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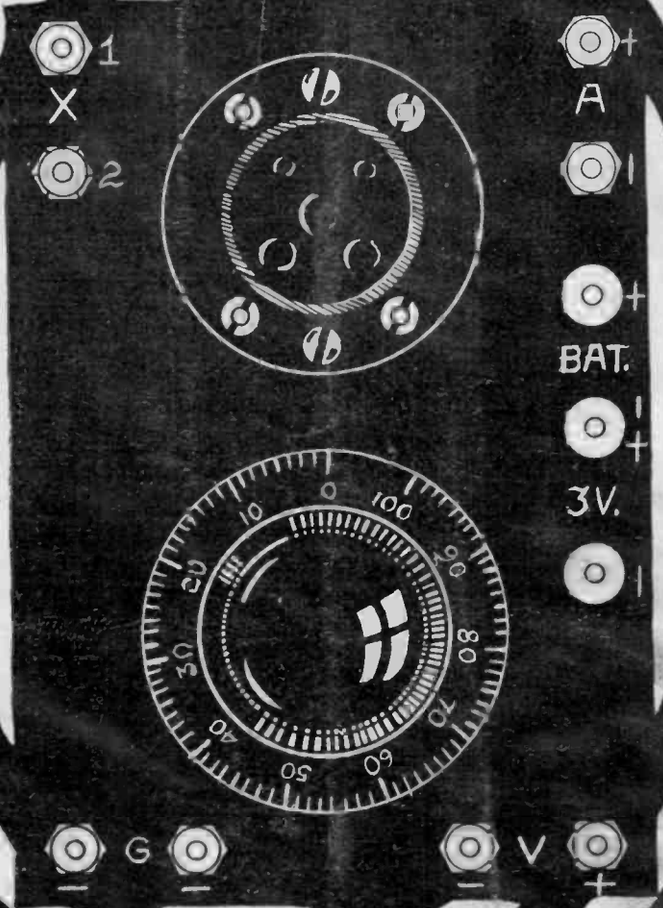

A Vacuum Tube Voltmeter

See Page 8

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Have been using one of your B. S. T.-5 sets about three months and I certainly am pleased with the results. I am using a 90 ft. aerial, B eliminator, storage battery and a cone speaker and have logged 115 stations from WOK, 217.3, to KSD, 545.1, all on loud speaker loud enough to be heard all over my house with a clear tone. My neighbors say they have heard it several times in their house with all windows closed and enjoyed it.

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Law Enacted, Relief Near
Commission to Cut Down Interference

THE enactment of the radio control bill, which creates a Government agency to regulate broadcasting, ends a deadlock that existed between the Senate and the House of Representatives for several years. The Senate adopted the compromise measure which represented the conciliatory preference of a conference committee, consisting of a group of Senators and Representatives.

A commission of five is created, which is what the Senators wanted, while the Secretary of Commerce enjoys some powers, thus meeting in part the desires of the House. After the first year of the commission's existence the Secretary of Commerce assumes most of the powers, and the commission functions as a quasi-judicial body, with rather appellate jurisdiction.

What It Means to Listeners.

To radio listeners the passage of the Dill-White compromise bill means that the Federal Government will assume charge of broadcasting, thus filling a void. Since nearly a year ago nobody has exercised authority over wavelengths, power, time on the air, etc., because the courts then ruled that the law of 1912 did not give the Secretary of Commerce such power, but that Congress had withheld that power to itself and had not exercised it. Hence, from now on, there will be a duly constituted authority to deal with the problem of interference in all its aspects, particularly in stopping wavelength jumping, and compelling stations as a whole to act for the common good, rather than merely for their individual advantage.

Interference is one of the problems that the commission is expected to tackle as soon as it gets started. With stations properly regulated, and in immediate danger of losing their licenses if they do not obey instructions, it is expected that inter-station interference will be greatly curtailed, and better quality of reception will result, together with restoration of the advantage of being able to tune through locals to get distant stations.

All Licenses at Mercy of Commission

Several plans already are afoot and will be presented to the commission. One of them contemplates the division of all stations into two classes, national and local stations, with wavelengths allotted to them, instead of wavelengths being seized at will. Power would be strictly limited.

One of the strong points of the law is that within a couple of weeks all station licenses will expire automatically, and that vests in the commission the power to issue licenses as public policy dictates. While the disposition to renew licenses is expected to prevail, nevertheless the commisson enjoys a sort of "police power" in that it can mete out punishment to offenders by withholding or refusing licenses.

The enactment of the law was hailed by radioists throughout the United States. In fact, only the strength of public sentiment compelled the Congress to take action. Just before enactment of the bill a flood of letters and telegrams descended on legislators at Washington from all over the country, urging adoption. Members of the trade were prominent among the petitioners, as they felt that, when the air was cleared of interference, business would be better.

ADOPTION FOLLOWS FOUR YEARS OF CONTROVERSY

Washington.

Enactment of the Dill-White radio bill into law was the culmination of more than four years' efforts in the Senate and House.

Representative Wallace White, Jr., of Maine, co-author of the bill, first became interested in radio legislation during the Summer of 1922. He introduced his first bill during the 1922 Fall session of Congress. His first bill passed the House but died in the Senate.

Early in the fall session of 1923, White introduced another radio bill on which extensive hearings were held. It was reported to the House and placed upon the calendar. Just when the House was about ready to take it up, Secretary of Commerce Herbert Hoover sent Mr. White a letter in which he declared he thought it unwise to enact a law in the then transitory and experimental stage of broadcasting. Mr. Hoover's letter was responsible for the radio bill being dropped, although many members of the House did not understand or sympathize with Mr. Hoover's views.

Nothing else was done about radio legislation until the fall of 1925, when Mr. White again introduced a radio bill. This bill passed the House early in 1926 and went to the Senate. The Senate Interstate Commerce Committee adopted the Dill bill as a substitute and reported it to the Senate for passage.

The Dill bill was adopted by the Senate a few days before adjournment and went to conference between the Senate and House. The conferees were unable to reach an agreement before Congress adjourned.

Early in the present session, the conferees took up the two bills but did not reach an agreement on a compromise measure until late in January.

The House adopted the compromise bill two days after it was reported back to it, although objections were expressed to some of its provisions.

In the Senate a filibuster prevented adoption for a short time, but the compromise bill was finally passed and approved by the President, who was strongly in favor of remedial legislation.

SUMMARY OF LAW

The radio control law, a compromise that fully satisfied nobody, but was agreeably accepted as the best that was obtainable from legislators with conflicting minds, establishes a Commission of five, which gets most of the authority over radio for one year. The Secretary of Commerce during that year exercises what authority is not vested in the Commission but becomes a more important radio official after the first year, the Commission's power being reduced then. The President is to appoint the Commission, with the advice and consent of the Senate.

Will Classify Stations

The Presidential Commission is empowered to clear up the air by classifying broadcasting stations, prescribing the nature of their service, assigning wave bands, power and time, determining location, regulating the character of apparatus used and controlling interference and chain broadcasting.

All existing broadcasting licenses are supposed to be renewed after the passage of the act, although sixty days of grace are granted in which operators may continue without objection. During the first year the Secretary of Commerce must refer to the Commission all applications for renewal and modification of licenses, but after that only the applications involving controversy.

Anti-monopolistic provisions were placed in the bill, licenses being refused to any person or corporation convicted in Federal Court of unlawfully monopolizing radio communication or trade in radio apparatus in interstate or foreign commerce.

Fine and Imprisonment

As a safeguard against foreign control, the bill forbids the granting or transferring of a license to any alien, any foreign Government or any corporation in which an alien is an officer or in which a fifth of the stock is held by aliens.

Penalties attached to the bill provide a fine of $500 for violating the law or regulations issued under it and a fine of $5,000 or five years' imprisonment, or both, for making a false oath at any hearing or in any required affidavit.

One section declares that equal courtesies are required in political broadcasting and that the sources of paid broadcasting must be announced. Divulging of private radio messages is forbidden.

Seventy-Five Eager To Make the Sacrifice

Washington.

About seventy-five applications have been received by President Coolidge for appointment to the Federal Radio Commisison. It is said at the White House that the President has given considerable thought to the personnel of the Commission.

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Limitation on Stations Backed by Leading Men

The 89 Wave Channels Would Be Divided Into 72 for National Stations and 17 for Local Ones—Recalcitrants Would Be Forced Off Air

Washington.

Tremendous pressure will be brought on the Federal Radio Commission, created by the Dill-White radio law, to eliminate a number of stations now on the air. Evidence of its character and form is already beginning to appear, although the personnel of the commission has not been definitely selected.

Already a plan has been drawn up for clearing the air of interference which will be urged upon the Commission. The plan has the approval of Representative Wallace White. Senator Dill believes it has considerable merit.

Under the plan there would be a radical change in existing allocation of wavelengths, and many stations would be forced to stop broadcasting. It contemplates a division of the broadcasting band into groups of national and local wavelengths. There would be 72 national and 17 local waves.

Distribution Plan

Of the 72 national waves, 48 would go to as many stations for full time operation. All stations would be permitted to qualify for these waves, but they would be scattered throughout the United States and assigned to cities of sufficient size and importance to provide talent worthy of a national audience.

The other 24 national waves would be divided among 48 stations scattered throughout the United States. These 48 stations would each operate half time.

Under the plan, allocations would be made with the view of enabling every listener in the United States to be close enough to receive a number of national stations.

The 17 local waves would go to local stations which would be required to operate with power not exceeding 250 watts so as not to interfere with other stations using the same wave at the same time. All stations which did not get national waves would be forced to accept the local classification or stop broadcasting.

Call Plan Practical

Advocates of this plan are convinced of its practicability. They point out that under existing conditions, it is difficult if not impossible to receive distant stations with sufficient clarity to enjoy a complete rendition because of station interference.

"It's a question of whether we will have 72 national stations and 500 local stations, or 600 local stations," one of the sponsors said. "There can be no question that with 72 national stations operating each night free from station interference most listeners will be able to get a dozen or more of them satisfactorily.

"If the present situation is continued, it will mean that listeners must depend entirely on local stations for entertainment.

"Nor would most stations now in operation be deprived of the privilege of serving their local communities. Except in congested areas like New York and Chicago, all existing stations would be permitted to continue operation on the local waves, but with decreased power.

Hardship "Not Too Great"

"The limitation of the power of these stations would not be too great a hardship on them. At present they are able to provide reliable service only to their local communities, and they will continue to do that."

In the plan is also a proposal to prevent the national stations from hooking up in chain broadcasts beyond a certain point. This would mean that most of the time there would be 72 different programs broadcast by stations with sufficient power to be heard almost throughout the United States.

Armstrong is Suggested for Commission Post

Washington.

A conflict between President Coolidge and Congress over the personnel of the Federal Radio Commission seems likely, according to those who are in close touch with the White House and leaders of the Senate.

In the first place, the Senate is going to examine critically the selections of the President for evidence of Secretary Hoover's handiwork.

In the second place, the Senate interpretation of eligibility for the Commission is at variance with that of the White House.

The sponsors of the Dill-White law assume that the clause requiring candidates for the Commission to be "actual residing citizens of a State" prevents the selection of "lame ducks" and residents of the District of Columbia for the post. Under the Congressional interpretation, "lame ducks" are not eligible because they have been living in Washington.

The White House looks at it in a different light, however. Advisers of the President point out that the courts have held that members of Congress are actual residing citizens of the states which they represent.

Among those considered for the Commission were Senator Irvine L. Lenroot, of Wisconsin; John Hayes Hammond, inventor, of Massachusetts; Major E. H. Armstrong, of Columbia University; Lambdin Kay, of Georgia, and Representative Frank Scott, of Michigan.

Among those mentioned for the Commission are Acting Secretary of Commerce Stephen Davis, Chief Radio Supervisor W. D. Terrell, and Dr. J. H. Dellinger, Chief of the Radio Laboratory of the Bureau of Standards. It is known on the best of authority that these men do not want the job.

The President has asked the views of Senator Dill and Representative White about the personnel of the Commission. Neither Mr. White nor Senator Dill recommended anyone for the Commission. But they did give their views as to the general character of the Commission as a whole.

They would like to see the Commission consist of a professor, an expert on economics, a radio expert and two lawyers. They would like to see men with vision appointed, men who are capable of rising above political and partisan influences. They believe it will be necessary first of all to consider the interests of the entire country rather than any particular section thereof. The President considered the suggestions.

Busy Builders Must First Get Commission O.K.

Washington.

Until the Federal Radio Commission begins to function radio is left without the slightest vestige of control or regulation.

Immediately upon signature of the Dill-White bill by the President, the radio section of the Department of Commerce stopped functioning. It no longer had the power to issue licenses, which was practically the only authority it had exercised.

Applications for licenses for stations are continuing to reach Mr. Terrell's office. In each case, Mr. Terrell is notifying the applicant that application must be made to the Federal Radio Commission; that the Department of Commerce no longer has the authority to issue licenses.

For a time Mr. Terrell considered sending a warning to the owners of new stations under construction calling their attention to the provision of the new law which requires that a construction permit be obtained from the Federal Radio Commission before work is continued.

It is assumed, however, that the builders of new stations must know about the new law. Radio inspectors, however, will point out the provisions of the law to those who seek information abut it.

Meantime, it is pointed out, stations which continue construction without first getting a permit to do so, will violate the law and probably prejudice their chances of ever getting a license.

Twelve Stations "Under the Wire"

Washington.

Twelve new stations won in their race to finish construction and obtain a license before enactment of the Dill-White radio law. Licenses have been issued to these stations by the Department of Commerce. One station is of 1,000 watts power.

New Stations

	w.	kc.	wts.
WFIW—The Acme Mills, Hopkinsville, Ky. ...	356.9	840	1,000
WNBK—H. C. Barton Elec. Co., LeRoy, N. Y...	354	847	250
KGFM—Geo. W. Johnson, Yuba City, Calif.....	450	666	15
KGFK—Kittson Co. Enterprise, Hallock, Minn.	225	1333	100
WNBJ—Lonsdale Bapt. Ch., Knoxville, Tenn. ...	335	895	10
WNBI—W. J. Romanouski, Peru, Ill.	357	840	10
KWBS—Schaeffer Mfg. Co., Portland, Ore.	200	1499	10
WNBL—H. R. Storm, Bloomington, Ill.	495	606	15
KLIT—L. I. Thompson, Portand, Oregon ..	380	798	10
KGFL—Trinidad Broadcast Co., Trinidad, Colo..	222	1351	50
WALK—Albert A. Walker (Portable)	285	1052	50
KELW—E. L. White, Burbank, Calif.	535	560	250

Discontinued

WLBU—Canastota, N. Y.
WGBR—Marshfield, Wisc.

CHANGES ....

The call of WMBX, Columbus, Miss., has been changed to WCOC. WBBC Brooklyn, has changed its wave to 267.7 meters, 1120 kc.

WGBU, Fulford, Fla., has changed its wave from 277.6 meters, 1,080 kc, to 384.4 meters 780 kc.

WCRW, Chicago. has changed its wave to 410.7 meters 730 kc.

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Sensible Volume Control
Finds Its Way Into the Good Receivers

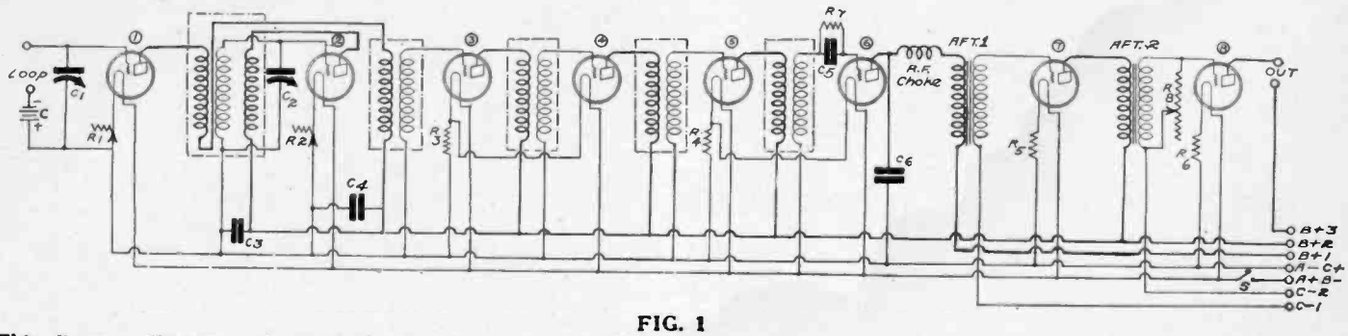

FIG. 1

This diagram illustrates the methods of volume control. R1 and R2 are filament rheostats in the radio frequency end of the circuit, a very satisfactory method. R8 is a potentiometer across the secondary of the second audio transformer, AFT2. It might better be across the secondary of the first audio transformer AF1.

By Charles Gribben

EVERYBODY wants a volume control on the radio set now. The day when the excellence of a radio set was measured by the number of blocks that the reproducer could be heard has passed. Now the excellence of the receiver is mainly measured by the quality which the loud speaker emits, and the ease with which the volume may be controlled. A simple and adequate control is now considered a prime necessity in the set.

Many methods of volume control have been recommended. Some of these concentrate the attention on the radio frequency end of the circuit and others on the audio frequency end.

In the early days the system most frequently used was the jack and plug arrangement. That has entirely passed out, and no one is shedding any tears over its demise.

Another method practiced by some fans was the use of a filament rheostat. Especially was this used in the last tube.

Prevention That Didn't

Where else should the volume control rheostat be used except in the last tube where volume was the greatest? This method was especially applied to prevent overloading of the last tube. The fact was that the more the volume was throttled down by this means the worse the overloading became.

Well, that system now is almost completely out of use. Education of the fans put the finishing touches on that method. But even yet this abominable method is used in the early stages of the audio amplifier. A few more lessons in the principles and operation of vacuum tube amplifiers will be required to put an end to the practice.

Another method of similar characteristics is the use of a shunt resistance across the loud speaker terminals, usually in the form of a variable resistance. This method controls the amount of output all right but it does not help the overloading condition of the last tube. It has the opposite effect. The lower the shunt resistance is the lower is the volume but also the worse is the quality.

Series Resistor Better

A better method of controlling the volume is to use a variable resistance in series with the speaker. This both cuts the volume and it tends to improve the quality at the same time. A greater input to the tube is allowable without distortion.

An atrocious method of controlling the volume is the use of a variable grid bias for the purpose. In order that this method be effective in greatly reducing the volume it is necessary either to increase the negative grid bias very greatly or else make the bias very much positive. One is as bad as the other.

The reduction of the plate voltage with a view of stopping down the volume is no better than the use of excessive grid bias, positive or negative, or the use of filament current control. When controlling the volume the three batteries or other voltage current sources in the audio frequency amplifier should be strictly left alone.

Resistor in Proper Place

A popular method of controlling volume is by the use of a shunt variable resistance across the input to the tube, for example a control across the secondary of an audio transformer. This is not a bad method but it is not the best by any means. In a measure it has the same effect as a similar variable resistance across the primary of the transformer, which is also a popular method of controlling the volume. Now a variable resistance across the primary decreases the load impedance to the tube preceding it and as soon as the impedance of the load on the tube becomes low, quality suffers. Harmonics are introduced into the signal. That is undesirable, of course. But the method of controlling the volume by a variable resistance across either the primary or the secondary is fair.

Is there then no method of volume control in the audio frequency amplifier which can be recommended under all conditions? There is one good method and only one, and that method is the use of a high resistance potentiometer across the secondary of the transformer. If the circuit is direct coupled the potentiometer may take the place of the grid leak resistance.

The Logical Place

A high resistance potentiometer does not affect the primary of the circuit to any appreciable extent, either directly or indirectly, and its resistance always remains constant no matter what the adjustment for volume may be.

Where should the control potentiometer be placed in the audio frequency amplifier? It will have the same effect on reducing volume in no matter what amplifier stage it is placed, but from the point of view of quality it will introduce least distortion if it is placed in the input circuit of the first audo frequency amplifier.

There is, therefore, only one logical method of controlling volume in the audio frequency amplifier, and that is by a high resistance potentiometer, and there is only one logical place to put it, in the grid circuit of the first audio frequency tube, after the detector.

The audio frequency output may be controlled in the radio frequency amplifier while the signal is still of high frequency. And here the volume may be controlled by a number of methods which are inadmissible in the audio frequency amplifier. There is then no fear of introducing any appreciable distortion to the audio signal. There is only one thing that should be avoided, and that is a decrease in the selectivity of the set.

One of the best methods of controlling volume in the radio amplifier is by means of a filament rheostat. The signal may be completely throttled out by this means without distortion. At the same time this method tends to increase the selectivity, if the grid return is properly connected. The use of a high variable resistance in the plate circuit is also an excellent method. This controls the plate voltage in the primaries of the RF transformers, or rather it controls the plate current in the plate circuit. Very good control may be obtained in this manner without increasing distortion or without damaging the selectivity.

Methods which are often used but which are not so good as the foregoing are shunt impedances across any of the windings in the radio frequency amplifier. It does not matter very much whether the impedance is a resistance, condenser or inductance coil.

Drags Down Selectivity

Selectivity suffers as soon as any shunt is connected across the windings. A variable resistance is very often connected across the primary winding for controlling volume, but this is not a good method because of the bad effect on the selectivity. The use of a high resistance potentiometer across the tuned secondary circuit is not desirable for the same reason. While this is the only method recommended in the audio frequency circuit it is to be avoided in the radio. Of course, if the resistance of the potentiometer is half megohm or more the effect on the selectivity is not great, but it is noticeable.

A possibly worse effect than the resistance across the tuned circuit is the necessity of using rather long leads in the grid circuit to and from the potentiometer.

The use of a tickler for varying the volume is desirable so long as some regeneration is used. It is very convenient. When the tickler is used to introduce damping in the circuit selectivity suffers and from this point of view the tickler as a volume control is not desirable.

The use of all three favorable methods of volume control in the radio frequency amplifier is often desirable, though not necessary.

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DX Much Better Now

Savants Baffled, While Fans Reap Benefit

By Capt. Peter V. O'Rourke

DX hunting now is better than it has been for some time. Those who have circuits which are at all capable of reaching out for the elusive wave originating somewhere between here and the Antipodes will find that, after all, the wave is not so elusive as it was last year. There must be a reason for this condition.

Not Well Understood

Just what causes the variation in the propagation of a radio wave from year to year is not well understood. Some blame it on sun spots, others on the weather, others on the earth's magnetism, while still others would put the blame elsewhere. There is no doubt that the sun has something to do with it, and long range variation in the weather as well as the earth's magnetism are closely related. But just how they are related is not well known. That is a subject of study at present by those who are in the vanguard of radio progress, in the hope of finding a definite relationship that may be of some practical use in radio work.

The Earth's Effect

Of course, some of the variation in the propagation of the radio wave is caused by terrestrial, or even mundane, phenomena.

The refinements in the radio receivers must be reckoned with. Much of the noise in radio receivers which formerly interfered with distant reception has been done away with, or at least has been greatly reduced. The signals that used to have a difficult time competing with the noise now come through without much trouble at all. Hence a signal of given intensity now seems much louder than it used to, simply because there is not so much heterogeneous competition.

The general increase in power of the broadcast stations also tends to improve the reception of DX. At a given distance from a station there is now a much greater signal strength than formerly, while the natural noises have decreased. Man-made noises have been greatly reduced by systematic and persistent elimination of various sources.

One reason for better DX that must not be forgotten is the fact that fewer fans have squealing receivers. The heterodyne squeal that used to hover around every weak carrier wave due to radiating receivers, can now be heard very rarely. This source of trouble, it will be remembered, was one of the main reasons why the international broadcast tests were a failure. It would seem that a similar attempt to pick up signals from Europe at this time would have a better chance of success, even with the same equipment which failed to "deliver the goods" a year ago.

Competition Hurts

Even where there is no heterodyne squealing around a carrier it is harder for any one to pick up the signals where a very large number of fans are trying at the same time to pick it up. There is only a certain amount of energy per unit volume of space and if that amount, which is very small at best, were divided up into a million parts, there would not be much hope for anybody.

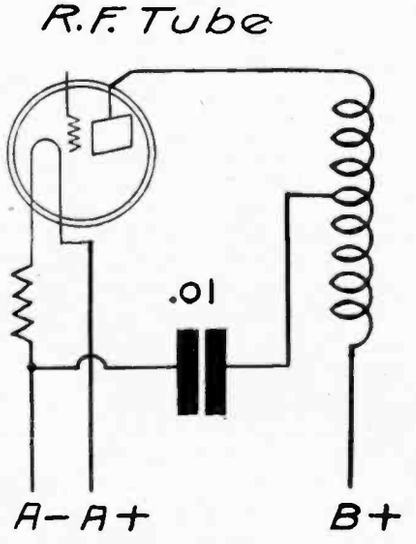
Foolish Things That I Have Read

By Edgar Ryan

Recently I read of a "new" system of neutralization of a radio frequency amplifier. Somehow or other this system had eluded the attention of experimenters and novelty hounds, until the other day the lucky finder triumphantly announced his find. And what did this new thing consist of? Just a new way of connecting the neutralizing condenser! One side of the neutralizing condenser must by force of precedent be connected to the mid tap of the primary of the RF transformer. The other side is left open that the experimenter may try his luck at finding a new point to which he may connect it.

Now there are a few dozen points in the average radio set to which this open terminal may be connected, and the bird that can find a point which some one else has not already used for purposes of neutralization is indeed lucky. According to the recent announcement of the new method the point discovered was the filament. The loose side of the condenser was therefore connected to that point. It was found by experiment that the condenser used had to be rather large, or the order of .01 mfd.

Did it neutralize? Yes, quite effectively. Also it reduced volume greatly and wholly spoilt selectivity. But a still better way of short-circuiting the secondary tuned circuit is to put a screw driver in between the tuning condenser. It has a most complete way of neutralizing a set. It makes absolutely no difference what the wavelength is!



A POOR method of neutralization, in that it is a "short-circuiter."

