Wisc.	1270-	236-	100
WIBC—L. M. Tate Post No. 39, V.F.W. St.Petersburg, Fla.	1350-	222-	100
WIBO—Nelson Brothers, Chicago, Ill.	1330-	226-	1000
WIBW—L. L. Dill, Logansport, Ind.	1360-	220-	100
WIBX—Grid-Leak, Inc., Utica, N. Y.	1460-	205-	150
WIL—St. Louis Star, Benson Radio Co., St. Louis, Mo.	1100-	273-	250
WIP—Gimbel Bros., Philadelphia, Pa.	590-	508-	500
WJAD—Jackson's Radio Eng. Laboratories, Waco, Texas.	850-	353-	500
WJAG—Norfolk Daily News, Norfolk, Nebr.	1110-	270-	200
WJAM—D. M. Perham, Cedar Rapids, Ia.	1120-	268-	100
WJAR—The Outlet Co., Providence, R. I.	980-	306-	500
WJAS—Pittsburgh Radio Supply House, Pittsburgh, Pa.	1090-	275-	500
WJAX—City of Jacksonville, Jacksonville, Fla.	890-	337-	1000
WJAZ—Zenith Radio Corp., Mt. Prospect, Ill. (Limited)	930-	322-	1500
WJBI—Robert S. Johnson, Red Bank, N. J.	1370-	219-	250
WJBL—Wm. Gushard Dry Goods Co., Decatur, Ill.	1110-	270-	500
WJBQ—Bucknell University, Lewisburg, Pa.	1420-	211-	100
*WJJD—Supreme Lodge L. O. Moose, Mooseheart, Ill.	810-	370-	500
WJR—Same as WCX.			
WJY—Radio Corporation of America, New York, N. Y.	740-	405-	1000
WJZ—Radio Corporation of America, New York, N. J.	660-	454-	1000
WKAF—WKAF Broadcasting Co., Milwaukee, Wis.	1150-	261-	500
WKAQ—Radio Corporation of Porto Rico, San Juan, P. R.	880-	341-	500
WKAR—Michigan Agric. Col., E. Lansing, Mich.	1050-	286-	1000
WKBB—Sanders Bros., Joliet, Ill.	1400-	214-	100
WKBE—K. and B. Electric Co., Webster, Mass.	1300-	231-	100
WKBG—C. L. Carrell (portable), Chicago, Ill.	1390-	216-	100
WKBK—Shirley Katz, New York, N. Y.	1430-	210-	500
WKRC—Kodel Radio Corp., Cincinnati, O.	710-	422-	1000
WKRC—Kodel Radio Corp., Cincinnati, O.	920-	353-	1000
WKY—E. C. Hull and H. S. Richards, Oklahoma, Okla.	1090-	275-	100
WLAL—First Christian Church, Tulsa, Okla.	1200-	250-	100
WLBL—Wisconsin Dept. of Markets, Stevens Point, Wis.	1080-	278-	500
WLIB—Liberty Weekly, Elgin, Ill.	990-	302-	2500
WLIT—Lit Bros., Philadelphia, Pa.	760-	395-	500
WLS—Sears, Roebuck Co., Chicago, Ill.	870-	345-	1500
WLSI—Lincoln Studios, Inc., Providence, R. I.	680-	441-	500
WLTS—Lane Technical High School, Chicago, Ill.	1160-	258-	100
WLW—Crosley Radio Corp., Harrison, O.	710-	422-	5000 / 500
WLWL—Mis. Soc. of St. Paul the Apostle, New York	1040-	288-	1500
WMAF—Round Hills Radio Corp., Dartmouth, Mass.	680-	441-	1000
WMAK—Norton Laboratories, Lockport, N. Y.	1130-	466-	500
*WMAQ—Chicago Daily News, Chicago, Ill.	670-	448-	1000
WMAZ—Mercer University, Macon, Ga.	1150-	261-	500
WMBB—American Bond & Mortgage Co., Chicago, Ill.	1200-	250-	500
WMBC—Michigan Broadcasting Co., Detroit, Mich.	1170-	256-	100
WMBF—Fleetwood Hotel, Miami Beach, Fla.	780-	384-	500
WMC—Commercial Appeal, Memphis, Tenn.	600-	500-	500
WMCA—Greeley Square Hotel Co., Hoboken, N. J.	880-	341-	500
WNAB—Shepard Stores, Boston, Mass.	1200-	250-	100
WNAC—Shepard Stores, Boston, Mass.	1070-	280-	500
WNAD—University of Oklahoma, Norman, Okla.	1180-	254-	250
WNAP—Wittenberg College, Springfield, Ohio.	1090-	275-	100
WNAT—Lennig Bros. Co., Philadephia, Pa.	1200-	250-	100
WNBH—New Bedfrod Hotel, New Bedford, Mass.	1210-	248-	250
WNJ—Radio Shop of Newark, Newark, N. J.	1290-	233-	150
*WNOX—People's Tel. & Tel. Co., Knoxville, Tenn.	1120-	268-	100
WNYC—City of New York, New York, N. Y.	1190-	252-	100
WOAI—Southern Equipment Co., San Antonio, Texas.	760-	395-	2000
WOAN—James D. Vaughn, Lawrenceburg, Tenn.	1060-	283-	500
WOAW—Woodmen of the World, Omaha, Nebr.	570-	526-	1000
WOAX—Franklyn J. Wolff, Trenton, N. J.	1250-	240-	500
WOC—Palmer School of Chiropractic, Davenport, Iowa	620-	484-	5000
WODA—O'Dea Temple of Music, Paterson, N. J.	1340-	224-	250
WOI—Iowa State College, Ames, Iowa	1110-	270-	750
WOK—Neutrowound Radio Mfg. Co., Homewood, Ill.	1380-	217-	5000