Not so long ago there came out a device using crystal detectors for amplifiers. This idea bobbed up again just the other day. Well, why cannot crystals be used for amplifiers when amplifier tubes can be used quite effectively as detectors? The desirability of the thing is very intriguing. It would make possible the smallest kind of receiver without tubes and batteries! There have been countless perpetual motion schemes suggested, and many of them much more plausible than this radio scheme. The idea of conservation of energy, fundamental though it is, does not seem to register at all.

I have also read descriptions of multi-tube radio receivers, which have been called greyhounds, DX-getters and Go-geters. Distance is the idea that they are supposed to call to mind. Many of these receivers have been composed of two main parts, gainers and lossers. First a tube has been put in to amplify the signal, then a losser has been put in to limit the amplification. This has been followed by another amplifier and another losser. This series has been extended to several stages.

What Do You Like

In RADIO WORLD—And What Don't You Like?

The Editorial Department of RADIO WORLD has been pretty successful in selecting text matter and illustrations that appeal to radioists. This fact is proven by our newsstand and subscription sales, and by the thousands of letters received regarding features in our various numbers.

But we want to get closer to the desires of our readers. Therefore, we ask you as a RADIO WORLD fan to drop us a line, and let us know what you particularly like in our columns. We ask also to let us know if there is anything in our pages that you do not like.

Eternal vigilance is the price of a periodical's success. While we still reserve the right to edit RADIO WORLD in a manner that seems most beneficial to all concerned, we should be only too glad to have criticisms from our friends, and to give these criticisms conscientious attention.

Write us your likes and dislikes, and thus help you and ourselves.

—THE EDITOR.

Name Spelling Change Gives Him Big Relief

Cincinnati.

What's in a name, anyway?

Plenty of grief, if it's spelled so the public pronounce it half a dozen different ways.

William C. Stoess, musical director and orchestra leader of WLW, the Crosley station at Cincinnati, found that his name was called Stace, Stoce, Stess and even Stooce. This got tiresome, so he has changed the spelling of it to Stace, as far as radio purposes are concerned. That is the correct pronunciation and from now on it will be spelled that way.

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The Variable Condenser Discussed With View Toward Right Choice

By James H. Carroll

Associate, Institute of Radio Engineers

WHILE the tube has often aptly been called the heart of the radio set, nevertheless, the variable condenser fills a highly important function also and, to carry out the simile, might well be termed the pulse of the circuit. It therefore behooves the set-builder to use great care in selecting the proper model for the circuit he is building and it must be absolutely the proper capacity to match the coil with which it is to work. Not only its physical shape and mechanical construction but also its electrical efficiency must be considered. Fortunately, there are many models on the market to choose from and our American-made condensers are marvels of mechanical construction—even cheap condensers often being a first-class job mechanically.

The first and most important thing to be determined after the size, which depends on the space allowed for in the layout, is the exact capacity. This capacity should be determined in microfarads and should exactly match the inductance of the coil to be used in the circuit.

Avoids Mistake

In this way one avoids the possibility of using a .00035 condenser where a .0005 should be used. Capacities usually range from .001 down to .00025, tuned radio frequency circuits generally calling for condensers of .00035 mfd., this value assuring the coverage of the entire wave band in conjunction with the proper coil in this type of circuit.

In building popular circuits the capacity of the condenser should be the one specified by the author and this should not be deviated from, as trouble may follow. The builder, however, may use any particular make he favors, provided it is of the specified capacity. The next important points to look for are mechanical construction, rigidity, trueness and proper alignment. The condenser selected should be able to stand pressure far beyond its apparent strength and should not be susceptible to misalignment by pressure at the corners. A poorly-made condenser of cheap materials may easily be warped by slight pressure and the plates bent sufficiently enough to make it the prime cause of trouble, which will later be hard to trace, by being shorted when the screws are being tightened in fastening the condenser to the panel.

An easily warped condenser will also prove a prolific cause of hand capacity and will throw out tuning with pressure on the dial, and will cause erratic changes in wavelength if the panel warps. The fit of the shaft is also highly important. The well-designed condenser should show no wabble or weave from side to side when pushed back and forth on the shaft. See, also that a secure form of adjustment is provided for taking up the wear on the shaft and that a good spring contact exists between the rotating part and the frame to insure efficient electrical contact at all dial settings.

Electrical Aspect Secondary

It is axiomatic that the electrical characteristics of the condenser are really secondary to the mechancial design. Although a poorly designed condenser has greater losses than one that is perfectly designed, and the results will not be as good, the resistance of even the poor one is a very small percentage of the total loss in the circuit. This does not mean that it is not necessary to use the best designed condenser obtainable, but that if one is limited to a hard and fast choice between one that is good mechanically but not as good electrically as another which is good mechanically, the one which is mechanically efficient will the better serve the purpose.

Losses in a condenser can be traced to many causes. For instance, the problem of dielectric loss, which is due to the dielectric in the field, will arise. Dielectric is the material used between the plates. In most variable condensers this is air, which has practically no losses. Nevertheless, a part of the condenser should be made with an insulating material, such as Bakelite or hard rubber, to support the stator plates, to insure against dielectric losses. If this insulation is not in the right proportion and is placed in a strong part of the field appreciable losses result. Insulation of this kind belongs at the ends furtherest from the center and not near the shaft. As a usual result, using end plates made of some insulating material does not make for as high efficiency as the putting the insulation as far as possible from the shaft.

Leakage Losses

Aside from introduced losses caused by the material itself there may also be losses caused by direct leakage across the insulator or through it. This is called surface leakage and is, in most instances, caused by dust. This is eliminated by keeping the apparatus enclosed or by regular cleaning of the plates and surfaces of the condenser with a piece of silk and an ordinary pipe cleaner which can be used for cleaning between the plates. See, also that the condenser chosen is a welded job, which is best both mechanically and electrically and not subject to any losses caused by direct current resistance in the plate and entire assembly.

Tuning Characteristics

The facts here set forth for our guidance in the choice of a condenser that will do the work best have no bearing on the type of condenser, whether it be straight line wavelength, straight line frequency, straight line capacity, or straight line tuning (midline). The only thought to consider in connection with the circuit being constructed is that the straight line frequency type will give better separation of stations on low waves at the expense of the higher waves.

These, therefore, are your main requirements in the condenser to be used in your new circuit, and any condenser you select from among the standard brands, if it is of the capacity specified by the designer, is bound to give good service in wearing ability and long-lived efficiency. And, as I said before, stick to the advertised brands, and don't use an old condenser that has been sticking around for ages and has been used time and again for other circuits. Get a new one. The results are worth it.

There is a wide variety of standard makes to choose from, among others, Amsco, graceful, beautifully made and long lasting; Karas, orthometric in name and performance; Hammarlund, rugged as the Rock of Gibraltar; Precise, which is all the name implies; Bruno, worthy of the name that dignifies a sterling line; Acme, strong and well protected; Cardwell, one of the pioneers in fine construction; Remler, smooth tuning, excellent anti-body capacity. All are names to conjure with in radio.

Gang Condensers

In gang or tandem condensers the same specially sought. Amsco makes a fine line of double and triple condensers, truely mounted, and Perlesz of Chicago specializes on this type, mounting as many as four and five condensers on one shaft, the jobs being geared as precisely as human ingenuity can make them. Another good job is the Victoreen Universal control recently put out by this well-known company. Bear in mind, that care and consideration of all parts before construction will always pay big dividends in good results and satisfaction.

Ancient Worlds In Making Affect Reception

The behavior of radio waves is puzzling the scientist as well as to the layman. The sun is usually suspected of affecting the propagation of the waves from radio stations. But the sun is not the only celestial body which may exert an influence. There are countless stars in the heavens which send their energy to us, and every one of them is capable of affecting the transmission of radio waves to some extent. Recently cosmic rays were discovered. These rays have immense powers of penetration, very much greater than the powers of the hardest X-rays. It is well known that X-rays affect adversely the propagation of radio waves. It is then reasonable to suppose that the cosmic rays have an even greater effect in making the radio waves misbehave. Cosmic rays pervade everything on and near the surface of the earth. No radio waves can escape their influence. What are these cosmic waves? They are waves of radiant energy of extremely short wavelength (of very great frequency). Where do they come from? Perhaps from a point beyond the Milky Way. Perhaps somewhere in space, a quintillion miles away, a universe was in the making some billion years ago, and the cosmic rays are nothing but the smoke of the catacylsmic conflagration that is just reaching us now.

Then again the cosmic rays may be coming from some stellar body not so far away but which is so hot that we cannot see it. One usually speaks of hot bodies as being red hot, white hot, or blue hot. But why should we stop with the visible colors? If the sun were twice as hot as it is now it would no longer be white hot, unless we redefined "whiteness." Perhaps it would be violet hot, or ultra-violet hot. If it were ultra-violet hot, it would be too hot for us to see it. Then its effect on radio waves would be very much greater than its present effect. If the sun were a million times as hot as it is now, we surely could not see it, yet it would emit rays similar to the cosmic rays.

Millions of stars have been discovered in the heavens by means of powerful telescopes. But only those stars which are not too hot to be seen, or those which are not too hot to affect the photographic plate, can be thus discovered. There may be millions of other stars which are either too cold or too hot to be discovered by the means at present available.

Perhaps the too-hot-to-be-seen stars may be discovered by their effect on the radio waves.

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A Vacuum Tube Voltmeter That Easily Measures Both AC and DC

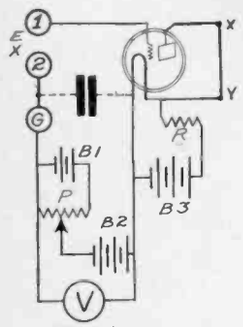

Fig. 1a

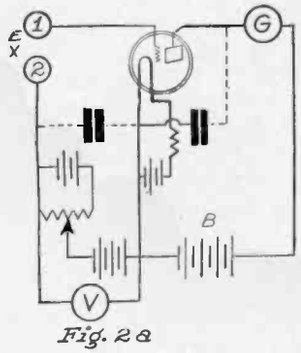

Fig. 2a

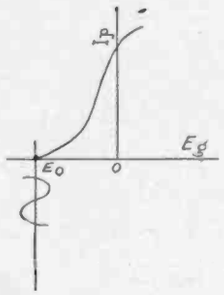

Fig. 2b

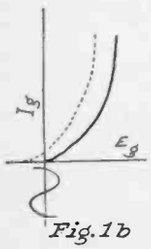

Fig. 1b

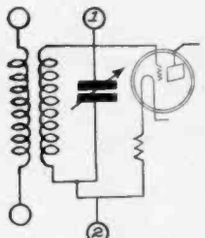

Fig. 3

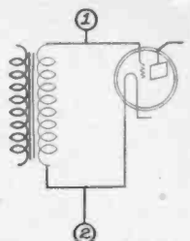

Fig. 4

Fig. 1a. Diagram of a simple vacuum tube voltmeter based on the operation of the Fleming two-electrode valve.

Fig. 1b. Characteristic curve of two-electrode tube, showing grid current against the grid voltage.

Fig. 2a. Standard three-element vacuum tube voltmeter in which the plate current is used to give an indication.

Fig. 2b. Characteristic curve of three-element vacuum tube showing plate current against the grid voltage.

Fig. 3. Diagram illustrating the use of the vacuum tube voltmeter for measuring the radio frequency input voltage to a tube.

Fig. 4. Circuit illustrating the use of the voltmeter for measuring the audio frequency input voltage to an amplifier tube.

By J. E. Anderson
Consulting Engineer

THERE are innumerable measurements in a radio receiver which cannot be made with ordinary meters, such as voltmeters, ammeters, milliameters and millivoltmeters. Nearly all meters which are at hand in the laboratory of the average radio experimenter are direct current devices, but most measurements on a radio set must be done on alternating currents and voltages. Also there are some DC measurements which cannot be made with the meters available because the meters are not suitable for the purpose. For example, the direct current voltmeters which are suitable for measuring the voltages of A, B, and C batteries are not at all suitable for measuring the steady voltage output of a B battery eliminator nor the steady DC potential obtained by voltage drop in high resistors used for grid bias. If an attempt is made to measure these voltages with the ordinary meters available not even approximately correct indications are obtained.

Advice on DC Tests

The reason for this is that the meters used in most cases draw a much greater current for their operation than does the circuit that is to be measured. An example of the utter failure of the direct current instruments to give a correct indication of voltage is when an attempt is made to measure the actual grid bias of a tube when that bias is obtained through a high resistance. The actual grid bias may be as high as 40 volts, yet when a voltmeter is connected from filament to grid no readable indication at all is obtained. The meter short-circuits the circuit to be tested, because the meter's resistance is so low.

For DC measurements a high resistance voltmeter may sometimes be used to get a close approximation of the actual voltages, but these meters are of no use when alternating voltages are to be measured. What is needed for these is a vacuum tube voltmeter which measures the peak voltage of the AC wave. A vacuum tube voltmeter is really a potential meter, and it may be used equally well for both AC and DC work.

A vacuum tube voltmeter is not a complex affair which only can be used in the better equipped laboratories. It is quite a simple contrivance which anyone interested can make or procure. Of course, the cost and complexity of the meter depends on the degree of sensitivity and precision that is necessary. And for many practical purposes an extremely simple device will suffice. It is the purpose of this article to describe such a simple vacuum tube potential meter, which most fans can afford to procure and is easy for anybody to use.

A vacuum tube voltmeter or potential meter employs an ordinary voltmeter of suitable range for measuring the actual voltage and some sensitive current indicating device for indicating a very small current. The more sensitive this indicating device is to direct current the more sensitive will be the vacuum tube potential. What is ordinarily used in this connection is a microammeter with a range of from 0 to 100 microamperes, but a galvanometer would be more sensitive.

May Use 0-1 Milliammeter

If neither of these devices is available a milliammeter of 0-1 sensitivity will give good results. The voltmeter used in this connection should have a range which is slightly greater than the range of peak AC or steady voltages that are to be measured. An instrument having a double or triple range would be desirable, as then more accurate values may be obtained for both high and low values of the unknown voltages.

At this point it is well to explain briefly the principle of the vacuum tube voltmeter. Several types have been developed, two of which will be described. The first of these the writer believes to be an innovation. This instrument is of extreme simplicity and its operation depends on the properties of the two electrode tube, or the Fleming valve. However, it is neither necessary nor desirable to use a two electrode valve for the purpose. Use a high mu tube, e. g., the new CX-340, which has a mu of 30.

The essential circuit of this simplified voltmeter is shown in Fig. 1a.

Identification of Constants

The circle is the tube, G is a sensitive current indicating device such as a galvanometer or milliammeter, and V is an ordinary voltmeter of suitable range. B1 is a three volt battery connected across a 400-ohm potentiometer P, and B2 is another battery which may be varied in steps of less than 3 volts. B1 and B2 conconstitute the grid bias of the tube. The voltmeter V is connected across the entire grid biasing battery. B3 is the filament heating battery and R is a suitable rheostat or Amperite. Observe particularly that the positive leg of the filament has been connected to the plate binding post

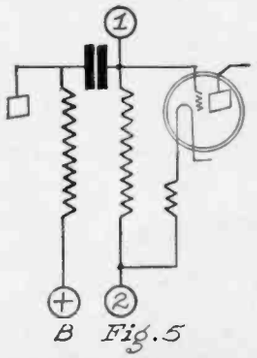

Fig. 5

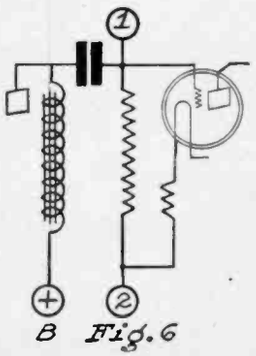

Fig. 6

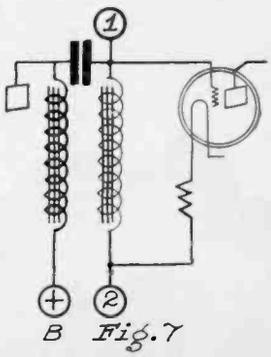

Fig. 7

Fig. 5. Illustrating the use of the vacuum tube voltmeter for measuring the voltage input to a tube in a resistance coupled amplifier.

Fig. 6. Showing how meter is used to measure the input voltage to a tube in an impedance coupled amplifier.

Fig. 7. In a double impedance coupled circuit the input voltage may be measured in this manner.

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of the tube by means of a strap x y. The unknown voltage to be measured is connected to the two binding posts marked 1 and 2.

The operation of this device depends on the stoppage of the flow of grid current. A high mu tube is desirable because for a given positive grid bias the grid current is greater the higher the mu is. Hence the device is more sensitive for higher values of mu. The grid current in the tube may be represented by a curve such as the dotted line in Fig. 1b.

A Simplified Connection

It will be noted that the grid current does not become zero as soon as the grid voltage becomes zero, but that a small negative value is necessary to stop it. This is unfortunate, since it would require a reversing switch in the leads to the voltmeter V if there were no other method of stopping the grid current when the grid voltage is zero. By connecting the plate of the tube to the positive end of the filament the grid current curve takes the shape of the full line in Fig. 1b, which passes through the zero point when the grid voltage is zero. This gives a definite starting point and it obviates introducing a reversing switch in the voltmeter leads.

The method of operation of the vacuum tube potential meter is as follows: First short circuit the binding posts 1 and 2 and adjust the voltage of the battery B1B2 until the current in the grid circuit just stops, as shown by the meter G. Note the reading on V. Then replace the short circuit strap by the voltage to be measured. If the unknown is DC the positive should be connected to point 1, or to the grid. Then increase the negative bias on the grid as given by the battery B1B2 until the current in G again just disappears.

Unknown Voltage Found

Note the new reading on the voltmeter V. The difference between the two readings on the voltmeter is the value of the unknown voltage. If this voltage is AC the reading is the peak value, and to get the effective value of the AC, the peak value should be multiplied by .707.

When radio frequency voltages are to be measured the by-pass condenser shown in dotted lines should be connected as shown. Its capacity should be about 1.0 mfd. Even for audio frequency measurements this condenser is desirable, though not necessary. For DC voltage measurements it is not at all necessary.

If it is desired to use the standard vacuum tube voltmeter the same device may be used by connecting it as shown in Fig. 2a. The three element tube is now used in the regular way. The indicating meter G is placed in the plate circuit of the tube to show the DC plate current and a plate battery B is added to the equipment. For high frequency measurements two by-pass condensers should now be used as shown by the dotted lines.

Reduces Plate Current to Zero

The three-element vacuum tube voltmeter works on the principle of reducing the plate current to zero. In Fig. 2b is shown a characteristic curve of a three-element tube, plate current against grid voltage. By increasing the negative bias to a suitable value the plate current can be reduced to zero. In Fig. 2b this voltage is OE. When operating the tube as a voltmeter, first adjust the bias so that the plate current just stops flowing. The reading on the meter V should then be noted. This reading is EO. The terminals 1 and 2 should of course be closed when taking this preliminary observation. Then the unknown voltage should be connected across the two input terminals and the grid bias should again be adjusted until the plate current just stops flowing. The reading on the voltmeter V should again be taken. The difference between the second and the first readings is the value of the unknown voltage across the terminals 1 and 2 if a steady voltage is measured, and it is the peak voltage of the unknown, if an alternating voltage is measured. The effective AC voltage is obtained by multiplying the peak voltage by .707.

The device described here may be used both as shown in Fig. 1a and Fig. 2a by making a few changes in the connection. The simple connection shown in Fig. 1a requires less equipment.

Increased Impedance

There is a slight advantage in using the second hook-up in that the input impedance to the device is slightly greater, that is, it is more nearly a potential meter. When grid current is used to give an indication as in Fig. 1a the input resistance has a finite value but it is extremely large so that for all practical purposes it may be regarded as infinite. The more sensitive is the indicating meter G, the greater is the impedance when the reading is taken. In the case of the second circuit no grid current at all flows since the plate current is used to give the indication on meter G. Hence the resistance is practically infinite.

When using the device as a three-electrode circuit it is also desirable to use a high mu tube because such a tube requires a lower grid bias to reduce the initial plate current to zero, and there is no great difference between the sensitivity of high and low mu tubes.

In Figs. 3 to 16 a few of the possible applications of the vacuum potential meter are suggested. Fig. 3 shows how the radio frequency input voltage to a tube may be measured. The numbers enclosed in the small circles correspond with the terminals of the same numbers on the meter. Figs. 14 and 15 show how to measure the radio frequency voltage across the tuned circuit in the detector stage with and without regeneration. Fig. 4 shows how the meter may be used to measure the audio frequency input voltage to an amplifier tube, or the voltage across the secondary of a transformer.

Separation of Components

Figs. 5, 6, and 7 show how to measure the input voltage to an amplifier in the three different types of direct coupled amplifiers. Fig. 8 shows how to apply the voltmeter to the measurement of the output voltage of a radio receiver, that is, the voltage across the loud speaker. In this case it is necessary to separate the AC component from the DC component of the plate current, since only the AC is of immediate interest. Fig. 9 shows how to measure the voltage across the loudspeaker when an output transformer is used for separating the DC from the AC.

In many cases it is desirable to measure the steady potential in radio receivers where an ordinary voltmeter completely fails to give the true indication of the voltage. One such case is shown in Fig. 10. The true voltage of the output of an eliminator and filter cannot be obtained with any ordinary voltmeter due to the high resistance in the eliminator. The vacuum tube voltmeter should be connected as shown and the voltage measured when the set is in operation. The set is represented by a load resistance. It will be noticed that the grid of the voltmeter is connected to the positive terminals of the eliminator. This will make a large

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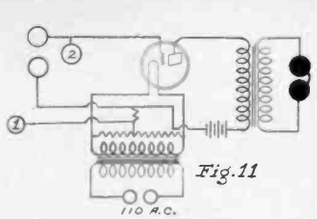


Fig. 11

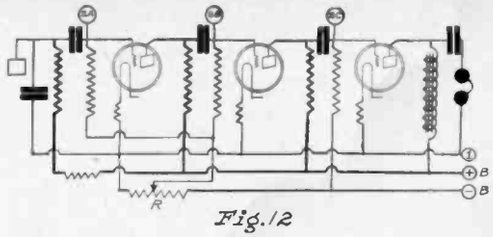


Fig. 12

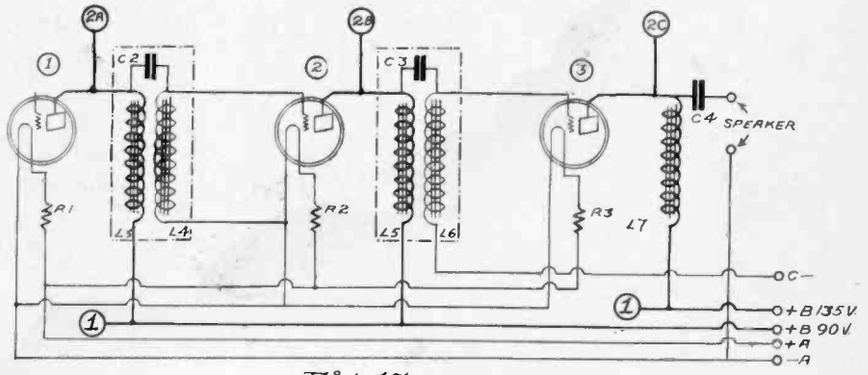


Fig. 13

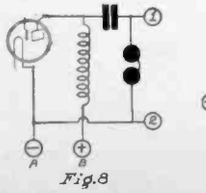


Fig. 8

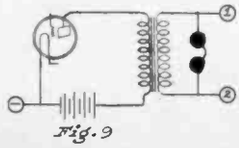


Fig. 9

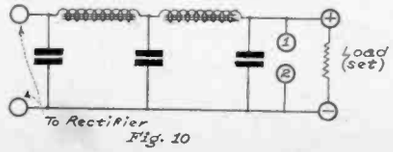
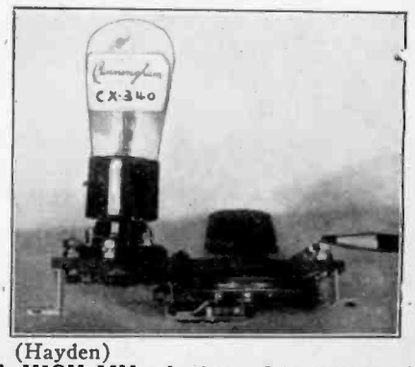


Fig. 10



(Hayden)

A HIGH MU tube is used in Anderson's vacuum tube voltmeter.

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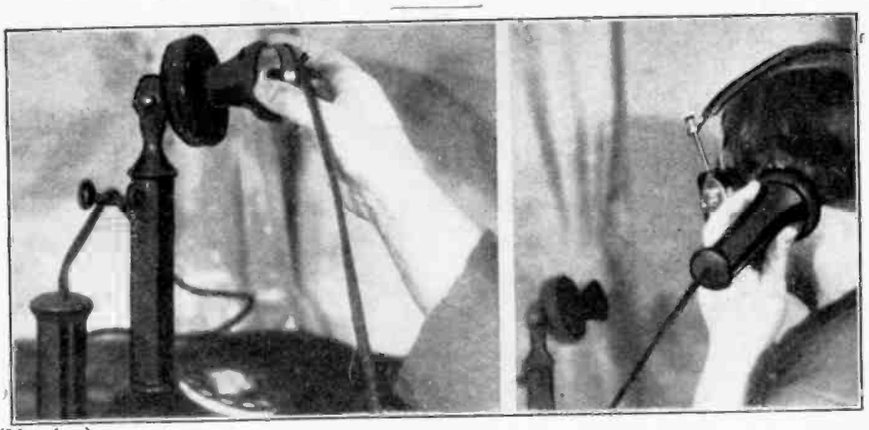
Fan Proud of Set "Flops" on 'Phoned Demonstration

Reception Put On the Wire In Good Style, But Noises Originating In the Relaying System Cause Listener to Complain of "Static"



(Hayden)

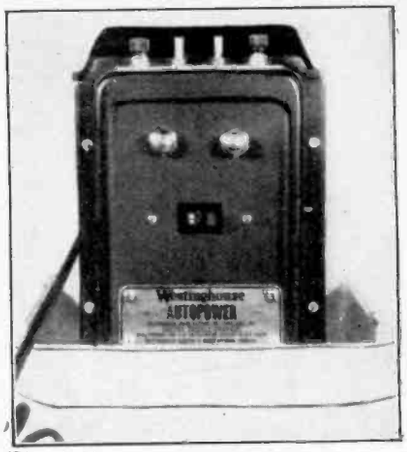
BY PLACING the earpiece in front of the telephone mouthpiece a friend at the other end of the wire can listen in to your radio receiver by merely putting the receiver of her own telephone to her ear. If she complains of noises the chances are they originate in the telephone line.

Sometimes a radio fan is very proud of the quality of his or her receiver and is anxious to have friends hear the performance. One way that the friend is made to hear the set without leaving home is for the proudful person to transmit the output of the set by the telephone. The earpiece of he receiver is placed in front of the microphone of the ordinary telephone and the friend at the other end of the wire listens in.

Now just imagine the friend complains there is considerable noise that comes over with the signal. Yet the proud owner of the receiver cannot hear any static that particular evening. The noise is undoubtedly picked up on the telephone line. Practically there are a million chances ot picking up noise on the ordinary telephone. Such noises are always present on the ordinary telephone, but due to the fact that the telephone is primarily a practical utility they are not noticed unless they are so severe as to interfere with a conversation. But compared with radio reception they are severe. Since radio is primarily an entertainment very little noise is tolerated.

Giving a demonstration of the quality of a radio receiver by ordinary telephone is very unfair to radio. It is a poor substitute for having the friend come over to the house and listen in.

A HELPFUL TRAY



(Hayden)

A STORAGE BATTERY and trickle charger in a proper tray.

It is a good plan to put a trickle charger, of the electrolytic type, or a storage battery, in a photographer's tray, as this is specially made to withstant acid effects. The commoner run of trays is not impervious to acid.

While the storage battery and the trickle charges give hardly any trouble on the score of acid, nevertheless carelessness on the part of the user, or unfamiliarity perhaps, sometimes causes a wee drop of the electrolyte to get on the carpet. And it's always a newly bought carpet or rug and some feminine voice in the house has a great deal to say on the subject in uneulogizing terms. Well deserved, too, but better avoided, so the tray idea is presented in all its pristine glory.

By the way, when charging the storage battery, do not forget to remove the ventilator caps over the plates. When the charging is completed, restore the caps.

Do not rely on hydrometer measurements, no matter when made, if distilled water has been newly added. The addition changes the specific gravity so that the reading is lower than otherwise. Do your measuring the next day.

(*Concluded from page* 9)

grid current flow when the voltage is applied. This current is stopped by the negative grid bias and the reading of the voltmeter V is taken.

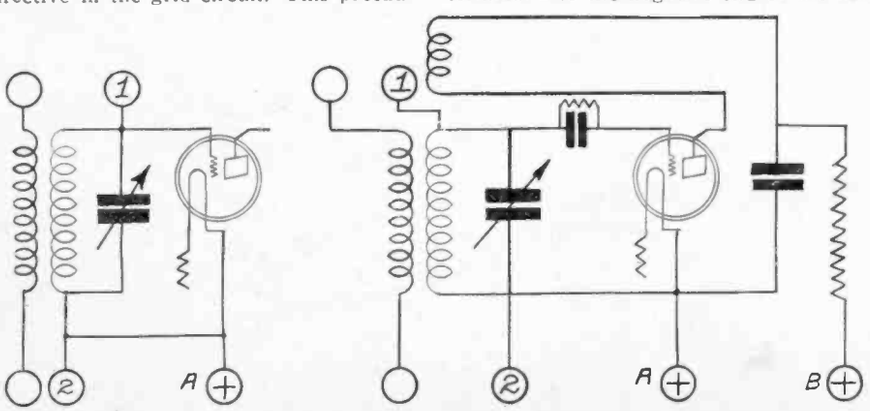
A Precaution

Care should be exercised in measuring high voltages of this nature. The grid and the filament of a high mu tube are close together and the insulation is likely to break down if the high voltage is applied directly. Also the high current that flows in the grid circuit is likely to ruin the indicating meter G. The approximate voltage of the unknown should be anticipated and the grid bias voltage should be adjusted approximately to the same value and the two applied together. Then only the difference between the two will be effective in the grid circuit. This precaution should be observed when either type 1a or 2a is used.

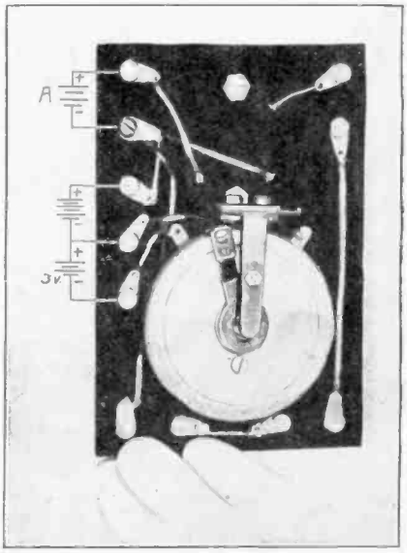
Another case of DC voltage measurement is shown in Fig. 11. Here the effective grid bias on an amplifier is measured. Similar measurements are shown in Fig. 12, where the effective grid voltages in a resistance coupled amplifier are measured. In these measurements the set should be turned on but the input to the detector tube should be short-circuited so that there will be no AC components present, as these would give false indications.

Another application of the voltmeter is shown in Fig. 13, which shows how to measure the direct current drop in the load impedance of the tubes in the set. In the same manner the effective plate voltages may be measured by connecting terminal 2 to the negative end of the filament. There must be no AC components of currents present, as was suggested above. Care must also be exercised here not to overload the grid circuit of the voltmeter tube, and the precautions suggested above should be carefully observed.

The drawing of the vacuum tube voltmeter as it appears on the cover page will be better understood by reference to Fig. 16.



FIGS. 14 AND 15



(*Hayden*)

FIG. 16

How the filament heating battery and main and auxiliary C batteries are connected is shown above.

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U. S. Has More Than Half of World Stations

Washington.

There are more than twice as many broadcasting stations in the United States as in all the rest of the world. This is revealed by a report of the Department of Commerce which shows 164 stations in Europe, 85 in North America (except the United States), 38 in South America, 16 in Asia, 28 in Oceania and 9 in Africa, a total of 340. At the present time there are more than 700 stations in operation in the United States.

Here is a list of some of the high-power foreign stations which might be received in United States under favorable conditions:

OKP—Prague, Czecho Slovakia. 508.5 meters, 5,000 watts.

AFT—Berlin, Germany. 483.9 meters, 4,000 watts.

IRO—Rome, Italy. 433.6 meters, 3,000 watts.

RYK—Kovno, Lithuania. 400 meters, 10,000 watts.

—Moscow Russia. 450 meters, 8,000 watts.

HHK—Port au Prince, Haiti. 361.2 meters, 1,000 watts.

JOAK—Tokyo, Japan. 375 meters, 2,000 watts.

2BL—Sydney, Australia. 353 meters, 2,000 watts.

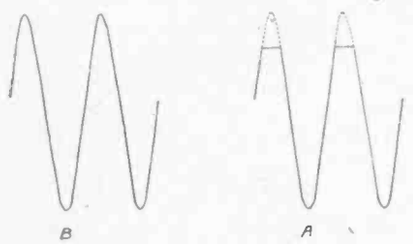
Sargent Wins Singing Fame

B. Felton Sargent is a young American singer who has received his entire musical education in this country. He has attracted attention with his radio, church, concert, and oratorio work both in the North and the South.

Mr. Sargent, prior to going South, was connected with Trinity Chapel, N. Y., Calvary Baptist Church, N. Y., Hedding Methodist Church, N. Y., and St. John's Episcopal Church, Jersey City, N. J.

Mr. Sargent has been broadcasting over WDBO, Rollings College, Winter Park, Fla., for two seasons, and has been delighting his radio audiences. He has a lyric baritone voice.

How Distortion Greets the Eye



The alteration of the wave form, representing the commonest distortion, is visible on an oscillograph. This is a tube device that enables the wave form to be seen on a fluorescent screen. If the frequency is very high, as at radio frequencies, the wave form still may be seen, because the repetition at almost incrediable and indivisible rate reduces itself graphically to a certain form, because of optical limitations. That is, the eye can not see fast enough, but can see group wave trains.

Thus by looking at the original wave form, and even tracing it on paper or photographing it, and then doing the same things with the wave form under different operating conditions, the changes, if any, may be noted. The original wave, say, is whole, as in B, but distortion wll cut the peaks, as in A.

VERSATILITY IN CHARGING

(Hayden)

IF THE RATE of charging of a charger is too great the current may be decreased by putting a rheostat of suitable value in series with the battery and the charger. The rate of charge may then be adjusted to any desired value by, adjusting the resistance in the rheostat. A 10-ohm rheostat is suggested. The charging of batteries of lower voltage than otherwise called for is thus made probable, too.

Remove Detector Leak To Test Grid Condenser

If the Insulation in the Capacity Unit Has Broken Down, Then You May Get Just the Same Results With Leak In or Out—How to Restore Efficiency

A small condenser is connected in the grid circuit of a detector tube to make the tube detect. To make the tube operative when there is a condenser in the grid circuit a leakage path must be provided across the condenser to give the grid the proper bias. Sometimes it will be found that the tube works better as a detector when the grid leak is removed, or at least it will work just as well. In such cases there is a leakage elsewhere, and it may be that the condenser is not leak-proof. If the condenser effectively stops all direct current the leak across it should be necessary for proper operation.

In some case the leakage takes place through the insulation of the socket. When the socket is made of poor insulating material there may be more leakage in the socket than in the grid leak, and when that is the case it makes very little difference whether a leak is connected across the condenser or not.

Another case in which the stray leakage is detrimental to the operation of a tube is the stopping condenser in direct coupled circuits. When this condenser leaks ever so little, the grid of the amplifier tube following it becomes positive and the amplifier will not function at all. It will behave in the most erratic manner. When that is the case and when the leakage through the condenser is not too great, the circuit may be restored to an operable condition by using a low resistance leak. However, the only safe remedy is to replace the condenser with one which is absolutely leak-proof. A leaky condenser has been the cause of the complete failure of many resistance coupled amplifiers.

(Hayden)

IF YOUR SET works just as well with the grid leak out of the detector circuit, it is a sign that something's wrong. Probably the grid condenser leaks.

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Four-Tube Designs Popular

Need of Greater Selectivity Expertly Met

By Herman Bernard

Associate, Institute of Radio Engineers

DURING the last three years the four-tube receiver has been very popular, and fans hold it in increasing esteem as time rolls on. The main reason is economy consistent with supreme results. While the three-tube set has passed out of the popularity class, on account of the demand for extra selectivity and the desire to be decent and not emit annoying whistles when tuning, the four-tube set has taken the vacated place in the hearts of those who demand something good, yet desire to be quite conservative in financial outlay.

The interesting parade of hookups that fascinates those technically inclined has shown a general trend in the direction of greater number of tubes. The reasons are various, and include the necessity for extra amplification to maintain efficiency at the output while resorting to shielding, the adoption of direct coupled forms of audio amplication, e. g., resistance and impedance coupling, or combinations including them, and the desire for loop reception.

Design Is Important

But on the radio frequency side no extra tubes are needed for full enjoyment of programs from near and far, if one uses a properly designed combination of a stage of tuned radio frequency amplification and a regenerative detector. This will give you all the selectivity and sensitivity than you would normally desire. In fact, properly designed and constructed, such a receiver will enable you to pierce through the local stations and bring in distant ones with all the volume you want. The secret lies in the refinement of design.

The combination of tuned RF and regenerative detector has been very popular, circuits embodying this design having been the favorites in the home-contruction field for the two or three years previous to the present one. Now the tendency is to omit regeneration in favor of an extra stage of tuned radio frequency amplification. While there are arguments on both sides that justify respectful attention, no statement or assertion can honestly contradict the greater sensitivity and selectivity of the regenerative type at lesser cost.

Improvement Developed

Some improvements are necessary in the previous standard designs of the two-tube radio frequency portion of the receiver. Many have found that circuits of this type were not selective enough for their needs. Such set owners probably live in air-congested centers, like New York and Chicago, or have powerful though few locals to contend with, and find themselves estopped from penetrating the local waves to bring in the distant ones. Yet, a radio circuit with just two tubes will do it, (disregarding audio), and such a circuit is the new Universal, which will be described in Radio World, beginning next week, issue of March 12.

On the score of selectivity, which has been considerably increased over what was obtainable from previous models, the midtap method has been employed. This consists of putting the tuning condenser across the secondary in each instance, as is the usual custom, but of connecting the grid return to a midtap on the secondary, instead of to the end of that coil. This utilizes more than the supposed half of the radio frequency voltage originally across the secondary.

The reason is that the voltage across the secondary, when the entire secondary is in the grid to filament circuit, is one thing, but the voltage across the entire secondary when the midtap method is used is less, while that across the utilized half of the coil relatively increases. Hence by the midtap method the voltage in the grid-to-filament circuit is more than half of the total voltage across the coil terminals.

Exceptional Selectivity

With so many stations on the air, and the necessity for selectivity being paramount, the increase in selectivity, obtained in both the RF stage and the detector input by the midtap method, is extremely valuable and important. Then, of course, the regeneration of the detector tube makes the set about four times as selective in this stage as it would be without regeneration. And, besides, the sensitivity goes up around a thousand times, due to feedback.

Negative grid bias is used on the RF tube to increase the grid-to-filament impedance, which makes the receiver more selective and reduces the plate current drain.

The method of regeneration control is particularly attractive. One of the annoying features of using regeneration is that it often requires continuous adjustment for different wavelengths, unless proper design eliminates this. If one may omit regeneration at will, as when tuning in strong locals (an instance of when the help of feedback is wholly unnecessary), and can do this without employing a short-circuting switch, he has a regeneration control that approaches the ideal. Such is the actual accomplishment of the Universal in its new and improved design.

The Audio Hookup

The audio frequency channel of the receiver consists of two transformer coupled stages. The transformers were chosen with due regard to the nature of the radio circuit, so that audio frequency oscillation is wholly avoided, and excellent tone quality is obtained. The transformers are of latest improved design, and are of the generous physical size so important in the manufacture of tone quality transformers. The first stage audio transformer is of moderate turns ratio, and has a high impedance primary, thus facilitating best detector action, most especially when the special detector type of tube is used, as recommended. This tube increases the sensitivity considerably, a fact that can not be noticed much when local stations are received, but which boldly asserts itself when a distant station—otherwise faint—is heard with all desired volume on the speaker. The second transformer is of lower ratio.

The first tube, the radio frequency amplifier, is of the —01A type, the special detector is an —00A, the first audio tube is of the same kind as the RF tube, while the final audio valve is a 112 power tube. Thus a fine combination of tubes increases the performance of the receiver both as to tone quality and volume.

Easy to Build

The audio channel is adapted to phonograph pickup installations, so that phonograph music may be amplified and played on your speaker, increasing volume and quality.

Of particular interest to the many who like to have a highly efficient yet inexpensive receiver is the fact that the set is very easy to construct. One need know hardly anything about radio to make a successful job of the building of the new Universal. To simplify matters to the extreme, blueprints will be available, and these will show where each lead goes, in life-size picture diagram, so that in actual construction you may simply copy the wiring as clearly revealed in the blueprint. The construction need take only a few hours, and yet a neat and substantial piece of workmanship will have been accomplished.

Along the same simplicity lines is the tuning itself. There are only two wavelength controls, the variable condensers. A rheostat in the negative leg of the radio frequency amplifying tube is the volume control, and thus is volume adjusted without introducing any distortion. An optional pilot light, of colored glass, and the switch complete the family of parts on the 7x21 inch front panel.

Hard to Beat

You have your choice of a right-angle arrangement for the front panel or any degree of slope that may be required by the most popular sloping type of cabinets, due to the inclusion of adjustable brackets.

When you build this receiver you will find that you have a set that can tune through the locals to bring in distance, a set that affords excellent tone quality, gives you an option of using no regeneration or, if you use it, of controlling regeneration with amazing smoothness, and a set that will not radiate offending squeals, a virtue resulting from the stabilization of the radio frequency tube. All in all, tube for tube, the receiver represents the most obtainable from the parts used, and also something quite near the maximum that a quality four-tube model affords.

British Plan Weekly Rebroadcast of WGY

If broadcasting conditions prove favorable, the British Broadcasting Company plans to relay a WGY program at 6:30 p. m. Tuesdays as a weekly broadcasting feature, according to a radiogram received by Martin P. Rice, manager of broadcasting for the General Electric Company. The music of the Ten Eyck orchestra is broadcast weekly by WGY, Tuesday night from 6:30 to 7 and on that evening 2XAF, the 32.79 meter wavelength transmitter also sends out the program. It is the signals of the latter station that the British Broadcasting Company proposes to pick up and relay through all the stations making up the great B. B. C. chain.

The radiogram, received from Captain A. G. D. West, assistant chief broadcasting engineer of the B. B. C. states:

"Relayed Ten Eyck Tuesday evening, Feb. 8, very successfully. Intend to make weekly feature 6:30 to 7 eastern if conditions remain good.

"WEST."

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New Tube Has Mu of 30

The CX-340 Improves Resistance AF

DEVELOPMENT work has been completed on a new special purpose high mu amplifier tube for resistance and impedance coupled audio frequency amplification circuits, according to an announcement made at the offices of E. T. Cunningham, Inc., manufacturers of Cunningham radio tubes, at 370 Seventh avenue, N. Y. City. This new tube, on the market March 1, is known as the CX-340 and is the sixteenth type bearing the Cunningham name.

General operating specifications of the CX-340 are as follows: filament voltage, 5.0 volts; filament current, .25 ampere; recommended B voltage 135 to 180 volts; amplification factor (mu), 30.

Audio frequency amplification today is accomplished by three general methods: transformer coupling, impedance coupling and resistance coupling. The requirement of the amplifier tube for resistance and impedance coupling is identical, but entirely different than the tube requirement for transformer coupling.

Up to the present time few satisfactory tubes have been on the market for resistance and impedance coupled circuits. Therefore many radio owners who have been using these forms of audio frequency circuit have not been obtaining maximum results due to lack of the proper special purpose type of tube.

Requirements Severe

In a preliminary audio resistance or impedance coupled circuit the voltage amplification is obtained primarily through the tube, and the requirement is an extremely high voltage amplification factor in the tube itself. The new Cunningham radio tube, CX-340, has a voltage amplification factor (mu), of 30 and the theoretical possible voltage gain per stage is 30.

There seems to be a general impression in the radio world that a resistance coupled audio frequency circuit is extremely simple to build. It is not true, however, that good tone quality can be had from any resistance coupled amplifier that is carelessly or hurriedly thrown together. The requirements, while simple, are severe and must be rigidly adhered to if the tube is to do its best job.

With a properly designed circuit, the CX-340, with either resistance or impedance coupling, offers very remarkable audio amplification possibilities.

The fact that the new Cunningham CX-340 is efficient as a special audio amplifier and as a detector tube will cause radioists to be greatly interested in the constants with which the tube is to be operated. The following recommendations are set forth by E. T. Cunningham, Inc.:

TABLE I

CX-340 as an Amplifier

Filament, 5.0 volts.....0.25 ampere
Amplification constant (mu).....30
Plate resistance (at 135 or 180 volts, under operating conditions; not at zero grid bias) 150,000 ohms.
Plate coupling resistor, .25 meg. (250,000 ohms).
Blocking condenser.....005 to .05 mfd.
Amplifier grid leaks..... 1 to 2 meg.
[See Table III for plate and grid voltage recommendations.]

TABLE II

CX-340 as a Detector

1. For detection with grid condenser and leak:
   Grid condenser.....00025 mfd.
   Grid leak..... 2 to 5 meg.
2. For detection by grid bias method, see table III.

[Suggested for use where sensitivity is of less interest than tone quality; not recommended for code reception only.]

The new high-mu tube, CX-340, which has a mu of 30.

TABLE III

Plate and Grid Voltage Values

AMPLIFIER

B Voltage	Grid Bias	Plate Resistor
Volts	Volts	ohms
135	1.0 to 1.5	.25 meg.
180	3.0	.25 meg.
Above 180	3.0 to 4.5	.5 to 1.0 meg.

DETECTOR

Condenser and Leak,			Grid Bias	
B Voltage	Grid Volts	Leak	Plate Resistor	Grid Bias Volts	Plate Resistor
135	2	to 5 meg.	.25 meg.	3.0	.25 meg.
180	2	to 5 meg.	.25 meg.	4.5	.25 meg.

Voltage Computation

When used as an amplifier, with more than 180 volts at the source, the CX-340 should have a plate resistor high enough so that effective voltage across plate and filament of the tube does not exceed 180 volts (the voltage drop in the plate resistor must be subtracted from the B voltage to obtain this.) A grid bias of 3.0 volts in the CX-340 is sufficient to allow operation of the CX-371 or CX-310 in the last audio stage at full volume, but 4.5 volts may be preferred in order to reduce plate current, thus avoiding overheating of plate resistor. The voltage across plate and filament may be estimated by reading the plate current on a sensitive milliammeter. Average values are, with —3.0 volts grid bias, .75 milliampere and with —4.5 volts, .25 milliampere (difficult to read on milliammeter, having full scale reading above 5 m. a.)

The increasing use of B voltages higher than 90 volts has made the use of resistance coupling practical in recievers designed for broadcast reception. The design of CX-340 results in recommended circuit constants that differ in important respects from the values commonly used. These values have been chosen in order to take full advantage of the high amplification constant of the CX-340 tube, and to obtain desirable frequency characteristics.

Why the .25 Meg. Resistor?

The use of a plate resistor of 250,000 ohms, instead of the more usual value of 100,000 ohms, makes possible the use of the proper grid biasing voltage for distortionless amplification, without sacrificing voltage amplification. The maximum possible voltage amplification obtainable from the tube would be a value equal to the amplification constant, or 30 per stage, and with the 250,000 ohm resistor about 60 per cent. of this value is obtained or about 20 per stage, thus comparing favorably with transformer coupled audio amplifiers in this respect.

The real necessity for the use of a grid biasing voltage to obtain distortionless amplification from resistance coupled amplifiers has not been generally appreciated although there is less power available in the place circuit to drive the grid positive than is the case with transformer coupling. The normal grid current of a high-mu tube is about 0.5 milliampere at zero grid, and as this current must flow through the grid leak, it tends to produce a drop proportional to the grid leak resistance. The use of low resistance grid leaks is not a satisfactory remedy, as this has the effect of cutting off low frequencies unless an oversize blocking condenser is used, a grid biasing voltage being the only method not open to criticism.

Insight Into Bias

The biasing or C voltage cannot be large, in fact, should be no higher than necessary. The most severe conditions under which a resistance coupled amplifier operates is found when a CX-371 tube is used in the last audio stage.

If the plate voltage is 135 volts the CX-371 is capable of taking a signal voltage having a peak swing of 27 volts (the recommended bias for that tube). With a voltage amplification of 20 per stage, the CX-340 just preceding the CX-371 must carry a peak swing of 1/20 of 27 volts, or slightly over 1.3 volts. A grid biasing voltage of 1.5 volts, obtained from a single small dry cell, will just suffice. With a tube having a higher amplification constant than the CX-371, such as the CX-112 or CX-310, a much smaller input voltage is required, and a bias of one volt, which may be obtained from the drop across a four ohm resistor placed in the negative filament lead, will be all-sufficient. This method may also be used to obtain the bias of 1.5 volts mentioned above, if a fixed resistor of higher value is used, as the tube will operate at 4.5 volts filament without any appreciable difference as compared with operation at 5.0 volts. In this case a six ohm fixed resistor should be used.

New Circuit on Way

By-pass condensers are quite ineffective at very low frequencies; for instance, at 30 cycles per second a condenser as large as 1.0 mfd. offers an impedance of more than 5,000 ohms and therefore is ineffitive. This means that amplifiers which are efficient at low frequencies may have considerable common coupling when several stages are operated in the usual manner from common B batteries, and this effect is still more pronounced in the case of B eliminators.

To avoid the trouble which has been termed "motor-boating" it has been common practice to decrease the resistance of the grid resistors and to use small size blocking condensers, the effect being to cut off the troublesome low frequencies. Other means are being developed of preventing this action and of maintaining the efficiency of the amplifier when the aim is utmost fidelity of reproduction, in which resistance coupling is said to excel.

The CX-340 is also adapted to impedance coupled amplification, but this method is said to offer little advantage over transformer coupled circuits, due to the necessity of using a very large reactor in the plate circuit.

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Radio University

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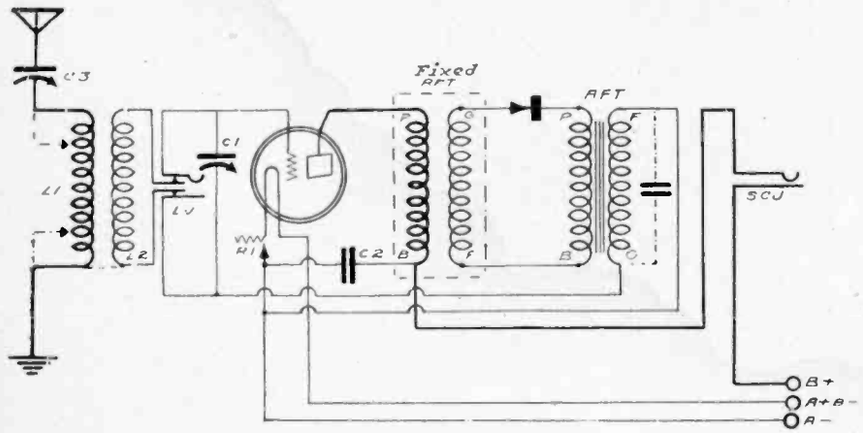

FIG. 521

A one-tube reflex, using a fixed radio frequency transformer to couple the tube output to the crystal detector.

CAN THE following parts be successfully used in a one-tube receiver: a fixed radio frequency transformer of a standard make; a double circuit jack; a two to one ratio audio frequency transformer and two .0005 mfd. variable condenser? If so, please give the circuit diagram of such a set. Please state any other material that may be necessary.—William Bumler, Kansas City, Kans.