WOO—John Wanamaker, Philadelphia, Pa.	590-	508-	500
*WOOD—Grand Rapids Radio Co., Grand Rapids, Mich.	1240-	242-	100
WOQ—Unity School of Christianity, Kansas City, Mo.	1080-	278-	1000
WOR—L. Bamberger & Co., Newark, N. J.	740-	405-	500
WORD—People's Pulpit Association, Batavia, Ill.	1090-	275-	5000
WOS—Missouri State Marketing Bureau, Jefferson City, Mo.	680-	441-	500
WOWO—Main Auto Supply Co., Fort Wayne, Ind.	1320-	227-	500
WPCC—North Shore Congregational Church, Chicago, Ill.	1160-	258-	500
WPG—Municipality of Atlantic City, Atlantic City, N. J.	1000-	300-	500
WPRC—Wilson Printing & Radio Co., Harrisburg, Pa.	1390-	216-	100
WPSC—Pennsylvania State College, State College, Pa.	1150-	261-	500
WQAA—Horace A. Beale, Jr., Parkesburg, Pa.	1360-	220-	500
*WQAC—Gish Radio Service, Amarillo, Tex.	1280-	234-	100
WQAM—Electrical Equipment Co., Miami, Fla.	1140-	263-	100
WQAN—Scranton Times, Scranton, Pa.	1200-	250-	100
WQAO—Calvary Baptist Church, New York, N. Y.	833-	360-	100
*WQJ—Calumet Rainbow Broadcasting Co., Chicago, Ill.	670-	448-	500
WRAK—Economy Light Co., Escanaba, Mich.	1170-	256-	100
WRAM—Lombard College, Galesburg, Ill.	1230-	244-	100
WRAX—Flexon's Garage, Gloucester City, N. J.	1120-	268-	500
WRC—Radio Corporation of America, Washington, D. C.	640-	469-	1000
WRCO—Wynne, Radio Co., Raleigh, N. C.	1190-	252-	100
WREO—Reo Motor Car Co., Lansing, Mich.	1050-	286-	500
WRM—University of Illinois, Urbana, Ill.	1100-	273-	500
WRMU—A. H. Grebe & Co., Richmond Hill, N. Y.	1270-	236-	100
WRNY—Experimenter Publishing Co., New York, N. Y.	1160-	258-	500
WRR—Dallas Police & Fire Dept., Dallas, Tex.	1220-	246-	500
WRST—Radiotel Mfg. Co., Bay Shore, N. Y.	1390-	216-	250
WRVA—Larus & Brother Co., Inc., Richmond, Va.	1170-	256-	1000
WRW—Tarrytown Radio Research Labs., Tarrytown, N. Y.	1100-	273-	500
WSAI—United States Playing Card Co., Mason, O.	920-	326-	5000
WSAJ—Grove City College, Grove City, Pa.	1310-	229-	250
WSAN—Allentown Call Publishing Co., Allentown, Pa.	1310-	229-	100
WSAR—Doughty & Welch Electric Co., Fall River, Mass.	1180-	254-	100
WSAX—Zenith Radio Corp., Chicago, Ill.	1120-	268-	100
WSB—Atlanta Journal, Atlanta, Ga.	700-	428-	1000
WSBC—World Battery Co., Chicago, Ill.	1430-	210-	500
WSBF—Stix, Baer & Fuller, St. Louis, Mo.	1100-	273-	250
WSBT—South Bend Tribune, South Bend, Ind.	1090-	275-	250
WSDA—The City Temple, New York, N. Y.	1140-	263-	250
WSKC—World's Star Knitting Co., Bay City Mich.	1150-	261-	100
WSMB—Saenger A'm'h Co., & Maison Blanche N. O. La.	940-	319-	500
WSM— Nat'l Life & Accident Ins. Co., Nashville, Tenn.	1060-	283-	1000
WSMK—S. M. K. Radio Corp., Dayton, Ohio.	1090-	275-	500
WSOE—School of Eng'rng of Milwaukee, Milwaukee, Wis.	1220-	246-	500
WSRO—Radio Co., Hamilton, Ohio.	1190-	252-	100
*WSSH—Tremont Temple Baptist Church, Boston, Mass.	1150-	240-	500
WSUI—State University of Iowa, Iowa City, Iowa.	620-	484-	500
WSY—Alabama Polytechnic Institute, Auburn, Ala.	1200-	250-	500
WTAB—Fall River Daily Herald Pub. Co., Fall R'vr, Mass.	1130-	266-	100
WTAC—Penn. Traffic Co., Johnstown, Pa.	1120-	268-	100
WTAG—Worcester Telegram Pub., Co., Worcester, Mass.	1120-	268-	500
WTAM—Willard Storage Battery Co., Cleveland O.	770-	389-	3500
WTAR—Reliance Electric Co., Norfolk, Va.	1150-	261-	100
WTAW—Agri. & Mech. Col. of Texas, Col. Station, Tex.	1110-	270-	500
WTIC—Travelers Insurance Co., Hartford, Conn.	860-	349-	500
WWAD—Wright & Wright, Philadelphia, Pa.	1200-	250-	250
WWGL—Radio Engineering Corp., Richmond Hill, N. Y.	1410-	213-	500
WWI—Ford Motor Co., Dearborn, Mich.	1130-	266-	500
WWJ—Detroit News, Detroit, Mich.	850-	353-	1000
WWL—Loyala University, New Orleans, La.	1090-	275-	100

*Additions and corrections.

†Wave Length Temporarily Assigned.