The circuit diagram of a receiver using these and a few extra parts is shown in Fig. 521. It is a standard reflex type, with a few modifications. The first tube acts as a radio frequency and audio frequency amplifier. A crystal is used, a detector of the synthetic type being preferred.. One .0005 mfd. variable condenser is used to tune the antenna, while the other is used to tune the secondary of a tuned radio frequency transformer, containing fifty turns of No. 22 double cotton covered wire, wound on a two and three-quarter inch diameter form. This is labelled L2 in the diagram. The primary L1, which is wound on this same tubing, consists of twenty turns of the same sized wire as used for the secondary, tapped at every second turn. Across the secondary winding of the tuned RFT, the double circuit jack, called LJ, because a loop can be inserted here to cut out the antenna, is placed also. The fixed radio frequency transformer is identified by Fixed RFT in the diagram. The filament of the tube is controlled by a twenty ohm rheostat. C2 is a .01 mfd. fixed condenser. The audio frequency transformer is labelled AFT in the diagram, and as you will note, is used to feed back the energy to the tube. A single circuit jack is used at the output. The—01A type tube should be used. At least ninety volts should be applied to the plate of this tube. The filament should, of course, be heated with a six volt A battery. Across the secondary winding of the audio transformer, a .001 mfd. fixed condenser may be shunted. This is indicated by dotted lines. The arrow and base indicates the crystal detector. The loop used, may be a two foot square affair, wound with about fourteen turns of No. 18 double cotton covered wire, each spaced one-quarter inch. The antenna should be no longer than one hundred feet. If you do not wish to use the taps, you can follow the solid connections. However, when doing this, the antenna should be connected to the tenth turn from the beginning of the transformer. Any type of audio frequency amplification can be used with this set. Use a separate B battery supply for the plates of the audio amplifying tubes.

* * *

ENCLOSED PLEASE find the circuit diagram of a five-tube receiver, which I am using at the present time. The primaries, L1 and L3, of the radio frequency transformers consist of fifteen turns, while the secondaries, L2 and L4, consist of sixty-two turns. Each primary and secondary is wound on a tubing which is two and three-quarters inches in diameter, using No. 24 single silk covered wire. a space of one-eighth inch existing between the two windings. These secondaries are shunted by .0005 mfd. variable condensers, C1 and C2. Now I am troubled with interference from some of our local stations which are about a half mile away from me. Could I do away with this nuisance, if I reduced the number of turns on the primaries? If so, how many? (2)—You will note, that I am using resistance coupled audio frequency amplification, with the following value resistors and condensers:—R4, R6 and R8 are one-tenth megohm; R5 a one megohm; R7 a one-half megohm; R9 a one-quarter meghom, while C5, C6 and C7 are all .25 mfd. fixed. Now the volume using —01A tubes is fair. I would like to use a power tube in the last stage to get louder signals. R1 is a twenty ohm rheostat. R2 is a four ohm rheostat. I would like to do away with both these, using a ten ohm rheostat to control the filament of the first three tubes, a ballast for the fourth tube and another ballast for the last tube, to take care of the power tube. Please show a diagram illustrating these filament corrections.—James C. Friedland, Lexington, Ky.

(1)—The reduction of the number of turns on the primaries will help greatly.

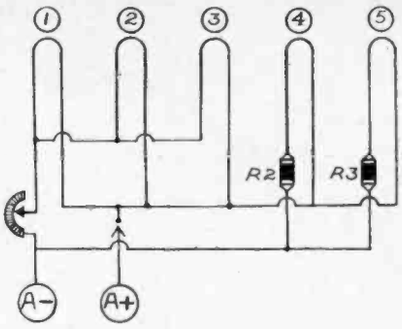

FIG. 523

The revised filament wiring diagram for the circuit sent in by Mr. Friedland.

You may also try inserting a .0005 mfd. variable condenser, shunted by a forty-five turn coil wound on a three-inch diameter tubing with No. 22 DCC wire, in series with the antenna. (2)—The circuit diagram of the receiver you sent in is shown in Fig. 522, while in Fig. 523, you have diagrammed the changes necessary to make for the installation of the power tube. You will note that the tubes are numbered in accordance with those of the circuit, you sent in. The filaments of tubes, one, two and three are controlled by the ten-ohm rheostat. The filament of the second audio tube is controlled by a one-quarter ampere ballast resistor as per your request. The filament of the last tube is controlled by a one-half ampere ballast resistor. Note the installation of the filament switch, in the plus A lead. It is also suggested that you apply a separate B voltage on the plate of the last tube.

* * *

COULD TWO, three-to-one ratio audio frequency transformers be used, instead of those specified in the six-tube portable receiver shown in the Radio University columns of the June 26 issue of RADIO WORLD?—Dave Harber, Waco, Tex.

Yes.

* * *

I AM going to build the two-tube set described in the Oct. 30 issue of RADIO WORLD, Radio University columns. I would like, however, to add on another tube in the form of a stage of transformer coupled audio amplification. Is this O. K.? I am going to use a two and one-half to one ratio transformer.—Garland Jenks, Pittsfield, Mass.

Yes.

* * *

PLEASE GIVE me the circuit layout of a simple crystal detector circuit, using a variocoupler, which has a twenty-turn primary, tapped every fifth turn, wound on a three and one-quarter inch diameter form and a fifty turn secondary (inserted inside of the primary), wound on a two and three-quarter inch diameter form, tapped at every tenth turn, No. 24 double silk covered wire being used in all cases. State the size of panel to be used.—Leroy Maxers, Clinton, N. Y.

Such a circuit is shown in Fig. 524. L1 and L2 are the primary and the secondary windings of the variocoupler. C1 is a .0005 mfd. variable condenser. CD is the crystal detector. C2 is a .0005 mfd. fixed con-

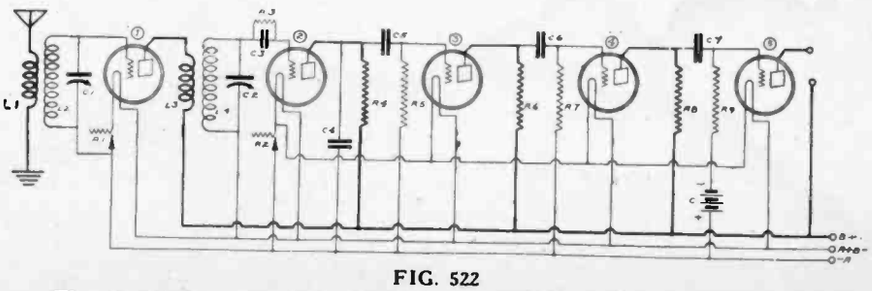

FIG. 522

The circuit diagram of the five-tube set sent in by James C. Friedland.

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denser, which may or may not be used. To reduce the number of controls, you can discard the use of the taps on the rotar, as well as the variable feature. The variable system can be avoided by placing the shaft directly opposite to the panel. Should you find it necessary to vary this coil in this way, it can be done without interfering with any of the other instruments in the receiver. The taps from the primary should be brought to both sides of the variable condenser, which should be mounted in the center of a panel, seven inches high, and fourteen inches long. If the crystal is of the adjustable type, such as galena, then place it in such a position, that it will not be difficult to approach, e.g., in the front of the panel, over the variable condenser dial. If it is of the synthetic type, it can be placed inside of the cabinet.

* * *

IS THE four and one-half battery commonly used as a C battery known as a primary battery?—Charles Lesward, Portland, Ore.

Yes.

* * *

ARE ALUMINUM cell rectifiers used most commonly in B eliminators? (2)—How are they made fundamentally?—John Malone, Boston, Mass.

(1)—Yes. (2)—Aluminum and lead are used as the electrodes, they being immersed in a solution of aluminum phosphate, sodium bicarbonate, or borax.

* * *

WHAT IS Argon gas?—Jessie Samson, Atlantic City, N. J.

It is an inert or inactive gas and a portion of the atmosphere. It was found in 1895 by Raleigh and Ramsay. No other combinations with elements can be made with it.

* * *

WHAT IS a fluorescent screen?—Francis McCloud, Jersey City, N. J.

It is a very fine screen, which is coated on one side of its surfaces with a fluroesecent substance, which may be potassium platino-cyanide, or calcium tungstate. When this surface is exposed to ultra-violet rays, cathode rays, etc., the light is seen.

* * *

REGARDING THE phone talk article, published in the Feb. 12 issue of Radio World. Can any type of audio frequency amplification be used? My set has three stages of resistance coupling. (2)—There is no provision at the detector output for listening in. Could I, therefore, run wires from each terminal of the input resistor to a single circuit jack, placed outside of the set?—Max Davis, Jamestown, N. Y.

Yes. (2)—Yes.

* * *

REFERRING TO the circuit diagram of the one-tube receiver shown on page 13 of the July 3 issue of Radio World, which uses a plate coil shunted by a .00035 mfd. variable condenser, to control the regenerative action of the detector tube. (1)—How many turns should be wound on a three-inch diameter tubing, to constitute L1 and L? (2)—What wire should be used? (3)—What is the capacity of C5 and C1? (4)—Can the audio frequency coupling used in the receiver described by J. E. Anderson in the Jan. 16 issue of Radio World, the diagram also being shown on this page, be used in conjunction with this set?—Willard Harris, Altoona, Pa.

(1)—L1 consists of fifteen turns, while L consists of fifty turns, each separated one-quarter inch. C1 and C5 are .0005 mfd. variable condensers. (2)—No. 22 double cotton covered wire. (3)—Yes.

* * *

MUST A rheostat be used to control the filament of the audio frequency amplifier tube used in the two-tube receiver described in the Radio University columns of the Oct. 30 issue of Radio World? I

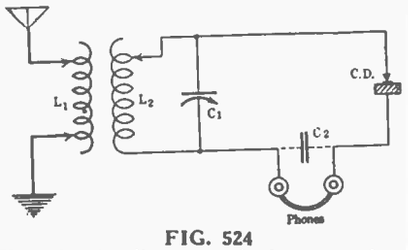

FIG. 524
The circuit diagram of the crystal set, which Leroy Maxers requested

have a 1-A Amperite, which I would like to use here. Can this be employed?—Jackson Palmer, Palm Beach, Fla.

(1)—No. (2)—Yes, this can be used. Connect it in the same way as the rheostat, that is, in the negative leg of the filament. The 01A type of tube must be used with this style ballast resistor.

* * *

I HAVE built the combination transmitter and receiver described on page 10 of the June 5 issue of Radio World, in response to a query sent in by John C. Buttry. The results are excellent on both sets. On the transmitter I have been heard, according to reports, using two —01A type tubes, at places more than one thousand miles distant. The receiver gets consistent reception from stations two thousand miles away. Now, I would like to build this set in my car, which is of the sedan type. (1)—Could the antenna be placed on top of the car, a five-wire T type being used? The entire length of the car is fifteen feet. (2)—Could the frame of the car be used as a ground? (3)—Is it O. K. to use the battery from the car as an A battery? (4)—Is it advisable to keep the receiver away from the dashboard of the car. (5)—At the present time, I only have a single stage of transformer audio frequency coupling, just as per original diagram. Would it be a good idea to add on another stage which could be switched in or out at will, so that the volume of stations, near or distant could be controlled? Of course, phones are now used. However, I intend, later on, to place a speaker in the car, and listen to the more powerful stations from this, when possible.—Harold James, Kansas City, Mo.

(1)—Yes. (2)—Yes. (3)—Although this may be done, it is suggested that you use a separate battery if possible. (4)—Yes, this is a good suggestion. In this way, you will prevent the reception of strays, emitted by the spark plugs, etc. (5)—Yes.

* * *

I AM thinking of building the three-tube regenerative receiver described in the Radio University columns of the Oct. 2 issue of Radio World. (1)—I would like to use the three-stage Twinchoke audio frequency amplifying system, described, by Kenneth Harkness in the Jan. 1 and 8 issues of Radio World. Could this be done? (2)—Do the output posts of the input coil of the audio coupler go to the variometer and B plus posts respectively? (3)—In the article, it is stated that only about 45 volts should be applied to the plate of the detector tube. Will it be necessary to increase this voltage with this new system of coupling? (4)—Could I use a variable grid leak? (5)—This leak has the adjuster connected to one post, and the resistance portion to another post. Should the adjuster post go to the end of L2, the secondary winding of the radio frequency transformer, while the other post is brought to the G post on the socket, both posts, of course, going to the grid condenser?—Leonard Markis, San Francisco, Cal.

(1)—Yes. (2)—Yes. It is advisable to insert a radio frequency choke coil in series with the variometer connection to the P post on the audio coupler. The fixed condenser C3, which is of the .0005 mfd. fixed type, should be brought directly from plate post of the detector socket to the minus A post. (3)—Suggest you try 67½ volts, as a starter. (3)—Yes. (4)—Yes. (5)—Yes, this is the correct method. Reversing these connections will cause body capacity, when you touch this leak.

* * *

PLEASE TELL me if both dials on the KH-27 receiver should read alike. Also how the volume is controlled, as well as how to receive the lower wavelength stations with the maximum efficiency. Any other general suggestions as to the best way to run the receiber will be appreciated. I am going to use a six volt, eighty ampere hour storage A battery, three forty-five volt, acid cell storage B batteries, and a special forty and one-half volt storage acid cell C battery for power supply.—Anna Kupperberg, Bx., N. Y. City.

To tune in stations, just turn the two vernier dials. They should read approximately alike for any given station. Volume is controlled by turning the center knob or filament rheostat. This may be turned on full without harming the tubes, a fixed resistance being at all times in series with the filaments of the two tubes it controls. The volume should be carefully adjusted to give the best quality.

Ordinarily, keep the antenna switch turned to the left. In this position low-wave stations are received best and the set is more selective. Turn to the right if your antenna is very short or if you want to receive distant long-wave stations. Of course the regular addition of water to batteries, should be made.

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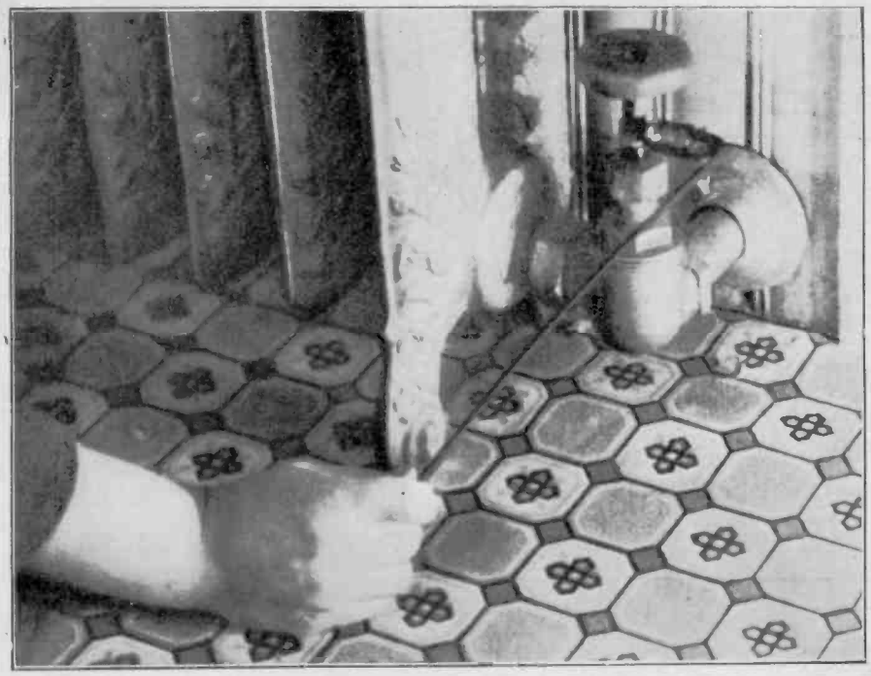
HOW TO GROUND TO RADIATOR



(Hayden)

WHEN MAKING the ground connection to the radiator valve, don't bring the clamp to that portion which is attached to the adjustor, as is shown above, since every time you wish to control the amount of steam you have also to turn the clamp and the wire, loosening or probably breaking the connection and of course, spoiling or even killing reception of signals. Instead bring the clamp to the thicker portion of the pipe, which needs no adjustment. Be sure to sandpaper and then thoroughly clean off the paint on the pipes. Do not fasten to the setscrew on the valve head.

The best ground that can be obtained is a direct connection to a cold water pipe. The connection should be soldered, clamped with a copper ground connector, or connected in a similar positive way.

A fair ground may be obtained by connecting the ground lead to the hot water pipes or to the radiator valve. It should be connected in the same manner that the ground wire is connected to the cold water pipe. The ground lead should never be connected to the gas pipes. These pipes are insulated at every joint. It would be just as effective to tie the ground lead to a nail in wall or to the coffee percolator on the able.

Higher Waves Favored By Dellinger and Taylor

1,000 to 1,600 Meter Band Their Choice for Test, As Fading Would Be Less, They Believe—Present Receivers Would Require Radical Changing

Washington.

Government scientists and technicians are having a dispute over the best band of waves for broadcasting. A number of them say a higher grade of broadcasting could be obtained on the band between 1,000 and 1,600 meters. Others say the best band for broadcasting is between 100 and 200 meters, while still others believe the band now in use is the best and most practical.

Dr. J. H. Taylor, chief of the Naval Research Laboratory, at Bellevue thinks there would be less fading between 1,000 and 1,600 meters. He wonders why the broadcasters have never attempted to use this band. The same view is shared by Dr. J. H. Dellinger, Dr. L. W. Austin and others of the Bureau of Standards. Signal Corps experts are strong for the band between 100 and 200 meters.

Chief Radio Supervisor W. D. Terrell thinks the present band is adequate to serve the entire United States and sees no reason for either enlarging or changing it.

"Broadcasting was put on its present band originally because that was the most convenient place for it," said Mr. Terrell. "As broadcasting enlarged, the band was expanded to its present proportions. There has been nothing yet to make me believe we made a mistake in assigning this band to broadcasting.

"It is claimed that the reason European stations use the band between 1,000 and 1,600 meters for broadcasting because it is possible to get better reception there. But I have also heard that the reason is to compel European listeners to buy European receivers. American receivers are made to operate between 200 and 600 meters and are of no use in Europe.

"Regardless of the merits of the various bands, it certainly would not be practical to attempt to change the broadcasting band now. If we did, every listener would have to get new equipment or make radical changes in his present set. Moreover, the band between 1,000 and 1,600 meters is in use by other kinds of service, and it would take years to clear them out so that interference would not be encountered in that band."

THE FIDDLE, THE FID

GODFREY LUDLOW, well-known Austr the famous "Paganini Strad" which was m of Walter Ford (right) who loaned it to h This $35,000 Stradavarius is playe

MEN WHO CONF

(Underwood & Underwood)

DR. G. BREIT (left) and Dr. M. A. Tu of terrestrial magnetism, Carnegie Institut ments verified the existence of a layer i waves back again to earth. The "Ceiling", although at times during the tests it was f known as the Ken

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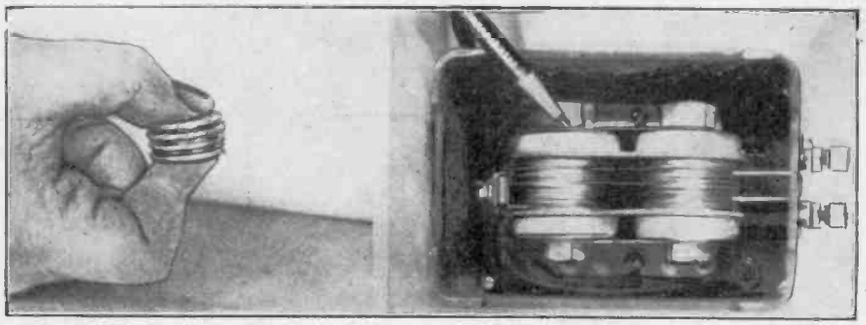
)LER AND THE DONOR

elian violinist broadcaster, (left), examining ade in 1727 and which passed into the hands dr. Ludlow for concert work in New York. d by Ludlow frequently from WJZ.

IRMED "CEILING"

ve, research investigators in the department ion, Washington D. C., as a result of experi- the upper atmosphere, which bends radio they say, is about 100 miles above the earth, ound to vary between 50 and 130 miles. It is nelly-Heaviside layer.

RECTIFICATION BY METALS



(Hayden)

A TRICKLE CHARGER that operates on the principle of dissimilar metal plates in contact under pressure. Metals often used are copper and lead. The principle of the dissimilar metal rectifier may be illustrated by a stack of coins. Nickel and copper coins are placed alternately and held together by the pressure of thumb and finger.

Best Minds Ponder on Weighty Program Problems

Advisory Council of N. B. A., Including Root, Hughes, Morrow and Damrosch, Called From Country Over, Meets in N. Y. for Listeners' Benefit

The Advisory Council of the National Broadcasting Company, consisting of a number of the most distinguished Americans in educational, public and social life, recently held its first meeting at the National Broadcasting Company's offices, New York City, to study the further extension of broadcasting service to millions of American homes.

Broadcasting was discussed by Owen D. Young, acting as temporary chairman. The progress of the National Bradcasting Company was presented by Merlin Hall Aylesworth, president of the company.

Among other members of the advisory council present were Elihu Root, Charles Evans Hughes, Dr. E. A. Alderman, President of the University of Virginia; William Green, president of the American Federation of Labor; Henry M. Robinson, president of the First National Bank of Los Angeles; Mrs. John D. Sherman, president of the General Federation of Women's Clubs; Dwight W. Morrow, of J. P. Morgan & Company; Dr. Charles F. MacFarland, general secretary, Federal Council of Churches of Christ in America; Francis D. Farrell, president of the Kansas State Agricultural College, and Walter Damrosch, conductor of the New York Symphony Orchestra.

United States Leads

In his report presented to the Advisory Council Mr. Aylesworth showed that in the number of listeners served, in character and quality of programs presented and in the educational and social services already organized, the United States had taken a position of leadership in broadcasting. The time was now ripe, he pointed out, with the cooperation of the leading factors in American educational, social and political life, to develop the broadcasting service of the country to a point where it will bring to the home not only music and entertainment but the best educational and cultural thought of the entire nation.

How best to develop national broadcasting from the cultural and educational standpoint was considered by the advisory council. Among the subjects discussed were: church activities, education, labor, political economy, music, drama, women's activities and agriculture. For the development of these subjects assignments were made to the following members of the Council: education, Mr. Alderman; church activities, Dr. MacFarland and Julius Rosenwald; music, Mr. Damrosch; agriculture, Mr. Farrell; Labor, Mr. Green; women's activities, Mrs. Sherman.

Nothing could so impair the object sought by the founders of the National Broadcasting Company so quickly and effectively as the misuse of the broadcasting facilities already created, Mr. Young declared,

Experiments Necessary

"In this country we must learn by experiment the best way of handling this important agency," he continued. "The National Broadcasting Company is making that experiment. It seeks to demonstrate to the American people that this agency can be handled by a private organization effectively, economically and progressively. It would like to demonstrate that it can respond quickly to the public taste and the public needs. It would like to show that it can administer these facilities without unfair discrimination and with maximum service both in quality and quantity.

"It is quite apparent that to a large degree broadcasting must be national in scope in order to give listeners the kind of service they should have. If the National Broadcasting Company can provide the highest quality of programs which exists in the United States, no matter where the point of origin may be, and can disseminate it completely throughout the country so that everyone can hear it, no matter where he may be, and if it can do this without charge upon the listener and without unfair discrimination between those fairly entitled to use the facilities, it will, in my judgment, have rendered a great service to the American people.

Need of Outside Help

"No one organization can hope to do that without the wise advice of disinterested and competent people widely distributed."

The most important function which the Advisory Council could serve, Mr. Young pointed out, was to make constructive recommendations as to how the broadcasting service of the country might be continually improved.

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A THOUGHT IN THE WEEK

THE fact that radio is more worth while than ever is proven by the truth that the radio market is moving from the strictly price class to the quality-above-all-else group

RADIO WORLD

The First and Only National Radio Weekly

Radio World's Slogan: "A radio set for every home."

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Ten cents per word. Minimum 10 words. Cash with order. Business Opportunities ten cents per word, $1.00 minimum.

Entered as second-class matter March 23, 1923, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Weekday Afternoon Programs by WJR

Detroit.

A new daytime schedule has been inaugurated by WJR, Detroit, called the Musical Matinee Program, and lasts from 12:45 to 2 o'clock every day, except Sunday. Before this, WJR has been broadcasting only in the evenings, except on Sunday, when the station is on the air almost continuously with programs.

There will be plenty of variety on the new program, with dance music alternating with concert music. From time to time, well known soloists will appear on the program, although the hour is intended primarily to be one of orchestral entertainment. Charles Fitz-Gerald and his Rhythm Kings will play groups of dance numbers throughout the program. Concert music, consisting of musical comedy selections, overtures, lighter operatic selections and other numbers for string sextet will be interspersed by Jean Goldkette's Petite Symphony Orchestra. The dance music will come from the Oriental Cafe and the concert music from the Venetian room of the Book-Cadillac Hotel.

If the fans take well to the idea it may be extended.

Davis Dons the Toga of Broadcasting Prophet

Hoover's Assistant, Legal Expert, Calls the Turns Like a Fortune Teller, and Shapes Many of the Radio Policies of Commerce Department

By Thomas Stevenson

Washington.

Enactment of the Dill-White Radio Law of 1927 has brought Assistant Secretary of Commerce Stephen Davis prominently into the radio limelight.

For four years former Judge Davis has had much to do in shaping the policies of the Department of Commerce on radio. He has been responsible for important decisions Hoover has made about radio since January, 1923.

Secretary Hoover has other problems equally important as radio. It would be impossible for him to handle all of them himself. So on Mr. Davis devolved many of the actual radio duties. Mr. Hoover has generally accepted Mr. Davis' advice.

The Turning Point

So long as the industry was 100 per cent with him, Mr. Davis made out nicely, and it is considered rather remarkable that it lasted as long as it did. The break in line did not come until last June, when the Zenith Radio Corporation, of Chicago, questioned the right of the Department to allocate wavelengths.

The Chicago Court took Judge Davis' sling-shot away from him. He saw the futility of involving the Government in innumerable court suits and asked the Department of Justice for its interpretation of the law. When that department agreed with the Chicago Court, Mr. Davis withdrew attempts to regulate radio.

Mr. Davis has a pleasing personality. He is 51, five feet ten, has dark hair, brown eyes, and a strong nose. He is fond of bridge and likes to argue. It has been said of him that he can almost prove black is white. Formerly he was a Justice of the Supreme Court of New Mexico.

Prophesies Come True

He has displayed an almost uncanny percept in dealing with broadcasting. Two years ago he wrote a book on its legal aspects. It was not accepted by the publishing house to which he sent it because of the limited appeal of its legal arguments.

But those who saw the book have been surprised at the accuracy of some of his predictions as borne out by recent events.

He is an enthusiastic radio fan. He has an eight-tube set and a nice log of distant stations.

In his consideration of broadcasting, his Bible has been "public interest." He is not terrified by visions of monopoly and considers that there will always be too many stations for any such charge to be taken seriously. He is keenly interested in the social aspects of broadcasting and its possibilities for spreading culture. He believes a certain amount of commercialism in broadcasting will result in better programs, but is opposed to direct advertising by radio.

Self-Annihilation

He is not alarmed, however, by the tendency in that direction, for he thinks stations which indulge in it will kill themselves off by alienating their listeners.

More than a year ago he was asked if he would accept the post of "Czar" of radio. Very emphatically he replied:

"No, indeed. There's too much grief in it for me."

(Copyright, 1927, by Stevenson Radio Syndicate)

Ford 'Plane Flight Guided by Beacons

Dayton, O.

Guided by the newly perfected radio beacon, the Stout-Ford three-motored airplane, owned by the Ford Airplane Company, recently, successfully made a trip from Detroit to this city, and back again.

With this beacon, the pilot is not dependent upon landmarks. When the transmitting stations is notified of the direction of the coming flight of a plane, a dial is set toward that point of the compass, the instruments being started, and the signals sent in the desired direction. When the aviator is in the correct direction, he hears a dash, which in telegraph represents T. Should he turn to the right, the signal dit dah or A is received. Should he turn to the left, dah dit or No is received.

The engineers of this company are now working on a new scheme, using lights, so that the pilot need not have a knowledge of code, to be able to use the beacon.

"PAGLIACCI" AT KGO

A new organization, the KGO Grand Opera Co., directed by Albert Gillette, is to present "Pagliacci." Friday, March 11, at 8:00 p.m. Mr. Gillette will be heard in the role of Tonio, Dorothy Buechner as Nedda, James Gerard as Canio, Gwynfi Jones as Harliquin, and Willard Schindler as Silvio.

Bristol Is Elected Engineers' President

Atlanta.

T. R. Bristol, well-known radio engineer with the Georgia Railway and Power company, and prominent in experimental and scientific circles of the radio world, was honored with the post of president of the Atlanta Institute of Radio Engineers at a recent meeting.

Mr. Bristol, who has occupied the office of vice president of the organization since its annual election, succeeds Henry L. Reid, who resigned the presidency because of pressure of work in conducting the affairs of Henry L. Reid and company, prominent radio retail store, and in his important activities with the American Radio Relay league. Mr. Reid is a pioneer in radio development in the Southeast.

George L. Llewellyn, secretary and treasurer, retains his position. The vacancy in the vice presidency will be filled at a subsequent meeting. The association is a chapter of the national body.

BRAHMS FEATURED

Oakland, Calif.

The San Francisco Symphony Orchestra, under the baton of Alfred Hertz, will feature Brahms' Symphony No. 1 in the Sunday afternoon broadcast over KGO, March 6, at 2:40 p.m. Rudolph Reuter, pianist, will be the guest artist.

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N.B.C. Executives Include Woman as Boss of WJZ

M. H. Aylesworth, president of the National Broadcasting Company, announced that the company's executive staff is at present constituted as follows M. H. Aylesworth, president; George F. McClelland, vice-president and general manager; H. W. Angus, assistant vice-president and general manager; Charles B. Popenoe, treasurer; Mark J. Woods, assistant treasurer; L. MacConnach, secretary; Donald Withycomb, assistant secretary; Harry F. McKeon, auditor.

Frank A. Arnold, director of development; George J. Podeyn, Pacific Coast manager; Gerard Chatfield, supervisor of programs; Nicholas de Vore, manager of musical and literary research; O. B. Hanson, manager of operations and engineering; G. W. Johnstone, publicity manager; Samuel L. Ross, manager of Artists' Bureau; H. A. Woodman, traffic manager.

Miss Bertha Brainard, manager of WJZ; Phillips Carlin, manager of WEAF; Ralph Edmunds, manager of WRC; Frank E. Mullen, manager of KFKX; Carl Dreher, staff engineer; E. F. Grossman, supervising engineer; W. H. Ensign and D. S. Tuthill, assistant sales managers; Herbert B. Glover, WJZ publicity representative; R. W. McAdam, WEAF publicity representative.

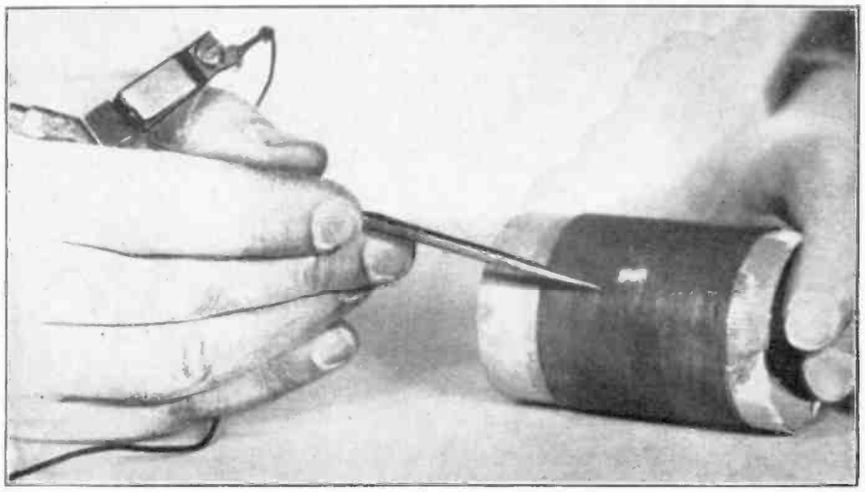
Let There Be Light But No Noise, Please!

Some noise heard in the radio receiver originate in the lighting system. Whenever a light is turned on or off a click is heard in the loud speaker. This click is louder the closer the light socket is, or rather the closer the leads to the light are to the radio set. This effect may easily be observed by turning on and off a light near the radio set. It is particularly noticeable when the contact in the light socket is not clean, when considerable arcing occurs at the break of the light circuit.

(Hayden)

THE ELECTRIC LIGHT circuit contributes many of the noises heard in a radio receiver. At make and break of a light circuit a click is heard. This is particularly severe on break, and when the contact at the light bulb is not clean.

Pointed Circuit Tester Serves Double Object



(Hayden) **A SIMPLE CIRCUIT TESTER**

Locates Break In Coil and Also Enables One to Determine How Many Turns are Necessary for a Given Capacity Condenser

When there is an open in an inductance coil the break may quickly be located by means of the simple tester shown herewith. A sharp pointed tool is used as an exploring point. This must be sharp enough to pierce the insulation and fine enough so that it will not damage the insulation. A mechanic's scriber or a large needle is suggested.

To operate this tester an indicating device is necessary and this may either be an ordinary voltmeter or a headset. Connect this indicator in series with a low voltage battery. One lead from the battery should be connected permanently to one end of the coil to be tested, and the free end of the indicating instrument should be connected by means of a clip to the scriber. When the insulation is pierced, establishing a contact with the wire of the coil, there will be an indication of current flow as long as the winding of the coil is continuous. If there is a break in the coil no indication is obtained. By trying the coil in various places it is possible to locate the break in the coil within one turn of wire. Usually some point is suspected of being defective. The test can then be applied to both sides of this point to determine whether the wire is open at the point suspected.

Another use of this circuit tester is to determine the right number of turns to use on a coil to bring the stations in on the desired dial settings. Suppose that the coil in the circuit is too large, that is, it has too many turns. One side of the coil is connected permanent as before and the other end of the coil is disconnected from the condenser. The needle is then connected to the condenser, the dial set at the desired point and then the station is tuned in by varying the number of turns in the coil, which may be done by simply piercing the insulation with the needle. When the right number of turns has been found, all excess turns can be removed and the coil connected up permanently.

SOCKET CONTACT VITAL

Defective contacts at the springs of the tube sockets are among the most prolific sources of noise in a radio receiver. The contacts corrode, accumulate dirt and gradually become weak, so that the contacts made with the tube prongs are very uncertain. Very often the noise takes the form of a disagreeable hissing. Clean the contacts occasinally and bend them with a pair of pliers in case the prongs have

Seattle Inaugurates Big Listeners' Club

Seattle, Wash.

With 300 persons present, preliminary steps in the formation of a citywide radio listeners' club were taken at a mass meeting in Eagles' Hall recently. John B. Powers, automobile dealer, was elected president. Assistant Fire Chief W. H. Clark was named first vice-president; Carl Croson, attorney, second vice-president, and E. W. Brownell, a vice-president of the National Bank of Commerce, secretary and treasurer.

A board of directors was chosen, consisting of H. R. Cunliff, A. S. Kincaid, George Shrive, D. W. Henderson and R. W. Frame.

Mayor Bertha K. Landes acted as temporary chairman at this meeting. Speakers in the open forum indicated a keen interest in the subject of interference and a silent period for local broadcasting stations.

Croson urged the expression of public thought on radio through the medium of a club.

"We don't want the atmosphere made an aerial billboard," said Andrews.

"At the same time, we know we are going to have some advertising because somebody has to sponsor the programs. It is for us to express the consensus as to just what we want."

Matt H. Gormley expressed belief that soon the influence of the local club will become statewide, and that it will be followed by similar organizations in Tacoma and Spokane. A. S. Kincaid pledged the support of the radio and music trades.

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Complete List of Stations

Corrected up to February 23, 1927

Station	Location	Owner	Meters
KBMH	Detroit, Mich.	Braun's Music House	352.7
KDGR	San Antonio, Tex.	Radio Engineers	240
KDKA	East Pittsburgh, Pa.	Westinghouse house E. & M. Co.	309.1
KDLR	Devils Lake, N. D.	Radio Elec. Co.	231
KDYL	Salt Lake City, Utah	Inter. Bdsctg. Corp.	246.8
KELW	Burbank, Calif.	E. C. White	535
KFAB	Lincoln, Neb.	Neb. Buick Auto Co.	340.7
KFAD	Phoenix, Ariz.	Elec. Equip. Co.	273
KFAF	San Jose, Cal.	A. E. Fowler	217.3
KFAU	Boise, Idaho	Indep. Sch. Dist. of Boise	280.2
KFBB	Havre, Mont.	F. A. Buttrey & Co.	275
KFBC	San Diego, Calif.	W. K. Azbill	380
KFBK	Sacramento, Calif.	Kinball Upson Co.	535.4
KFBL	Everett, Wash.	Leese Bros.	224
KFBS	Trinidad, Cal.	School District No. 1	238
KFBU	Laramie, Wyo.	St. Matthews Cathedral	374.8
KFCB	Phoenix, Ariz.	Nielson Radio Supply Co.	238
KFDD	Boise, Idaho	St. Michael Cathedral	275.1
KFDM	Beaumont, Tex.	Magnolia Petroleum Co.	315.6
KFDX	Shreveport, La.	First Baptist Church	236.1
KFDY	Brookings, S. D.	S. D. State College	299.8
KFDZ	Minneapolis, Minn.	H. O. Iverson	231
KFEC	Portland, Ore.	Meier & Frank	252
KFEL	Denver, Colo.	E. P. O'Fallon, Inc.	254.1
KFEQ	St. Joseph, Mo.	Scroggin & Co.	268
KFEY	Kellog, Idaho	Bunker Hill & Sullivan	233
KFFP	Moberly, Mo.	First Baptist Church	242
KFH	Witchita, Kans.	Hotel Lassen	267.7
KFHA	Gunnison, Colo.	Western State College	252
KFHL	Oskaloosa, Ia.	Penn College	240
KFI	Los Angeles, Cal.	Earl C. Anthony, Inc.	467
KFIF	Portland, Ore.	Benson Poly. Inst.	247.8
KFIO	Spokane, Wash.	North Central High School	272.6
KFIQ	Yakima, Wash.	First Methodist Church	256
KFIU	Juneau, Alaska	Alaska Elec. Light & Power Co.	226
KFIZ	Fond Du Lac, Wisc.	Fond Du Lac Commonwealth Reporter	273
KFJB	Marshalltown, Ia.	Marshall Electric Co.	248
KFJF	Oklahoma City, Okla.	Nat'l. Radio Mfg. Co.	260.7
KFJI	Astoria, Ore.	E. E. Marsh	245.8
KFJM	Grand Forks, N. D.	Univ. of N. D.	278
KFJR	Portland, Ore.	A. C. Dixon & Son	263
KFJY	Fort Dodge, Ia.	Tunwall Radio Co.	246
KFJZ	Fort Worth, Tex.	W. E. Branch	254.1
KFKA	Greeley, Colo.	Colo. State Teachers Col.	273
KFKB	Milford, Kans.	Dr. J. R. Brinkley	434.5
KFKU	Lawrence, Kans.	Univ. of Kans.	275
KFKX	Hastings, Neb.	Westinghouse, E. & M. Co.	288.3
KFKZ	Kirksville, Mo.	Cham. of Com.	225.4
KFLR	Albuquerque, N. M.	Univ. of N. M.	254
KFLU	San Benito, Tex.	San Benito Radio Club	236
KFLV	Rockford, Ill.	Swedish Evan. Church	229
KFLX	Galveston, Tex.	Geo. Roy Clough	240
KFMR	Sioux City, Ia.	Morningside College	261
KFMX	Northfield, Minn.	Carlton College	336.9
KFNF	Shenandoah, Ia.	Henry Field Seed Co.	461.3
KFOA	Seattle, Wash.	Rhodes Dept. Store	454.3
KFOB	Burlingame, Cal.	K. F. O. B., Inc.	225.4
KFON	Long Beach, Calif.	Nichols & Warimer, Inc.	232.4
KFOR	David City, Neb.	Tire & Electric Co.	226
KFOT	Wichita, Kans.	College Hill Radio Club	231
KFOX	Omaha, Neb.	Technical H. S.	248
KFOY	St. Paul, Minn.	Beacon Radio Service	252
KFPL	Dublin, Tex.	C. C. Baxter	252
KFPM	Greenville, Tex.	New Furniture Co.	242
KFPR	Los Angeles, Cal.	L. A. County Forestry Department	231
KFPW	Carterville, Mo.	St. John's Methodist Episcopal Church	258
KFPY	Spokane, Wash.	Symons Investment Co.	272.6
KFQA	St. Louis, Mo.	The Principa	261
KFQB	Fort Worth, Tex.	Searchlight Publishing Co.	508.2
KFQD	Anchorage, Alaska	Anchorage Radio Club	300
KFQP	Iowa City, Ia.	G. S. Carson, Jr.	224
KFQU	Holy City, Cal.	W. E. Riker	230.6
KFQW	North Bend, Wash.	C. F. Knierim	215.7
KFQX	Seattle, Wash.	A. M. Hubbard	210
KFQZ	Hollywood, Cal.	Taft Products Co.	226
KFRB	Beeville, Tex.	Hall Brothers	248
KFRC	San Francisco, Calif.	Don Lee, Inc.	267.7
KFRU	Columbia, Mo.	Stephens College	499.7
KFSD	San Diego, Cal.	Airfan Radio Corp.	245.8
KFSG	Los Angeles, Calif.	Echo Park Evan. Assn.	275.1
KFUL	Galveston, Tex.	T. Goggan & Bros.	258
KFUM	Colorado Springs, Colo.	W. D. Corley	239.9
KFUO	St. Louis, Mo.	Concordia Seminary	545.1
KFUP	Denver, Col.	Fitzsimmons Gen. Hosp.	234
KFUR	Salt Lake City, Utah	L. L. Sherman	256.2
KFUS	Oakland, Cal.	L. L. Sherman	256
KFUT	Salt Lake City, Utah	Univ. of Utah	263
KFUU	Oakland, Calif.	Colburn Radio Lab.	220.4
KFVD	San Pedro, Calif.	C. & W. J. McWhinnie	208
KFVE	St. Louis, Mo.	Benson Bdcstg. Corp.	239.9
KFVG	Independence, Kans.	First M. E. Church	236.1
KFVI	Houston, Tex.	Headquarters Troop, 56th Calvary	240
KFVN	Fairmont, Minn.	C. E. Bagley	227
KFVR	Denver, Col.	Moonlight Ranch	244
KFVS	Cape Girardeau, Mo.	Cape Girardeau Battery Station	224
KFVY	Albuquerque, N. M.	Radio Supply Co.	250
KFWB	Hollywood, Cal.	Warner Bros. Pic.	252
KFWC	San Bernardino, Calif.	L. E. Wall	291.9
KFWF	St. Louis, Mo.	St. Louis Truth Center	214.2
KFWH	Eureka, Calif.	F. W. Morse, Jr.	254
KFWI	S. South Francisco, Cal.	Oakland En Society	249.9
KFWM	Oakland, Calif.	Oakland Educa. Soc.	325
KFWO	Avalon, Cal.	Lawrence Mott	211.1
KFWU	Pineville, La.	Louisiana College	238
KFWV	Portland, Ore.	KFWV Bdcst. Studios	212.6
KFXB	Big Bear Lake, Cal.	B. C. Heller	202.6
KFXD	Logan, Utah	Service Radio Company	205.4
KFXF	Denver, Col.	Pikes Peak Broadcasting Company	430.1
KFXH	El Paso, Tex.	Bledsoe Radio Co.	242
KFXJ	Near Edgewater, Col.	R. G. Howell	215.7
KFXR	Oklahoma City, Okla.	Classen Film Finishing Co.	214.2
KFXY	Flag Staff, Ariz.	M. N. Costigan	205.4
KFYF	Oxnard, Cal.	Carl's Radio Den	214.2
KFYJ	Portable, Tex.	Houston Chronicle Publishing Company	238
KFYR	Bismark, N. D.	Hoskins-Meyer, Inc.	248
KGAR	Tucson, Ariz.	Tucson Citizen	243.8
KGBS	Tucson, Ariz.	A. C. Dailey	227
KGBU	Ketchikan, Alaska	Alaska Radio and Service Company	228.9
KGBX	St. Joseph, Mo.	Forster Hall Co.	347.8
KGBY	Shelby, Neb.	Dunning & Taddikon	202.6
KGBZ	York, Neb.	Federal Live Stock Remedy Company	333.1
KGCA	Decorah, Ia.	C. W. Greenle	280.2
KGCB	Wayne, Neb.	Wayne Hospital	434.5
KGCG	Newark, Ark.	Moore Motor Co.	234.2
KGCH	Wayne, Neb.	Wayne Hospital	434.5
KGCI	San Antonio, Tex.	Liberto Radio Sales	239.9
KGCL	Seattle, Wash.	Louis Wasmer	238
KGCM	San Antonio, Tex.	R. B. Bridge	263
KGCN	Concordia, Kans.	Concordia Bdcstg Co.	235
KGCR	Brookings, S. D.	Cutlers Broadcasting Service	252
KGCU	Mandan, N. D.	Mandan Radio Assn.	285
KGCX	Vida, Mont.	First State Bank	240
KGDA	Dell Rapids, S. D.	Home Auto Co.	254.1
KGDE	Barrette, Minn.	Jaren Drug Co.	232.4
KGDJ	Cresco, Ia.	R. Rothert	405.2
KGDI	Seattle, Wash.	N. W. Radio Service Co.	416.4
KGDJ	Cresco, Ia.	R. Rathert	202.6
KGDM	Stockton, Calif.	V. G. Koping & C. F. Peffer	217.2
KGDO	Dallas, Tex.	C. H. & Henry Garrett	285
KGDP	Boy Scouts Pueblo, Colo.	Boy Scouts	260
KGDW	Humboldt, Neb.	F. J. Rist	241.8
KGDY	Oldham, S. D.	L. A. Loesch	210
KGDZ	Decorah, Ia.	New Norwegian Luther Coll.	431
KGEF	Los Angeles, Cal.	Trinity Meth. Ch.	516.9
KGEH	Eugene, Ore.	Eugene Bdcst. Station	236.1
KGEK	Yuma, Colo.	Beehler Elec. Equip. Co.	252
KGEL	Jamestown, N. D.	E. W. Ellison	225
KGEN	El Centro, Cal.	E. R. Irey & F. M. Bowles	281
KGEO	Grand Island, Nebr.	R. D. Chamberlain	271
KGER	Long Beach, Cal.	C. M. Dobyns	325.9
KGES	Central City, Neb.	Central Radio Elec. Co.	205.4
KGEU	Lower Lake, Cal.	L. W. Clement	222
KGEW	Fort Morgan, Colo.	City of Morgan	256
KGEY	Denver, Colo.	J. W. Deitz	204
KGFK	Hallbock, Minn.	Kittson Co. County Enter.	225
KGFL	Trinidad, Colo.	Trinidad B'rdcasting Co.	222
KGFG	Oklahoma City, Okla.	Full Gospel Ch.	384
KGFH	La Crescenta, Cal.	Frederick Robinson	218.8
KGFI	Fort Stockton, Tex.	M. L. Eaves	220.4
KGFJ	Los Angeles, Cal.	Bon S. McGlashan	340.7
KGFM	Yuba City, Calif.	G. W. Johnson	450
KGFK	Hallock, Minn.	Kittson Co. Enter.	225
KGO	Oakland, Cal.	General Electric Co.	361.2
KGRC	San Antonio, Tex.	Gene Roth & Co.	315
KGRS	Amarillo, Tex.	Gish Radio Service	234
KGTT	San Francisco, Cal.	Glad Tidings Temple & Bible Inst.	206.8
KGU	Honolulu, T. H.	Marion A. Mulrony	270
KGW	Portland, Ore.	Oregonian Pub. Co.	491.5
KGY	Lacey, Wash.	St. Martins College	277.6
KHJ	Los Angeles, Cal.	Times Mirror Co.	405.2
KHQ	Spokane, Wash.	Louis Wasmer	394.5
KICK	Anita, Ia.	Atlantic Auto Co.	272.6
KJBS	San Francisco, Cal.	J. Brunton & Sons Co.	220.4
KJR	Seattle, Wash.	Northwest Radio Serv. Co.	384.4
KKP	Seattle, Wash.	City of Seattle	260
KLDS	Independence, Mo.	Reorganized Church of Jesus Christ	440.9
KLIT	Portland, Ore.	L. L. Thompson	380
KLS	Oakland, Cal.	Warner Brothers	250
KLX	Oakland, Cal.	Tribune Publishing Co.	508.2
KLZ	Denver, Col.	Reynolds Radio Co.	384.4
KMA	Shenandoah, Ia.	May Seed & Nursery	461.3
KMED	Medford, Ore.	W. J. Virgin	250
KMIC	Inglewood, Calif.	J. R. Fouch	387
KMJ	Fresno, Cal.	The Fresno Bee	234.2
KMMJ	Clay Center, Neb.	M. M. Johnson Co.	228.9
KMO	Kokomo, Wash.	KMO, Inc.	249.9
KMOX	St. Louis, Mo.	Voice of St. Louis	280.2
KMTR	Hollywood, Calif.	KMTR Radio Corp.	370.2
KNRC	Santa Monica, Calif.	C. B. Juneau	238
KNX	Los Angeles, Cal.	Los Angeles Express	336.9
KOA	Denver, Col.	General Electric Co.	322.4
KOAC	Corvallis, Ore.	Oregon Agriculture Col.	280.2
KOB	State College, N. M.	New Mexico College of Agriculture	348.6
KOCH	Omaha, Neb.	Omaha Central H. S.	258
KOCW	Chickashia, Okla.	Oklahoma College for Women	252
KOIL	Council Bluffs, Ia.	Mona Motor Co.	305.9
KOIN	Portland, Ore.	KOIN, Inc.	319
KOLO	Durango, Colo.	G. K. Hunter	355.1
KOMO	Seattle, Wash.	Fisher Blend Station	305.9
KOWW	Walla Walla, Wash.	F. A. Moore	285
KPCB	Seattle, Wash.	Pacific Coast Biscuit Co.	521
KPO	San Francisco, Cal.	Hale Bros. Inc.	428.3
KPJM	Prescott, Ariz.	Wilburn Radio Service	215
KPPC	Pasadena, Cal.	Pasadena Presbyterian Church	229
KPRC	Houston, Tex.	Houston Priting Co.	296.9
KPSN	Pasadena	Star-News, Pasadena, Ca.	315.6
KQW	San Jose, Cal.	First Baptist Church	333.1
KQV	Pittsburgh, Pa.	Doubleday Hill Electric Company	275
KRAC	Shreveport, La.	Caddo Radio Club	220
KRLD	Dallas, Tex.	Dallas Radio Labs., Inc.	357.1
KROW	Portland, Ore.	Oregon Bdcst. Co.	231
KROX	Seattle, Wash.	N. D. Brown	265.3
KRSC	Seattle, Wash.	Radio Sales Corp.	499.7
KRE	Berkeley, Cal.	Berkeley Daily Gazette	256
KSAC	Manhattan, Kans.	Kansas State Agricultural College	340.7
KSBA	Shreveport, La.	W. G. Patterson	260.7
KSCJ	Sioux City, Ia.	Sioux City Journal	444
KSD	St. Louis, Mo.	Pulitzer Publishing Co.	545.1
KSEI	Pocatello, Idaho	KSEI Bdcstg. Co.	260.7
KSL	Salt Lake City, Utah	Radio Service Corp.	299.8
KSMR	Santa Maria, Cal.	Santa Maria Valley R. R.	283.8
KSO	Clarinda, Ia.	A. A. Berry Seed Co.	405.2
KSOO	Sioux Falls, S. D.	Sioux Falls Bdcst. Ass.	360
KTAB	Oakland, Cal.	Ass. Broadcasters	302.8
KTAP	San Antonio, Tex.	R. B. Bridge	263
KTBI	Los Angeles, Cal.	Bible Institute	293.9
KTBR	Portland, Ore.	M. E. Brown	263
KTHS	Hot Springs, Ark.	New Arlington Hotel	374.8
KTNT	Muscatine, Ia.	Norman Baker	333.1
KTUE	Houston, Tex.	Uhalt Electric	263
KTW	Seattle, Wash.	First Presbyterian Church	454.3
KUJ	Seattle, Wash.	Puget Sound Bdcst. Co.	352.5
KUOA	Fayetteville, Ark.	University of Ark.	299.8
KUOM	Missoula, Mont.	University of Mont.	243.8
KUSD	Vermillion, S. D.	University of S. D.	278
KUT	Austin, Tex.	University of Tex.	231
KVI	Tacoma, Wash.	Puget Sound Bdcst. Co.	342.5
KVOO	Bristow, Okla.	SW Sales Corp.	374.8
KVOS	Seattle, Wash.	L. L. Jackson	333
KWBS	Portland, Ore	Schaeffer Mfg Co.	200
KWCR	Cedar Rapids, Ia.	H. F. Parr	296
KWG	Stockton, Cal.	Portable Wireless Telegraph Co.	248
KWKC	Kansas City, Mo.	Wilson Duncan Studios	236
KWKH	Shreveport, La.	The W. K. Henderson Iron Works and Supply Co.	312.3
KWSC	Pullman, Wash.	State College of Wash.	348.6
KWTC	Santa Ana, Cal.	Dr. J. W. Hancock	263
KWUC	Lemars, Ia.	Western Union College	252
KWWG	Brownsville, Tex.	Chambers of Com.	278
KYA	San Francisco, Cal.	Pacific Bdcst. Corp.	399.8
KYW	Chicago, Ill.	Westinghouse E. & M. Co.	535.4
KXL	Portland, Ore.	KXL Bdcstg.	400
KZKZ	Manila, P. I.	Electric Supply	270
KZM	Oakland, Cal.	Preston D. Allen	240
KZRG	Manila, P. I.	Far Eastern Radio, Inc.	222
NAA	Arlington, Va.	U. S. Navy	435
WAAD	Cincinnati, O.	Ohio Mechanical Inst.	258
WAAF	Chicago, Ill.	Daily Drovers Journal	277.6
WAAM	Newark, N. J.	Isaiah R. Nelson	263
WAAT	Jersey City, N. J.	F. B. Bremer	235
WAAW	Omaha, Neb.	Omaha Grain Exchange	384.4
WABB	Harrisburg, Pa.	Harrisburg Radio Co.	204
WABC	Richmond Hill, N. Y.	Atlantic Bdcst. Co.	315.6
WABF	Pringleboro, Pa.	Markle Bdcst. Corp.	410.7
WABI	Bangor, Me.	First Universalist Church	240
WABO	Rochester, N. Y.	Hickson Elec. Co.	278
WABQ	Philadelphia, Pa.	Keyston Bdcst. Co.	260.7
WABR	Toledo, O.	Scott High School	263
WABW	Wooster, O.	The College of Wooster	306.8
WABX	Mount Clemens, Mich.	H. B. Joy	246
WABY	Philadelphia, Pa.	J. Magaldi, Jr.	242
WABZ	New Orleans, La.	Colis Place Baptist Church	275.1
WADC	Akron, O.	Allen T. Simmons	258
WAFD	Detroit, Mich.	A. B. Parfet Co.	312.3
WAGM	Royal Oak, Mich.	R. L. Miller	225.4
WAGS	Somerville, Mass.	Willow Garages, Inc.	250
WAIT	Tauton, Mass.	A. H. Waite & Co.	229
WAIU	Columbus, O.	American Ins. Union	293.9
WALK	Bethayres, Pa.	(portable) A. A. Walker	285
WAMD	Minneapolis, Minn.	Radisson Radio Corp., & S. E. Hubbard	243.8
WAOK	Ozone Park, N. Y.	A. H. Andreason	247.8
WAPI	Auburn, Ala.	Alabama Polytechnic Inst.	461.3
WARC	Medford, Mass.	American Radio & Research	261
WARS	Brooklyn, N. Y.	Amateur Radio Specialty Co.	295
WASH	Grand Rapids, Mich.	Baxter Launderers & Cleaners	256.3
WATT	Portable-First District, Edison Electric, Ill.		243.8
WBAA	W. Lafayette, Ind.	Purdue Univ.	273
WBAK	Harrisburg, Pa.	Pa. State Police	275
WBAL	Baltimore, Md.	Consol. Gas & Power Co	245.8
WBAO	Decatur, Ill.	James Miliken Univ.	270.1
WBAP	Fort Worth, Tex.	Carter Pub., Inc.	475.9
WBAW	Nashville, Tenn.	Waldrun Drug Co.	236
WBAX	Wilkes Barre, Pa.	J. H. Stenger, Jr.	256
WBBC	Brooklyn, N. Y.	Bklyn. B'dsctg. Co.	267.7
WBBL	Richmond, Va.	Grace Covenant Presbyterian Church	228.9
WBBM	Chicago, Ill.	Atlass Investment	226
WBBP	Petosky, Mich.	Petosky High School	238
WBBR	Rossville, N. Y.	Peoples Pulpit Assn	416.4
WBBW	Norfolk, Va.	Ruffner Junior H. S.	222
WBBY	Charlestown, S. C.	Washington Light Infantry	268
WBBZ	Portable, Ill.	C. L. Carrell	215
WBCN	Chicago, Ill.	Foster & McDonnell	266
WBES	Takoma Park, Md.	Bliss Electrical School	222
WBET	Boston, Mass.	Boston Transcript Co.	384.4
WBKN	Brooklyn, N. Y.	A. Faske	291.1
WBMS	Union City, N. J.	G. J. Schowerer	223.7
WBNY	New York, N. Y.	Baruchrome Corp.	322.4
WBOQ	Richmond Hill, N. Y.	A. H. Grebe & Company, Inc.	236
WBRC	Birmingham, Ala.	Birmingham Bdcstg. Corp.	247.8
WBRE	Wilkes Barre, Pa.	Baltimore Radio Exchange	231
WBRL	Tilton, N. H.	Booth Radio Labs.	420
WBSO	Wellesley Hills, Mass.	Babson's	242
WBRS	Bklyn, N. Y.	Univ. Radio Mfg. Co.	394
WBT	Charlotte, N. C.	C. Cham. of Com.	275
WBZ	Springfield, Mass.	Westinghouse E. & M. Company	333.1
WBZA	Boston, Mass.	Westinghouse E. & M. Company	333.1
WCAC	Mansfield, Conn.	Conn. Agri. College	275
WCAD	Canton, N. Y.	St. Lawrence University	263
WCAE	Pittsburgh, Pa.	Kaufman & Baer Co.	461.3
WCAH	Columbus, Ohio	Entrekin Elec. Co.	265.2
WCAJ	University Place, Neb.	Neb. Wesleyan Univ.	254

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Station	Location	Owner	Meters
WCAL	Northfield, Minn.	St. Olaf College	336.9
WCAM	Camden, N. J.	City of Camden	336.9
WCAO	Baltimore, Md.	Monumental Radio Co., Inc.	275
WCAR	San Antonio, Tex.	S. Radio Corp	268
WCAT	Rapid City, S. D.	School of Mines	240
WCAU	Philadelphia, Pa.	Universal Bdcstg Co.	278
WCAX	Burlington, Vt.	Univ. of Vt	250
WCAZ	Carthage, Ill.	Carthage College	245.8
WCBA	Allentown, Pa.	C. W. Heimbach	254
WCBD	Zion, Ill.	Wilber Glenn Voliva	344.6
WCBE	New Orleans, La.	Uhalt Radio Co	263
WCBH	Oxford, Miss.	University of Miss	242
WCBM	Baltimore, Md.	Hotel Chateau	229
WCBR	Portable, R. I.	C. H. Messter	234.2
WCBS	Providence, R. I.	(portable), H. L. Dewing & C. H. Messter	242.5
WCCO	Anoka, Minn.	Washburn Crosby Co.	416.4
WCFL	Chicago, Ill.	Chicago Fed. of Labor	491.5
WCFT	Tullahoma, Tenn.	Knights Pyth. Home	252
WCGU	Lakewood, N. J.	C. G. Ungar	350.6
WCLO	Camp Lake, Wis.	C. E. Whitmore	231
WCLS	Joliet, Ill.	WCLS, Inc.	214.2
WCMA	Culver, Ind.	Culver Military Academy	258.5
WCOA	Pensacola, Fla.	City of Pensacola	252
WCOC	Columbus, Miss.	Crystal Oil Co	265.3
WCOM	Manchester, N. H.	172nd Field Artil.	252
WCOT	Olneyville, R. I.	Jacob. Conn	265.3
WCRW	Chicago, Ill.	C. R. White	410.7
WCSH	Portland, Me.	H. R. Rines	499.7
WCSO	Springfield, O.	Wittonberg College	248
WCWK	Fort Wayne, Ind.	C. W. Keen	234.2
WCWS	Portable, Conn.	C. Wm. Selen	232.4
WDAD & WLAC	Nashville, Tenn.	Dad's Auto Access., Inc., & Life & Casualty Ins. Co	226
WDAE	Tampa, Fla.	Tampa Daily Times	273
WDAF	Kansas City, Mo.	Kansas City Star	365.6
WDAG	Amarillo, Tex.	J. L. Martin	263
WDAH	El Paso, Tex.	Trinity Methodist Ch	267.7
WDAY	Fargo, N. D.	Radio Equipment Corp	260.7
WDBE	Atlanta, Ga.	Gilham Electric Co	270
WDBJ	Roanoke, Va.	Richardson, Wayland Elec. Corp.	228.9
WDBK	Cleveland, O.	WDBK Bdcst. Station Co. Inc.	227
WDBO	Winter Park, Fla.	Rollins College	240
WDBZ	Kingston, N. Y.	Kingston Radio Club	233
WDEL	Welmington, Del.	Wilmington Elec. Spec. Co.	266
WDGY	Minneapolis, Minn.	Dr. G. W. Young	263
WDOD	Chattanooga, Tenn.	Chattanooga Radio Co., Inc.	256
WDRC	New Haven, Conn.	Doolittle Radio Corp.	268
WDWF	Cranston, R. I.	D. W. Flint, Inc	440.9
WDWM	Newark, N. J.	Radio Industries Bdcst. Co.	280.2
WDXL	Detroit, Mich.	DXL Radio Corp	296.9
WDZ	Tuscola, Ill.	James L. Bush	278
WEAF	N. Y. City	National Bd'g Co. of Am.	491.5
WEAI	Ithaca, N. Y.	Cornell University	254
WEAM	North Plainfield, N. J.	Borough of North Plainfield	261
WEAN	Providence, R. I.	The Shepard Co	367
WEAO	Columbus, O.	Ohio State University	293.9
WEAR	Cleveland, O.	Willard Storage Battery Company	389.4
WEAU	Sioux City, Ia.	Davidson Bros. Co	275
WEBC	Superior, Wisc.	W. C. Bridges	242
WEBG	Harrisburgh, Ill.	Tate Radio Co	226
WEBH	Chicago, Ill.	Edgewater Beach Hotel	370.2
WEBJ	New York, N. Y.	Third Ave. R. R. Co	273
WEBL	Portable, R. C. A.		226
WEBR	Buffalo, N. Y.	H. H. Howell	244
WEBW	Beloit, Wisc.	Beloit College	258
WEBZ	Savannah, Ga.	Savannah Radio Corp	263.
WEDC	Chicago, Ill.	Emil Denemark Bdcstg. Station	249.9
WEEI	Boston, Mass.	Edison Electric Ill. Co.	348.6
WEHS	Evanston, Ill.	A. T. Becker	241.8
WEMC	Berrien Springs, Mich.	Emanuel Miss. Colleg	315.6
WENR	Chicago, Ill.	All-American Radio Corp.	266
WEPS	Gloucester, Mass.	Matheson Radio Co.	295
WEW	St. Louis, Mo.	St. Louis University	360
WFAA	Dallas, Tex.	Dallas News & Dallas Journal	475.9
WFAM	St. Cloud, Minn.	Times Publishing Co.	273
WFAV	Lincoln, Neb.	University of Neb	275
WFBC	Knoxville, Tenn.	First Baptist Church	250
WFBE	Cinc., O.	Garfield Place Hotel	232.4
WFBG	Altoona, Pa.	W. F. Gable Co	278
WFBJ	Collegeville, Minn.	St. John's University	236
WFBL	Syracuse, N. Y.	Onondaga, Conn	252
WFBM	Indianapolis, Ind.	Merchant H. L. Co.	268
WFBR	Baltimore, Md.	Fifth Infantry, National Guard	254
WFBZ	Galesburg, Ill.	Knox College	254
WFCI	Pawtucket, R. I.	Frank Crook, Inc.	229
WFDF	Flint, Mich.	Frank D. allain	234
WFHH	Clearwater, Fla.	Ft. Harrison Hotel	355.4
WFI	Phila., Pa.	Strawbridge & Clothier	394.5
WFIW	Hopkinsville, Ky.	The Acme Mills, Inc.	356.9
WFKB	Chicago, Ill.	F. K. Bridgman	217.3
WFKD	Philadelphia, Pa.	Foulkord Radio Engineering Co.	249.9
WFRL	Brooklyn, N. Y.	Flatbush Radio Labs.	329.5
WGAL	Lancaster, Pa.	Lancaster Electric Supply and Construction Co	248
WGBB	Freeport, N. Y.	H. H. Carman	243.8
WGBC	Memphis, Tenn.	First Baptist Church	278
WGBI	Scranton, Pa.	Scranton Bdcstg. Inc	252
WGBS	Astoria, L. I.	N. Y. Gimbel Bros	315.6
WGBU	Fulford-by-the-Sea, Fla.	Florida Cities Finance Company	384.4
WGBX	Oreno, Maine	Univ. of Maine	234.2
WGCP	Newark, N. J.	May Radio Bdcstg. Corp.	252
WGES	Chicago, Ill.	Oak Leaves Broadcasting Corporation	315.6
WGHB	Clearwater, Fla.	Ft. Harrison Hotel	266
WGL	New York City	Internat'l Bdcst. Corp.	442.4
WGM	Ieanette, Pa.	Verne & Elton Spencer	269
WGN	Chicago, Ill.	Chicago Tribune	302.8
WGMU	Portable, N. Y.	A. H. Grebe & Co	236
WGR	Buffalo, N. Y.	Federal Tel. & Tel. Co	319
WGST	Atlanta, Ga.	School of Tech	270
WGY	Schenectady, N. Y.	G. E. Co	379.5
WHA	Madison, Wisc.	University of Wisc	535.4
WHAD	Milwaukee, Wisc.	Marquette Univ	275
WHAM	Rochester, N. Y.	Stromberg-Carlson Tel. Mfg. Co	278
WHAP	New York, N. Y.	W. H. Taylor Finance Corporation	431
WHAR	Atlantic City, N. J.	F. D. Cooks Sons	275.
WHAS	Louisville, Ky.	Courier Journal & Louisville Times	399.8
WHAZ	Troy, N. Y.	Rensselaer Polytechnic Inst.	379.5
WHB	Kansas City, Mo.	Sweeney School Co	365.6
WHBA	Oil City, Pa.	C. C. Shaffer	250
WHBC	Canton, O.	Rev. E. P. Graham	254
WHBD	Bellefontaine, O.	Chamber of Com	222.1
WHBF	Rock Island, Ill.	Beardsley Spc. Co	222
WHBL	Portable, Ninth District, C. L. Carrell		215.7
WHBM	Portable, Ninth District. C. L. Carrell		215.7
WHBN	St. Petersburg, Fla.	First Avenue M. E. Church	238
WHBP	Johnston, Pa.	Johnston Auto Co	256
WHBQ	Memphis. Tenn.	St. Johns M. E. Ch.	233
WHBS	Rock Island, Ill.	Beardsley Spec. Co	221.1
WHBU	Anderson, Ind.	Riviera Theatre	218.8
WHBW	Philadelphia. Pa.	D. R. Kienzle	215.7
WHBY	West De Pere, Wisc.	St. Norberts College	249.9
WHDI	Minneapolis, Minn.	W. H. Dunwoody Institute	278
WHEC	Rochester, N. Y.	Hickson Electric Co., Inc.	258
WHFC	Chicago, Ill.	Triangle Bdcstrs	258.5
WHK	Cleveland, O.	Radio Air Service Corp	272.6
WHN	New York, N. Y.	Geo. Schubel	361.2
WHO	Des Moines, Ia.	Bankers Life Co	526
WHOG	Huntington, Ind.	Huntington Bdcstrs. Association	241.8
WHT	Deerfield, Ill.	Radiophone Bdcstg. Corp.	238.8
WIAD	Philadelphia, Pa.	Howard R. Miller	250.
WIAS	Burlington, Ia.	Home Elec	254
WIBA	Madison, Wisc.	Strand Theatre	236.1
WIBG	Elkins Park, Pa.	St. Paul's Protestant Episcopal Church	222
WIBH	New Bedford, Mass.	Elite Radio Stores	209.7
WIBI	Flushing, L. I., N. Y.	F. B. Zittel, Jr.	218.8
WIBJ	Portable, Ill.	C. L. Carrell	215.7
WIBM	Portable, Ill.	B. Maine	215.7
WIBO	Chicago, Ill.	WIBO Bdcstrs., Inc	226
WIBR	Weirton, W. Va.	Thurman A. Owings	246
WIBS	Elizabeth, N. J.	Thos. F. Hunter	202.6
WIBU	Poynette, Wisc.	The Electric Farm	222
WIBW	Logansport, Ind.	Dr. L. L. Dill	220
WIBX	Utica, N. Y.	WIBX, Inc.	234.2
WIBZ	Montgomery, Ala.	A. D. Trum	230.6
WICC	Bridgeport, Conn.	Bridgep't Bdcstg. Sta.	285
WIL	St. Louis, Mo.	St. Louis Star	258
WIOD	Miami, Fla.	Carl G. Fisher Co	247.8
WIP	Philadelphia, Pa.	Gimbel Bros	508.2
WJAD	Waco, Tex.	Jackson's Radio Engineering Laboratories	352.7
WJAF	Ferndale, Mich.	J. S. Fernberg Radio Co.	407
WJAG	Norfolk, Neb.	Norfolk Daily News	270
WJAK	Kokomo, Ind.	Kokomo Tribune	254.1
WJAM	Cedar Rapids, Ia.	D. M. Perham	268
WJAR	Providence, R. I.	The Outlet Co.	483.6
WJAS	Pittsburg, Pa.	Pittsburgh Radio Supply House	275
WJAX	Jacksonville, Fla.	City of Jacksonville	336.9
WJAY	Cleveland, O.	Cleveland Radio Bdcst. Corp.	435.7
WJAZ	Mount Prospect, Ill.	Zenith Radio Corp.	329.5
WJBA	Joliet, Ill.	D. H. Lentz, Jr.	206.8
WJBB	St. Petersburg, Fla.	Financial Journal.	254.1
WJBC	La Salle, Ill.	Hummer Furniture Co	234
WJBI	Red Bank, N. J.	R. S. Johnson	218.8
WJBK	Ypsilanti, Mich.	E. F. Goodwin	233
WJBL	Decatur, Ill.	Wm. Gushard Dry Goods Co.	270
WJBO	New Orleans, La.	V. Jenson	267.7
WJBR	Omro, Wisc.	Omro Drug Stores	227.1
WJBT	Chicago, Ill.	John S. Boyd	468.5
WJBU	Lewisburg, Pa.	Bucknell University	211.1
WJBW	New Orleans, La.	C. Carlson, Jr.	270.1
WJBY	Gadsen, Ala.	Elec. Construction Co	260
WJBZ	Chicago Heights, Ill.	R. G. Palmer	419.3
WJJD	Mooseheart, Ill.	Loyal Order of Moose	370.2
WJR-WCX	Pontiac, Mich.	Station WJR, Inc., & Detroit Fress Press	516.9
WJUG	New York City	U. B. Ross	516.9
WJY	New York, N. Y.	Nat. Bdcstg. Co. of Amer.	405.2
WJZ	Bound Brook, N. J.	Nat. Bdcstg Co. of Amer.	454.3
WKAF	Milwaukee, Wisc.	WKAF Broadcasting Corp.	261
WKAQ	San Juan, P. R.	Radio Corporation of Porto Rico	340.7
WKAR	East Lansing, Mich.	Michigan State College	285.8
WKAV	Laconia, New Haven	Laconia Radio Club	224
WKBA	Chicago, Ill.	Arrow Battery Co	209.7
WKBB	Joliet, Ill.	Sanders Brothers	282.8
WKBC	Birmingham, Ala.	H. L. Ansley	225
WKBE	Webster, Mass.	K. & B. Electric Co.	270.1
WKBF	Indianapolis, Ind.	N. D. Watson	244
WKBH	La Crosse, Wisc.	Callaway Music	249.9
WKBG	Portable, Ill.	C. L. Carrell	215.7
WKBI	Chicago, Ill.	F. L. Schoenwolf	220.4
WKBJ	St. Petersburg, Fla.	Gospel Tabernacle, Inc.	280
WKBL	Monroe, Mich.	Monrona Radio Mfg. Co.	252
WKBM	Newburgh, N. Y.	J. W. Jones	285.5
WKBN	Youngstown. O.	Radio Elec. Serv. Co	360
WKBO	Jersey City, N. J.	Jersey Observer	472.2
WKBP	Battle Creek, Mich.	Enquirer & News	265
WKBS	Galesburg, Ill.	P. N. Nelson	361.2
WKBT	New Orleans, Ia.	First Baptist Church	252
WKBU	New Castle, Pa.	H. K. Armstrong	238
WKBV	Brookville, Ind.	Knox Battery & Electric Co.	236.1
WKBY	Danville, Pa.	(Portable) F. Quick	220
WKBW	Buffalo, N. Y.	Churchill Evan. Assn.	362.5
WKBZ	Ludington, Mich.	K. L. Ashbacker	256.3
WKDR	Kenosha, Wisc.	E. A. Dato	428.3
WKJC	Lancaster, Pa.	Kirk Johnson & Co	258.5
WKRC	Cincinnati, O.	Kodel Radio Corp	422.3
WKY	Oklahoma City, Okla.	R. C. Hull & N. S. Richards	275
WLAL	Tulsa, Okla.	First Christian Church	250
WLAP	Louisville, Ky.	W. V. Jordan	275
WLB	Minneapolis, Minn.	University of Minnesota	278
WLBC	Muncie, Ind.	D. A. Burton	223.7
WLBE	Bklyn, N. Y.	J. H. Fruitman	230.6
WLBF	Kansas City, Mo.	E. L. Dellard	211.1
WLBH	Farmingdale, N. Y.	J. J. Lombardi	230
WLBI	East Weonona, Ill.	A. Yarc	296.9
WLBJ	Cleveland, O.	H. Grossman	300
WLBL	Stevens Point, Wisc.	Wisc. Department of Markets	278
WLBM	Boston, Mass.	Browning-Drake Co	480
WLBN	Portable, W. E.	Hiler	225.4
WLBO	Galesburg, Ill.	F. A. Trebbe	243
WLBP	Ashland, O.	R. A. Fox	220.4
WLBQ	Atwood, Ill.	E. D. Trout	230.6
WLBR	Belvidere, Ill.	Alford Radio Co	335
WLBT	Crown Point, Ind.	H. Wendell	230
WLBV	Mansfield, O.	J. F. Weimer & D. A. Snick	230.6
WLBW	Oil City, Pa.	Petroleum Tel. Co	321
WLBX	Long Island City	J. N. Brahy	230.6
WLBY	Iron Mountain, Mich.	Aimone Elec	249.9
WLBZ	Dover-Foxcroft, Me.	T. L. Guernsey	299
WLCI	Ithaca, N. Y.	Lutheran Assn. of Ithaca	266
WLIB	Elgin, Ill.	Liberty Weekly, Inc	302.8
WLIT	Philadelphia, Pa.	Lit Brothers	394.5
WLS	Crete, Ill.	Sears Roebuck Co	344.5
WLSL	Cranston, R. I.	The Lincoln Studios, Inc.	440.9
WLTS	Chicago, Ill.	Lane Technical High School	258
WLW	Harrison, O.	The Crosley Radio Corp.	422.3
WLWL	N. Y. C.	Paulist Fathers	384.4
WMAC	Cazenovia, N. Y.	C. B. Meredith	275
WMAF	Dartmouth, Mass.	Round Hills Radio Corp.	440.9
WMAK	Lockport, N. Y.	Norton Laboratories	266
WMAL	Washington, D. C.	M. A. Leese Optical Co.	293.9
WMAN	Columbus, O.	Haskett Radio Station	278
WMAQ	Chicago, Ill.	Chicago Daily News	447.5
WMAY	St. Louis, Mo.	Kings Highway Preb. Church	248
WMAZ	Macon, Ga.	Mercer University	261
WMBA	R. Is. (portable), L. J. Beebe		249.9
WMBB	Chicago, Ill.	American Bond & Mortgage Co.	250
WMBC	Detroit, Mich.	Michigan Broadcasting Co., Inc.	256
WMBD	Peoria Heights, Ill.	Peoria Heights Radio Lab.	279
WMBE	St. Paul, Minn.	Dr. C. S. Stevens	220
WMBF	Miami Beach, Fla.	Fleetwood Hotel Corp.	384.4
WMBG	Richmond, Va.	Havens & Martin	220
WMBH	Chicago, Ill., (portable)	E. D. Aber	280
WMBI	Chicago, Ill.	Moody Bible Inst	288.3
WMBJ	Monessen, Pa.	W. Roy McShaffrey	277.6
WMBK	Hamilton, O.	J. C. Slade	360
WMBQ	Bklyn, N. Y.	P. J. Gollhofer	210
WMBR	Tampa, Fla.	Premier Elec. Co	250
WMBS	Harrisburg, Pa.	Mack's Battery Service	360
WMBU	Pittsburgh, Pa.	P. J. Miller	236.1
WMBW	Youngstown, O.	Youngstown Bdcstg Co., Inc.	279
WMBY	Bloomington, Ill.	R. A. Isaacs	291.1
WMC	Memphis, Tenn.	Commercial Pub. Co	499.7
WMCA	Hoboken, N. J.	Greely Square Hotel	340.7
WMPC	Lapeer, Mich.	1st Meth. Prot. Ch	202
WMRJ	Jamaica, N. Y.	P. J. Prinz	227.1
WMSG	N. Y. C., N. Y.	Radio Eng. Corp	302.8
WMVM	Newark, N. J.	E. J. Malone, Jr	475.9
WNAB	Boston, Mass.	Shepard Stores	280.2
WNAC	Boston, Mass.	Shepard Stores	430.1
WNAD	Norman, Okla.	University of Okla	254
WNAL	Omaha, Neb.	Omaha Central H. S.	258
WNAT	Philadelphia, Pa.	Lennig Brothers Co.	250
WNAX	Yankton, S. D.	Dak. Radio App. Co.	244
WNBA	Forest Park, Ill.	M. T. Rafferty	238
WNBF	Union Station, Endicott, N. Y.	Howitt-Wood Radio Co	205.4
WNBH	New Bedford, Mass.	New Bedford Hotel	247.8
WNBJ	Knoxville, Tenn.	Lonsdale Bapt. Ch	355
WNBK	LeRoy, N. Y.	H. C. Barton Electric Co.	354
WNBI	Peru, Ill.	W. M. Romanouski	357
WNBL	Bloomington, Ill.	H. R. Storm	495
WNJ	Newark, N. J.	H. Lubinsky	350
WNOX	Knoxville, Tenn.	Peoples Tel. & Tel. Co.	267.7
WNRC	Greenboro, N. C.	W. M. Nelson	224
WNYC	New York, N. Y.	Department of Plants & Structures	526
WOAI	San Antonio, Tex.	Sou. Equip. Co	394.5
WOAN	Lawrenceburg, Tenn.	Vaughan Con. of Music	356.4
WOAW	Omaha, Neb.	Woodmen of the World	526
WOAX	Trenton, N. J.	F. J. Wolff	240
WOBB	Longacre, Ill.	Longacre Engr. Const. Co.	555.2
WOC	Davenport, Ia.	Palmer School of Chiropractic	483.6
WOCB	Orlando Bdcstg. Co.,	Orlando, Fla.	293.7
WOCL	Jamestown, N. Y.	A. B. Newton	273.1
WODA	Patterson, N. J.	O'Dea Temple of Music	360.9
WOI	Ames, Ia.	Iowa State College	270
WOK	Homewood, Ill.	Neutrowound Radio Mfg. Co.	217.3
WOKO	Peekskill, N. Y.	H. E. Smith	232.4
WOO	Philadelphia, Pa.	J. Wanamaker	508.2
WOOD	Grand Rapids. Mich.	Grand Radio Co	241.8
WOQ	Kansas City, Mo.	Unity School	278.
WOR	Newark, N. J.	L. Bamberger & Co	405.2
WORD	Batavia, Ill.	Peoples Pulpit Assn	275
WOS	Jefferson City, Mo.	State Marketing Bureau	440.9
WCWB	Milwaukee, Wis.	Radiocast Corp. of Wisc.	384.4

(Concluded on page 27)

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THE RADIO TRADE

Court Reduces Tariff on Parts to 30 Per Cent.

The tariff rate on loudspeakers, units, parts of radio apparatus or attachments, was lowered by a decision of Judge Fischer, of the United States Customs Court, sustaining protests of Abraham & Straus, A. J. Bracher & Company, J. H. Faunce, Inc., and P. Luckenbach. These parts, etc., were taxed on entry at the rate of 40 per cent. ad valorem, under paragraph 399, act of 1922. Judge Fischer fixed duty at 30 per cent ad valorem under the provision in paragraph 372 for "Machines or parts thereof."

NEW BOSTON STORE

Boston.

An entire store devoted to the best nationally-known radios has been opened by the Prime Furniture Company, next door to Prime's furniture store, at 16 Stuart st. The entire first floor, with a large show window, is devoted to radio.

Bernard H. Lippin is to be manager of the new radio store.

J. E. Anderson's Vacuum Tube Voltmeter

Price Completely Assembled **$5.00**

M. LERNER

145 West 45th Street, N. Y. City

SOMETHING YOU HAVE BEEN WAITING FOR!

Powertone Wave Trap

(STATION SEPARATOR)

Price $2.00

at all good dealers

Powertone Elec. Co.

221 Fulton St. New York City

COMPLETE DATA

ON THE KH-27 RECEIVER AN EXCELLENT 6-TUBE SET

Kenneth Harkness, prominent consulting radio engineer, known the world over for his ingenious radio receiver circuit contributions, designer of the famous Harkness Reflex and the Harkness Counterflex circuits, is the designer of a new receiver, known as the KH-27, which surpasses all of his other types, and which was described in the January 29th, February 5th and 12th issues of RADIO WORLD.

The outstanding features of this remarkable set are:

(1)—Simplicity in tuning.
(2)—Tremendous volume on locals and distant stations with tonal quality that enchants.
(3)—No disagreeable squeals, or howls.
(4)—Inexpensive to build.
(5)—Works from either batteries or eliminators.

In the January 29 issue, a general discussion of the receiver, together with wonderful photos and circuit diagram were given.

In the February 5 issue, detailed assembly and wiring directions were given, accompanied with specially drawn diagrams, simplifying the wiring.

In the February 12 issue, directions on installing and operating this set were given; also Lucid diagrams accompanied this article.

Send 15c for any one copy, or 30c for all three. Send $6 for one year's subscription (52 numbers) and get the three numbers FREE.

RADIO WORLD

145 West 45th St., New York City

Roy T. Anderson Enters Radio In Sales Post

ROY T. ANDERSON

Roy T. Anderson, formerly of the Lincoln-Lily Advertising Agency of Chicago, has become vice-president and sales manager of the Buckingham Radio Corporation, 25 E. Austin, Chicago.

Mr. Anderson has been successfully associated in the advertising business for over eight years and his recent decision to enter the radio industry should prove even more beneficial to him and also to his business associates.

The Buckingham Radio Corporation, according to Mr. Anderson, is now making active plans for a larger national distribution on their extensive line of chassis cabinets and one and two-dial receivers.

SECOND IRISH STATION

The International Telephone and Telegraph Corporation announces that its subsidiary, the International Standard Electric Corporation, through its associated company in London, is in receipt of an order from Cork, Irish Free State, for a 1 kw. broadcasting station, including a duplicate power plant. This station is the second to be erected in the Free State and is scheduled to be completed about April 1.

$1 GET DISTANCE

AMAZING INVENTION FOR ANY RADIO

Why confine your radio programs to a few local stations when the expensive concerts, dance music and lectures of hundreds of big cities are ready for you? Connect this **DISTANCE GETTER** to your radio, tune according to instructions and presto—note the distant programs roll in!

Satisfaction Guaranteed

Your money instantly refunded if you are not satisfied. The article on proper tuning, furnished FREE with each Distance Getter, alone is worth the price. Galloway of Chicago writes: "Results beyond all expectations. Cuts thru locals like a knife."

MAIL COUPON TODAY

HAZLETON LABORATORIES
4554 Malden St., Dept. RW, Chicago, Ill.

Send me Distance Getter, postpaid. Enclosed find $1.00 (M. O. stamps or check).
Send C. O. D. plus small postage added.

Name .....

Address .....

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

Literature Wanted

THE names of readers of RADIO WORLD who desire literature on parts and sets from radio manufacturers, jobbers and dealers are published in RADIO WORLD on request of the reader. The blank below may be used, or a post card or letter will do instead.

RADIO WORLD,
145 West 45th St., N. Y. City.

I desire to receive radio literature

Name .....

Address .....

City or town .....

State .....

C. B. Vermilyea, Box 272, Fairmont, Mo.
C. Bland, 2829 North Madison St., Louisville, Ky.
G. H. Paris, 217 Torrey Building, Duluth, Minn.
T. O. Aittola, 111 Whittemore, Fitchburg, Mass.
M. Rozen, c/o Terris, 1191 Fulton St., Brooklyn, N. Y.
Charles H. Karutz, P. O. Box 746, Hollywood, Fla.
W. P. Lamjou, Box 111, Lester, Pa.
Bet Bertram Susdorf, Box 366, Rautoul, Ill.
P. E. Flagg, 3190 Hull Ave., N. Y. City, N. Y.
A. A. Feldman, 742 Montgomery St., Brooklyn, N. Y.
J. J. Miller, P. O. 176, Panhandle, Tex.
David Speir, Uvaldi, Tex.
Bert Smith, Jr., Uvaldi, Tex.
Edward H. Houghton, 9 Prospect St., Charlestown, Mass.
J. H. George, 5207 Holmes St., Pittsburgh Pa.
J. P. Muffler, Fine Lawn, Mo.
W. R. Wood, 718 6th St., Bremerton, Wash.
Victor A. Piliere, 301 East 40th St., N. Y. City, N. Y.
L. R. Bagwell, 2110 Tom Green St., Austin, Tex.
Sidney Greenstein, 828 Dawson St., Bronx, N. Y.
Bertram Reinitz, 127-A Clarkson Ave., Brooklyn, N. Y.
R. A. Weyer, 1134 Colorado St., Davenport, Ia.
John H. Draper, Glenella Cottage, East Ave., Elmira, N. Y.
John K. Barker, 503 Mifflin St., Butler, Pa.
Giese & Spang, P. O. Box 1475, San Antonio, Tex.
Edward Slaton, 315 West Main St., Susquehanna, Pa.
P. J. Back 7227 North Paulina St. Chicago, Ill.
W. J. Schlager, 535 Quincy Ave., Scranton, Pa.
R. H. Claypool, 1906 North 5th St., Waco, Tex.
Millard E. Smith, Ogallaha, Neb.
William Richards, 10 Sherman Ave., East Portchester, Conn.
F. E. Brock, 105 Tecumseh St., Pittsburgh, Pa.
N. S. Shapiro, 203 East 12th St., N. Y. City, N. Y.
William Stieman, 16 Passaic St., Trenton, N. J.
B. F. Long, 5036 Catharine St., Philadelphia, Pa.
Leonard Langston, 616 Newton St., Denver, Colo.
J. S. Kees, 631 East 65th St., N. Portland, Ore.
George Kausch, 1022 Birch St., Reading, Pa.
B. D. Gribble, Roit Route 3, Delhi, N. Y.
B. Danheiser, 11 West Division St., North East, Pa.
Fred W. Fahnauer, 803 Kansas Avenue, Leavenworth, Kans.
Mortimer Derfler, 311 East 110th St., N. Y. City, N. Y.
Sam Cook, 1930 Jersey Ave., Hamilton, Ohio.
C. B. Holm, Selby, S. D.
Albert C. Chambers, 547 Seymour Ave., Jackson, Mich.
P. T. Handiges, 833 Kingston Ave., Toledo, O.
Roger J. Kennelly, 6829 Kelley St., Pittsburgh, Homewood P. O., Pa.
T. H. Woodworth, 88 Gardner Ave., Groveland, Mass.
E. V. Miracle, Bruceton, Pa.
Edward C. Breden, 219 Union Ave., Mt Vernon, N. Y.

World "A" Power Unit--$12.75

Automatically provides even, unvarying "A" current from your light socket. Absolutely noiseless. Assures full tone quality from your set and wider D. X. range. Famous WORLD quality—at less than half the cost of any similar equipment. Shipped complete, subject to inspection on receipt of price, or C.O.D. if you wish. 25 amp. unit for sets of 4 tubes or less, $12.75. 60 Amp. unit for sets of 5 tubes or more, $15.75. 5% discount if cash in full is sent with order. Send order today. World Battery Co., 1219 So. Wabash Ave., Dept. 82, Chicago, Ill.

Alden Processed **NA-ALD** Sockets and Dials

UX POWER TUBES installed in any set without rewiring by Na-Ald Adapters and Connectoralds. For full information write Alden Manufacturing Co., Dept. S-20, Springfield, Mass.

www.americanradiohistory.com

Sangamo Condenser "Parvolt" Hereafter

Thomas B. Rhodes announced that the wound condenser formerly trade marked "Sangamo" will now be known as "Parvolt".

The Acme Wire Company of New Haven, Conn., who furnished the condenser cartridge to the Sangamo Company, will now manufacture the condenser in its entirety. Distribution plans on the condenser will not be altered.

This change also brings the vice-presidency of Rossiter and Company, New York, to Thomas B. Rhodes, who has been associated with Sangamo for thirteen years.

This contact with the Sangamo Electric Company will not be completely broken as he will continue relations with both Sangamo and Acme Wire Company in reference to their radio advertising and publicity.

Mr. Rhodes takes with him to Rossiter the exclusive sales representation from Cleveland east for all Sangamo radio products and the Parvolt condenser.

This move is of particular interest as it marks the entrance of Mr. Rhodes, an executive with more than 24 years of experience in the electrical industry, into the radio business.

His new work will not be unfamiliar as he has been in charge of radio and radio development for the Sangamo Electric Company since they entered the field three years ago.

Van Horne Company Increases Capital Stock

An increase in the capital stock of The Van Horne Company, Franklin, Ohio, was announced, following the return of J. S. Van Horne, president of the company, to the factory after an extensive Eastern trip.

It is understood that contracts with two or three leading set manufacturers call for the delivery of production quantities of a new Van Horne tube which is to be used in a new circuit as yet unannounced. The demand for this tube and another special Van Horne tube will make all-Summer production necessary.

WHOLESALE HOUSE MOVES

Omaha, Neb.

The Radio Apparatus Company, Inc., for the past four years located at 1808 Farnam street, wholesaling and retailing radio parts, supplies and equipment, has moved to its new location at 1109 Farnam street.

It has discontinued its retail store and is devoting all its time and attention to the wholesale business, particularly catering to dealers, professional set builders and amateurs.

A. Greenspan is manager and H. Herron assistant manager.

HARKNESS
KH-27 Receiver

Write for FREE BOOKLET, "How to Build the Harkness KH-27." Complete data, photographs, list of parts, big picture wiring diagrams. No obligations. FREE! Write NOW!

K. H. RADIO LABORATORIES, Inc.
124-R Cypress Avenue Bronx, N. Y.

Send for Latest RADIO CATALOG and GUIDE

Hot off the press—latest Radio Catalog and Guide for 1927, brimful of new ideas, 164 pages of special hook-ups with information—all free. Shows savings as high as 50% on sets and supplies. Write letter or postal now. Also please include name of radio friend.

BARAWIK CO., 560 Monroe Street, Chicago, U. S. A.

NEW CORPORATIONS

Sixth Avenue Radio Shop, N. Y. City, $15,000; A. and L. Lewis, M. Leonard. (Atty., L. E. Ginsburg, 1440 Broadway, N. Y. City, N. Y.).

Viphonic Corp., radios, N. Y. City, $2,000; F. L. Wilson, W. Leplattner, V. Sherlock. (Atty. Brill, Bergenfeld & Brill, 29 Broadway, N. Y. City, N. Y.).

Highway Automotive Co., radio accessories, N. Y. City, $10,000; L. Wiltchick, S. Schwartz. (Atty., L. Mayers, 51 Chambers St., N. Y. City, N. Y.).

Radio Mart, retail radio, Passaic, N. J., Clarence Kip. (Incorporated under the laws of New Jersey.)

Johnson-Kennedy Radio Corporation, deal in radios and conduct a radio broadcasting station, Gary, Inc., $30,000; Thomas J. Johnson, Francis K. Johnson. (Incorporated under the laws of Indiana).

Walter E. Bathgate Co., radio products, N. Y. City, $10,000; W. E. Bathgate, S. and G. Angstreich. Atty., W. B. Sandler, 160 Broadway, N. Y. City, N. Y.).

Oklahoma Radio Post No. 300, Oklahoma City, Okla., No capital; E. Ramsey, Joe P. Crawford, Walter W. Long, all of Oklahoma City. (Incorporated under the laws of Oklahoma).

Radio Caster, broadcasting, N. Y. City, 1,000 shares, Class A, 1000 Class B, both common, no par; L. Bannister, W. O. Hubbard, E. K. Stitt, Jr. (Attys., Walton, Bannister, Hubbard & Stitt, 40 West 40th St., N. Y. City, N. Y.).

Virginia Paint and Radio Corporation, Newport News, Va., deal in radio and paint lines; $50,000; T. A. Fowler, A. Rosenbaum, W. T. Bull, Allan D. Jones, all of Newport News, Va. (Incorporated under the laws of Virginia.)

Mitchell Electric Company, Sebring, Fla., deal in electric lamps, radios; $10,000, divided into 100 shares, par value, at $100 each; Thomas M. Mitchell, C. H. Mitchell, Sophy Mae Mitchell. (Incorporated under the laws of Florida.)

Everite Radio and Phonograph Co., N. Y. City., $50,000; J. Frey, J. Tannenbaum, F. H. Mahoney. (Atty., J. Gurger, 1440 Broadway, N. Y. City.)

CAPITAL INCREASES

Heina Radio Corp., N. Y. City, $25,000 to $200,000.

TRADE NOTES

Glendale, Calif.

J. A. Newton, president of the J. A. Newton Electric Co., 154 South Brand boulevard, has announced that his firm will discontinue the sale of lighting fixtures after the present stock is closed out.

"The space now occupied by lighting fixtures will be turned into a radio display room," he said. This concern sells and services a complete line of Radiolas.

* * *

Minneapolis, Minn.

T. E. Date has been appointed northwest factory representative of the Magnavox Company, manufacturers of radio and electrical equipment. Mr. Date for the last six years has been in charge of the radio department of the Minneapolis Drug Company, which has just discontinued its radio business, Mr. Date taking over the line. Mr. Date was one of the first distributors of radio equipment in Minneapolis and has had a long association in the radio and music field. He has been active in the work of the Northwest Radio Trades Association, of which he is a director.

* * *

St. Louis.

H. T. Whitten, president of the Valley Electric Company, and Thomas Barnes have opened an imposing radio store at the corner of Delmar avenue and Kingshighway Boulevard, under the firm name of Whitten & Barnes Radio Company.

A JOURNEY IN SLEEP

C. R. Smith of Leicester, England, informs WGY that he fell asleep while listening to a jazz program from WGY Sunday morning, January 23, and was awakened by a German announcing divine service from station OKP, Stuttgart, Germany.

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HOW TO BUILD THAT CIRCUIT

The following circuits have been explained and illustrated in back issues of Radio World:

The National Power Amplifier, Dec. 25, Jan. 8, 15, 22, 1927. 4 copies 60c.

The Bernard, Oct. 16, 23, 1926. 2 copies 30c.

The Antennaless Receiver, Nov. 27, Dec. 4, 1926. 2 copies, 30c.

The Regenerative Equamatic, Dec. 4, 1926. 15c per copy.

The Equamatic, Oct. 2, 9, 16, 23, 1926 4 copies, 60c.

The Lincoln Super-Heterodyne, Dec. 4, 1926. 15c per copy.

The 3-Tube Karas, Dec. 11 and 18, 1926. 2 copies, 30c.

The Lynch Amplifier, Jan. 1, 8, 15 and 22, 1926. 4 copies, 60c.

Or send $6.00 for yearly subscription and get as a premium any one set of circuit copies noted above. No other premium with this offer.

RADIO WORLD
145 WEST 45th STREET, N. Y. C.

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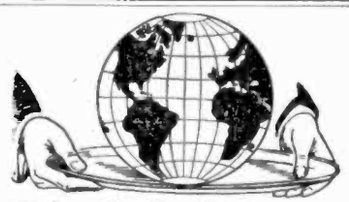

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C. E. Mfg. Co.,
INC.
Providence, R. I.

CeCo RADIO TUBES

COMPLETE DATA on "How to Build a DC A and B Eliminator," were given in the Dec. 4 issue of RADIO WORLD, by Lewis Winner. Lucid photos and diagrams accompanied this excellent article. Either send 15c for this copy, or begin your subscription with this issue. RADIO WORLD, 145 West 45th St., N. Y. City, N. Y.

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Armstrong Co. Makes Full Line of Tubes

The Armstrong Electric & Mfg. Co. announces the perfection, after four years of experimentation and research, of their new Armor C F-500 tube. This is an oxide coated, platinum filament tube, embodying new principles which the manufacturers claims give much higher emission than any other type of tube, being practically non-michrophonic. The Armor tube is made in every type, including power tubes. The five-volt tube has a most unique characteristic, in that it will work on a very low voltage, several that the writer has had under severe test in his laboratory having worked along delivering perfect tone at high volume on only two volts. The three volt tube under laboratory test nearly equalled a five-volt tube. It is exceptionally long-lived for this type of tube due to the oxide coated platinum filament. This tube will make possible the general use of electrified sets using the 99 type tubes in series. An interesting experiments in electrification are being carried on at the Armstrong factory under the able direction of Mr. R. A. Clarke, well-known expert in this line of work.

The manufacturer claims for the Armor tube, practically double filament emission at twice the volume over any other type of tube; really pure tone, due to the platinum filament; longer filament life and highest vacuum; elimination of tube noises; low internal capacity making tuning much sharper and practically a power tube at low voltage, no extra "B" batteries required. The filament, plate and grid of this tube are sealed with glass beads at five points making it impossible for the elements to work out of position. This tube may also be had in a really armored model being surrounded with a copper shield with protective layers of felt between tube and shield. Rossiter & Co., 136 Liberty Street, New York City, have taken the exclusive distribution for the New York metropolitan district, believing that a quality tube of this type will be in big demand. These tubes are manufactured at the factory of the Armstrong Electric & Mfg. Co., 351 Halsey Street, Newark, N. J., under the personal supervision of Mr. Armstrong. Literature will be sent to those interested on application.—J. H. C.

AEROVOX Fixed Condensers and Resistances
"Built Better"
AEROVOX Products are used by more than 200 manufacturers of Radio Receivers and "B" Eliminators.
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Identify all your leads instantly. Avoid losses. No more short circuits. Quick hookup. Includes Power Tubes and all "C" voltages. Blan's Battery Markers, send now for set of 15, with free log book and station map. 10c
Kill that offending station with
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The newest scientific appliance for trapping out interference. $2.00
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Airtram Stranded Wire

Scientifically stranded pure copper wire gives the greatest radio conductive service, and the wire in a radio set is of bigger importance as to conductivity and tone than some people imagine. Although many alloys have been experimented with, nothing has been found to equal pure copper wire, honestly made.

The Radio Electric Manufacturing Company, of 442 Clinton Avenue, Newark, N. J., is one of the early pioneers making a secialty of pure copper wire for radio, and other stranded "Airtram" wire, on which they have now achieved admirable results in their factory, which is completely equipped with the most modern machinery for this production.

It is suggested that all those interested write to the Radio Electric Manufacturing Company, get samples and quotations, and learn of the real worthwhile improvements this company has made in aerial and radio wire.—J. H. C.

A Novel, Efficient Loop

High efficiency is attained through physical height in the new model Volumax loop. This loop is designed to intercept the most energy from the broadcast wave on a new principle. The limit in height, keeping within the limitations of the modern home, has been kept in mind. The loop, while 69 inches in height, is so constructed that it can be swung in a radius of only 7½ inches. It has many other novel features, among them portability and compactness It is made of the best materials and guaranteed against defects in workmanship and material. According to the specifications this loop should be wonderfully efficient on any loop adapted circuit. Type S is equipped with center tap for Super-Heterodynes using .0005 condensers and type R with no center tap working with .00075 condenser. The Volumax loop, aptly termed "the original skyscraper loop," is manufactured exclusively by the Weber Electric Works, Brooklyn Station, Cleveland, Ohio. Full descriptive literature will be sent to those who write to the company for it.

New City Radio Store

The City Radio Co., well-known pioneer in the radio chain store business, has opened a new and handsomely appointed store at 42 Cortlandt Street, New York City. This is adjacent to the Hudson Terminal Building and will prove a boon to thousands of hurrying commuters who can rush in to buy without having to worry over the quality of the merchandise or value received. A full stock is carried of all popular standard radio goods, eliminators, tubes, batteries, speakers of all types, good makes of sets and a most complete line of parts for the set builder.

Ample facilities are provided for testing and complete demonstrations of sets and speakers may be had in comfortable surroundings. Satisfaction is guaranteed and courtesy is the watchword under the able management of Dave Schloss. The many readers of RADIO WORLD who have bought from Henry Berman for the past three years at other City Radio stores and who have benefited by his courteous service and expert advice will meet him here as assistant manager.

AROUND THE TRADE

Boston.

The MacNeil Electric Service Company recently opened a radio and electric wholesale and retail store at 50 High St., under the management of P. H. MacNeil.

* * *

Saginaw, Mich.

A new radio shop was recently opened at 122 North Baum street. The shop is under the management of Fred W. Schmidtke and Grant Rowe, and will handle radios and radio accessories.

* * *

Portland, Ore.

"Bob" Smith, radio service man, has announced a change of headquarters from 1009 Belmont street to 1107 Sandy Blvd.

LAST PUBLIC OFFERING
of a Limited Number of Shares of the
BERNARD RADIO CORPORATION
AT $10.00 Per Share

Concurring in the opinion of the largest manufacturers that the present-day need is for a dependable radio receiving set, constructed on mechanically perfect lines, and to be sold at a price within reach of all, Mr. Herman Bernard, the inventor, has produced in the Bernard Electric Bronze Beauty, a radio wonder possessing rare distinctive features heretofore unrealized.

Mass production will enable this company to put this six-tube wonder on the market at a price to the ultimate consumer defying competition, and returning a handsome profit to the shareholders.

Mr. Bernard needs no introduction to the readers of the Radio World and radio fans in general. For years he has occupied a foremost position as radio expert, inventor, and broadcaster over the radio on all matters pertaining to radios and their installation.

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The Bernard Radio Corporation is capitalized under the laws of Delaware for fifty thousand shares of no par value. The first offering of these shares will be at ten dollars per share. Each subscription will be limited to a maximum of fifty shares. You may subscribe to any amount up to that number.

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HOW THE TRANS-OCEAN PHONE WORKS

Described in detail by a famous engineer in the issue of Jan. 22, 1927 and in such a way that even the novice gets an insight into the fundamentals of this type of radio transmission. Follow this up with a description on how to build a set to listen-in on the overseas phone, by Capt. Peter V. O'Rourke, in the issue of Jan. 29, 1927. Send 30c for both of these, or better still send $6 for one years subscription to Radio World and get these copies as a premium. RADIO WORLD, 145 W. 45th St., N. Y. C.

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AT YOUR SERVICE

PLEASE tell me how to test transformers for short circuits and slight defects. (2)—What is the difference between a long wave transformer and a filtering transformer?—D. V. Clark, Miami, Fla.

(1)—You do not state in your letter whether the transformers you wish to test are RF, IF, or AF. I assume they are AF, as these are the ones most frequently under discussion. They can be tested by means of a 40-watt light in series with the regular light lines and transformer windings. The test is made for both the primary and secondary. The light should light with somewhat less the normal brilliancy when in series with the primary and should not light when in series with the secondary, there being a slight sparking at the terminals, when the connection is made and broken. If you do not want to try this, you can use a voltmeter or ammeter in series with the battery and the winding of the transformer. If a short circuit exists, the reading will be practically the same as if the two ends of the test leads were connected directly together, but if there is no short-circuit, the reading should be considerably less when the transformer is in the circuit. This test cannot be made with a high grade voltmeter. (2)—A long wave transformer is designed to pass a fairly big band of frequencies from the output of one tube to the input of the next. Filter transformers are somewhat more sharply tuned so that only a comparatively narrow wave band is passed. Both are used in Super-Heterodynes.

* * *

I HAVE a Victoreen radio and would like to know if it will be a good thing to shield it. (2)—Can I place the coils straight, instead of on an angle as it would make a better job. I am bothered with a lot of interference and I think by shielding I will get away from some of it.—E. B. Churoveth, Cleveland.

(1 and 2)—If you shield your Victoreen and have shielding between the stages, so that the coils you refer to are in separate compartments, the angular placement can probably be done away with. Before bothering to put in the shielding, remove the loop (or antenna and ground) from the set and see whether the noise decreases or is entirely eliminated. If all the noise stops when the pickup systems are removed, shielding will do you no good, as your pickup of noises would be entirely through the antenna.

* * *

WE HAVE an eight-tube super-heterodyne built of Remler part on Best's circuit, but do not get the volume we would like. We get most anything in the U. S. and can tune anything in or out, but we think it is not loud enough. A boy came in the other night with a three tube of his own make with a four dollar speaker that was louder than ours. Ours has a cabinet and built in speaker, and uses a loop. Some fans suggest a new speaker, some new transformers, some wet batteries, (ours use 199 tubes with dry batteries) some suggest power tubes, etc.—John Shaffer, Gentry, Ark.

The fact that your set gets everything in the United States and is extremely selective would indicate that the detectors, oscillator and intermediate frequencies are all right. Lack of volume can probably be attributed to some defect or mistake in the audio end. I would recommend that you examine these stages and also try out your loud speaker on another set to see that it is all right. You do not state whether you are using transformer or resistance coupling, but a transformer coupled amplifier will work best with a Super-Heterodyne.

* * *

I HAVE a four-tube Diamond of the Air. I am using —99 type tubes, one All-American audio transformer and one Giliffin 3½—1 AFT. The reception from the phone jack is O. K., but the results from the speaker jack are poor. That is, there is a rushing sound heard all the time.—F. L. Bell, Oakland, Calif.

There are several things that may be the matter with your set. First, I would say that you had better examine the contacts of your phone jack. It is more than likely that the springs do not make the necessary contact when the plug is removed. If this is all right, examine your wiring and socket prongs. Then test out the transformer primaries and secondaries with a meter and battery to make sure that there is no open circuit. If there are any condensers in this last stage, test them out also. As a last resort, try another tube, as the one in that stage may be defective.

* * *

I WOULD like to ask you a few questions in regards to my radio set. I have a Harkness Counterflex, three tubes, employing three UX 199 tubes. I do not seem to get the howl that is so frequent with a reflex, only on the low wave lengths up to about 400 meters. The volume is very low for the speaker and too strong for earphones.

I wound the counterformers myself. The secondaries are wound with No. 24 D. S. C. wire instead of No. 23 S. C. C. as specified. I could not get 23 wire anywhere here in town. Would this have any effect on the volume or oscilation of the reflex tube?

I have tried bypassing the reflex audio with different sized condensers, but find I get better results by bypassing as specified with a .0001 mfd. I have used all Frost parts with the exception of condensers and audio transformers. I have used Harkness subpanel AFT and Dubilier micadon condensers. My batteries are in A1 condition. I am using 90 volts B battery, 4½ volts C battery and 4½ volt A battery.

Can you help me with any suggestions which will add volume to my set?—Claude L. Warner, Lansing, Mich.

You might try adding or removing a few turns from the secondaries of your Counterformers. If you do not want to bother with this, you can probably find complete satisfaction in building a separate one stage amplifier in which you can use a CX-220 tube.

* * *

I WISH to take advantage of your service to readers of RADIO WORLD. I have a 5 tube T. R. F. set described on pp. 395-7

(*Continued on page 26.*)

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Super Coils
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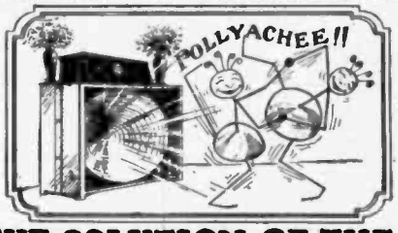

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(*Concluded from page 25*)

of The Radio Amateur's Handbook, 4th edition, and desire to improve its sensitivity and selectivity. Can I add another tube, and how, in order to do the above?

Would there be sufficient improvement to warrant the substitution of the Benjamin R. F. Coils? The present coils are hand made, as directed, 10 to 50 turns.—Rey. Paul M. Spangler, Cherryville, Flemington, N. J.

I have no copy of this magazine. However, instead of adding another tube, I would suggest that you either reduce the primaries of the radio frequency coils, or add regeneration to the detector. This can be done by winding a 3 inch coil with 20 turns of No. 22 D. C. C. wire and placing it at the grid end of the detector coil. This coil should, of course, be wound in the same direction as the detector coil. A variable high resistance, say from 0 to 50,000 ohms can be used, shunted across this coil to control regeneration.

* * *

SOME TIME ago I purchased a Universal Victoreen Kit from a local dealer. The set worke fine and is very selective. I can pick up stations up to 1,500 miles away with a ground wire without loop or aerial on the loud speaker. Now here is my trouble. WOO and WIP in Philadelphia broadcast on 508.2 meters and WFI and WLIT, Philadelphia, broadcast on 394.5 meters. The 508.2 meter stations cause much interference. Is there any way to change the heterodyne? It is the heterodyne on 394.2 stations, it being same on a loop and outside aerial. I shall be very grateful if you will advise me on this trouble.—Walter H. Hodges.

It is possible to re-design your set, so that the heterodyning of which you complain will be eliminated, but it would call for the purchase of several new parts and much rewiring. If your set is otherwise satisfactory I would say that you had best leave it alone. Your trouble might also be caused, not through any fault of the set, but through stations having a harmonic which is sent out with their wave, causing the interference.

* * *

CAN you give me the name and address of Manufacturers of Edison Nickel Type Storage Cells, or tell me where they can be purchased?—R. B. Caehamer.

The Todd Electric Company, 109 W. 23rd Street, New York, is a manufacturer of Edison type batteries. There is also a concern called Gray's Electrical and Chemical Laboratories, Bayonne, New Jersey, which makes batteries of this type.

* * *

I HAVE been very much interested in your articles which have been appearing in RADIO WORLD. However, there are one or two questions which I would like to ask.

I have one stage of transformer and two stages of resistance coupling in my audio. I am using a .001 fixed condenser across the primary of the transformer and two .1 meg. resistors with a ½ meg. leak in the first stage and a ¼ meg. leak in the last stage of the resistance coupling. The by-pass condensers are .4 mfd.

The grid return of the first two tubes of the audio circuit is to —3 volts C battery, using 90 volts on the plates, and the last tube, the grid return is to—7½ volts C with 135 volts on the plate.

After tuning in a station, I found that to disconnect the grid return of the last tube did not affect the signal. Neither did changing the value of the negative bias change the quality or volume.

Also when the filament of the last tube is turned up, even slightly, the circuit howls as though caused by a microphonic tube, but changing tubes does not remedy same.

Naturally there is distortion, although at times the signal seems quite clear to the ear. The distortion has the effect of one talking with a hot potato in the mouth, and, on strong stations, the signal seems to be hushy or even at times seems to be similar to a rattle in the horn. This I also noticed with the head phones.

If there is anything which you might suggest to remedy the conditions above, it would be very greatly appreciated.—Walter A. Sorg.

I believe that if you will either increase the resistance in the plate circuit, or decrease the resistance in the grid circuit of one of the last two tubes (particularly the last one) you will eliminate the trouble of which you complain. Your B voltages seem right, but I would suggest that you use 9 volts C on the last tube. Probably by using a ¼ meg. in the plate circuit of the last tube, or a 1/10 meg. in the grid circuit would help.

* * *

YOUR QUESTION and answer department in RADIO WORLD is a fine thing for us newsstand buyers, as I have been having quite a lot of questions to ask and now find a chance to have them answered.

Well, the first thing will be my troubles. I built a Victoreen Super last August, and have had rotten selectivity, both on a loop and outside aerial. Am using National condensers and dials. How about correcting this circuit either by adding a tube or something to gain more selectivity? Would building it like the Fenaway Super make it selective? And, if so, what kind of a coil, etc. I don't want to put in loop regeneration unless it's the only way out. The Fenaway had an RF coil ahead of the first detector or the first tube in the Super and also used regeneration in this coil too, which he claimed made it selective, and also got away from receiving the same station on two different places on the dials. Outside of this trouble, the set is O. K., but would like to know what difference, if any, it would make whether I wired this receiver with bus wire or flexible stranded spaghetti covered wire. I used the last named on all wiring, now I understand I should have used bare bus wire in plate and grid leads.

One more question: For year in and out service would the Air Gap socket make any noticeable difference?

Would be much obliged if you would give me complete answer to the above, would prefer actual workings instead of experimental circuits made on paper, but never tried.—W. DeLong.

Adding a stage of radio frequency to your set undoubtedly would increase the selectivity, but the set itself is selective if properly made. Try using a .00025 or .0001 mfd fixed condenser in series with the aerial. See the article on the Victoreen in the February 12 and 19 issues.

If bare bus is used, there is less likelihood of leads being run too close together. Some people claim that spaghetti insulation absorbs enough of the radio frequency energy to decrease the efficiency of the set. If you did a good job and kept your leads reasonably far apart, I see no reason why your set should not operate satisfactorily because the spaghetti covered flexible wire was used.

* * *

[*This department is conducted by Robert Eichberg, director of the Extension Division Cass Avenue, Detroit, Michigan. All questions regarding the construction, repair, selling, merchandising and advertising of radio equipment should be sent direct to Mr. Eichberg at that address. The answers to questions of general interest will be printed here. All others will be answered by a personal letter from Mr. Eichberg.*]

WRHM Moves

Minneapolis.

WRHM is being moved to a new location 6½ miles north of the city limits, according to Dr. Troy S. Miller, owner of the station. The 3,000-watt transmitter will be located at the Backus-Brooks Lumber Co. plant on the Central avenue road. Approval of the change was given by J. C. Vincent, assistant city engineer, and Oscar Eryckman, electrical inspector, technical advisors to the council committee working on the proposed ordinance to place all transmitters outside the city limits.

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Leak Manufacture Keeps Apace of Public Demand

By H. G. Richter

Chief Engineer, Electrad, Inc.

We all know that tremendous strides have been taken in the development of radio during the last five years, but few of us realize what a prodigious task it has been for radio engineers to keep pace with the demands for better and better equipment.

Radio equipment, in general, has improved, and it is quite interesting to take the case of some particular unit, look back to its status some five or six years ago and consider the steps in its development up to the present time.

For instance, let us consider the grid leak. A few years ago we used to draw a few pencil marks on a piece of paper and the resistance embodied in these pencil marks was made to function as a grid leak.

The importance of the grid leak soon became apparent, and manufacturers started turning them out in large quantities. At this time these units consisted of a small tubular-shaped piece of glass with the resistance element fastened within. The resistance units consisted of a piece of paper covered with India ink, in some instances, and in other cases a piece of paper which had been impregnated with carbon.

In the course of manufacture the resistance element was inserted within the glass tube, the ends flapped over the glass and caps soldered on the ends of the tubing. This type of grid leak was unsatisfactory for several reasons.

First, it was inefficient in operation due to the poor connection between the end caps and the resistance unit; second, you had absolutely no assurance that the leak which was marked 2 megohms was anywhere near this value, due to the method of manufacture and also due to the fact that the particles of carbon were in light suspension and were continually in motion.

The third major disadvantage to this type of leak was due to the fact that it had a tendency to absorb moisture. It is quite natural that all of these disadvantages tended toward inefficiency, which was manifested sometimes by noisy operation and sometimes by producing distortion in the output signal.

The first fault was overcome by attaching a phosphor bronze contact to each end of the resistance element in the process of manufacture, and this contact was in turn soldered to the metal end cap. This was a help in eliminating the noise due to poor contact, but it didn't overcome the other disadvantages inherent in this type of leak.

The advent of the "metallic" type of grid leak eliminated the second and third major faults listed above and a lot of minor ones as well. There is no question that the metallic type of grid leak will take the place of all the old paper types, due to its inherent superiority.

The metallic leak consists of a glass tube of the same shape as that used in the old style leak. A metallic resistance element is fused to the inside of the glass tube by a secret process. This metallic coating on the inside of the glass, then is the resistance element, and it is also a part of the inner surface of the glass tube, due to the heat fusion process.

This metallic type of grid leak has several outstanding features not embodied in the old paper resistance element type. The value of the resistance in the metallic leak is not affected by moisture or by heat after it has once been sealed. Being a metallic resistance element, it has a greater current carrying capacity than the carbon type, and since it is fused to the inside of the glass tube, using no paper, carbon, fiber, or varnish, the resistance is non-inductive and is noiseless in operation.

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Good Back Numbers of RADIO WORLD

The following illustrated articles have appeared in recent issues of RADIO WORLD: 1926:

June 19—Selectivity's Amazing Coil, by J. E. Anderson. The Light 5-Tube Portable Set, by Herman Bernard.

July 3—Set with a 1-Turn Primary, by Herman Bernard. Part 2 of the Victoreen Portable, by H. Bernard. Trouble Shooting Article for The Light 5-Tube Portable.

July 10—A Bub in Single Control, by Herman Bernard. A DX Double Regenerator, by Capt. P. V. O'Rourke. A 2-Tube Dry Cell Receiver, by Samuel Schmaltz.

July 31—What's Best in an AF Amplifier, by Herman Bernard. A 6-Tube Reversed Feedback Set, by K. B. Humphrey.

Aug. 14—The Improved Browning-Drake, by Herman Bernard (Part 1). Storage Batteries, by John A. White.

Aug. 21—A New Stabilized Circuit, by E. H. Loftin and S. Y. White (Part 1). The Browning-Drake by Herman Bernard (Part 2).

Aug. 28—The Constant Coupling, by E. H. Loftin and S. Y. White (Part 2). The Browning-Drake, by Herman Bernard (Part 3).

Sept. 4—The Four Rectifier Types, by K. B. Humphrey. A Simple Battery Charger, by J. E. Anderson.

Sept. 11—The Beacon (3-tubes), by James H. Carroll. The 1927 Model Victoreen, by Herman Bernard.

Sept. 18—The 1927 Victoreen, by Arthur H. Lynch. Eliminator in a Cash Box, by Paul R. Fernald.

Sept. 25—The Lynch Lamp Socket Amplifier, by Arthur H. Lynch. Wiring up the Victoreen, by Herman Bernard.

Oct. 2—The Victoreen (Continued), by Herman Bernard. New Equamatic System, by Capt. P. V. O'Rourke.

Oct. 9—A Practical "A" Eliminator, by Arthur H. Lynch. Building the Equamatic, by Capt. P. V. O'Rourke.

Oct. 16—The Bernard, by Herman Bernard. How to Box an "A" Supply, by Herbert E. Hayden.

Oct. 23—The 5-tube P. C. Samson, by Capt. P. V. O'Rourke. Getting DX on the Bernard, by Lewis Winner.

Oct. 30—The Singletrol Receiver, by Herbert E. Hayden. How to Get Rid of Squeals, by Herman Bernard.

Nov. 6—Reduction of Interference, by A. N. Goldsmith. Variations of Impedances, by J. E. Anderson.

Nov. 13—The 4-tube Hi-Power Set, by Herbert E. Hayden. A Study of Eliminators, by Herman Bernard.

Nov. 20—Vital Pointers About Tubes, by Capt. P. V. O'Rourke. The 4-tube Diamond of the air, by Herman Bernard.

Nov. 27—The Antennaless Receiver, by Dr. Louis B. Blan (Part 1). Short Waves Yield Secrets, by M. L. Prescott.

Dec. 4—The Regenerative 5-Tube Set, by Capt. P. V. O'Rourke. The 8-tube Lincoln Super, by Sidney Stack. The Antennaless Receiver, by Dr. Louis B. Blan (Part 2). Winner's DC Eliminator, by Lewis Winner.

Dec. 11—The Universal Victoreen, by Ralph G. Hurd. Some Common Fallacies, by J. E. Anderson.

Dec. 18—Selectivity on One Tube, by Edgar Speare. Eliminating Interference, by J. E. Anderson. The Victoreen Universal, by Ralph G. Hurd (Concluding Part).

Dec. 25—A New Coupling Device, by J. E. Anderson. Functions of Eliminators, by Herman Bernard.

Jan. 1, 1927—The 2 Tube DeLuxe Receiver, by Arthur H. Lynch. The Twin-Choke Amplifier, by Kenneth Harkness.

Jan. 8—Tuning Out Powerful Locals, by J. E. Anderson. A Choice Superheterodyne, by Bronsten Brunn. The 2-Tube De-Lux Receiver, by Arthur H. Lynch (Part 2).

Jan. 15—The DeLuxe Receiver, by Arthur H. Lynch (Part 3). The Simple Meter Test Circuit by Herbert E. Hayden. The Superheterodyne Modulator Analyzed, by J. E. Anderson.

Jan. 22—The Atlantic Radiophone feat, by Lewis Rand. An Insight Into Resistors, by J. E. Anderson. A Circuit for Great Power, by Sidney Stack.

Jan. 29—The Harkness KH-27 Receiver (Part 1), by Kenneth Harkness. Use of Biasing Resistors, by J. E. Anderson.

Feb. 5—5-Tube, 1 Dial Set, by Capt. P. V. O'Rourke. The Harkness KH-27 (Part 2), by Kenneth Harkness. What Produces Tone Quality, by J. E. Anderson.

Feb. 12—Phone Talk Put On Speaker, by Herbert E. Hayden. All Batteries Eliminated, by Herman Bernard. The Harkness KH-27 Receiver, by Kenneth Harkness (Part 3) conclusion.

Any copy, 15c. Any 7 copies, $1.00. All these 31 copies for $3.25, or start subscription with any issue. RADIO WORLD, 145 West 45th Street, New York City.

New WEAF Transmitter Will Be on Long Island

Big Power to Be Used From Model Station, With All Programs By Remote Control, As Studios Will Be In New Offices on Fifth Avenue

A new WEAF, planned to be the most modern broadcasting station in the world, will soon rise to take the place of the present station, Merlin Hall Aylesworth, president of the National Broadcasting Company, announced.

"The new station," Mr. Aylesworth explained, "will carry more clearly and perfectly the programs of the National Broadcasting Company. The present WEAF transmitter, located atop the Bell Telephone Laboratories, is interfering with the important research work of the American Telephone and Telegraph Company, and it was a part of the agreement of the officials of the National Broadcasting Company and the American Telephone and Telegraph Company when WEAF was sold that the station should be relocated at the earliest convenient date."

The most eminent radio engineers in the country, included in the board of consulting engineers of the National Broadcasting Company, have drawn the plans for the rebirth of WEAF. The new station, which will be located on Long Island, is expected to be in operation by early Summer.

The board of consulting engineers includes Dr. Alfred N. Goldsmith, chief broadcast engineer of the Radio Corporation of America; Dr. E. F. W. Alexanderson, consulting engineer of the General Electric Company; and Frank Conrad, consulting engineer of the Westinghouse Electric and Manufacturing Company.

The latest principles of construction and equipment will be incorporated in the station, said Mr. Aylesworth.

Located on Long Island, and consequently between the two great steamship lanes covered by the great Atlantic liners on the south and the Sound steamers on the north, the new WEAF will have many advantages, according to Dr. Goldsmith. The troubles heretofore experienced by radio listeners from telegraphic code signals and from land stations in the vicinity will be largely eliminated, he hoped.

"In relocating WEAF in the open spaces of the country," Dr. Goldsmith continued, "the 'radio shadows' which have caused a blight on radio reception for many listeners situated in some city areas will be avoided to a large extent. These 'shadows' have been due to the fact that the great masses of steel in city buildings often absorb the signals from stations located in their vicinity, and, therefore, affect reception to thousands of listeners located in certain areas.

"The power of the new station will be adjusted to give adequate reception to the listeners within the normal service area of a high quality network station. The signals provided from the new WEAF will be entirely adequate also, to give reliable reception practically at all times, notwithstanding man-made or natural electrical disturbances which sometimes fill the air.

"The new station will represent the complete application of the principle of remote control of transmitting stations situated a considerable distance from broadcasting stations."

It is hoped that the first program from the National Broadcasting Company's new building and grouped studios, at 711 Fifth Avenue, New York City, will be radiated from this station when the company moves to its new quarters about June 1.

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Five Famous Announcers Featured by Eveready

Five of the most popular radio announcers in the country have planned and will present the Eveready Hour Tuesday evening, March 15, from the station WEAF of the National Broadcasting Company, and its network of associate stations.

Graham McNamee and Philips Carlin, of WEAF; Norman Brokenshire, formerly of WJZ, and now appearing in vaudeville; Milton Cross, of WJZ, and Niles T. Granlund ("N. T. G."), of WHN, will each have a voice in the Eveready Hour program of that evening.

The idea is one which Eveready program directors have been thinking over for some months. A few days ago the directors called the five announcers into conference and commissioned each of them to prepare a miniature program lasting ten minutes, with himself in any role he may select and the regular staff of Eveready artists and musicians as entertainers. Thus fifty minutes of the hour will be taken up with the five ten-minute periods. In the final ten minutes, all five announcers will combine forces in an impromptu sketch designed as the climax of the Hour.

The manner in which the program has been prepared is unique. Each announcer has outlined the program for his own ten-minute period and has delivered its in a sealed envelope to the program directors. He knows nothing about what the other announcers will do with their ten-minute periods. Only the program directors know in advance what the entire hour will bring forth.

Virginia Rea, soprano; Barbara Maurel, mezzo-soprano; the Eveready Revellers, comprising Wilfred Glenn, Franklin Baur, Lewis James and Elliott Shaw, and the Eveready Orchestra, will respond to the calls of the five radio ringmasters.

Canadian Station Is Sued on Copyright

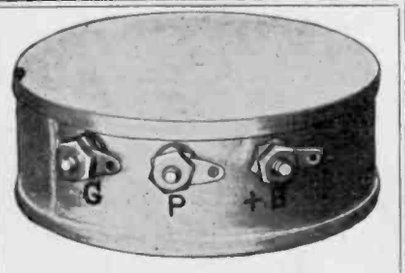
Toronto, Ontario.

The Canadian Performing Right Society, Limited, has filed a writ at Osgoode Hall against the Wentworth Radio Supply Co., Limited, the proprietors of radio station CKOC, Hamilton, asking an injunction to restrain the broadcasting without consent of a copyright musical works.

VIRGINIA REA, coloratura soprano, recently added to the Eveready Hour "regulars."

KGO SPOKEN DRAMA

Spoken drama before the microphone will again be featured by KGO on the second and fourth Thursday of each month. The new series of plays will begin with "The Conjurer," Thursday night, March 10, at 8 o'clock. This play is in three acts, and written for the stage by Mansfield Scott. Wilda Wilson Church, whose voice and name are familiar to western radio listeners as a director of radio drama, will again have charge of the production.



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Snowbound Postmaster Located by Broadcast

St. Paul, Minn.

When Fred C. Peterson, postmaster at Oak Island, Minn., the northern-most postal station in the United States, failed to get in his report to the Minneapolis Post Office for the last quarter, fear was expressed that he might be snowbound, lost or ill in the wooded regions of the Northwest's triangle lake country. Each quarter, every postmaster in Minnesota sends in a report which the Minneapolis postmaster forwards to Washington. The end of the month came and only the report from Oak Island was missing.

At the request of postal authorities, WCCO, broadcast a request to all radio listeners in the North triangle lake country to try and get in touch with Peterson. Radio was the only method of reaching him, as his post office is located on the Lake of the Woods, 50 miles Northwest of Warroad, the nearest contact with civilization.

The radio report reached Peterson and a few days later his quarterly postal report was received in Minneapolis. It had been ten days on the way, because that part of the country in which he was located was snowbound and it took several days to take the mail and reports by dog train to Warroad.

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JOINS AEROVOX STAFF

L. Alexander, formerly New York salesman for Dubilier Condenser Corporation, now represents Aerovox Wireless Corporation in the Metropolitan district.

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ARTHUR H. LYNCH, auto speed demon and radio enterpriser extraordinary, about to take a 60-mile-an-hour jog in his car.

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The Bretwood Grid Leak came with today's mail. It is now exactly 9:00 P.M. and the leak was installed about a half hour ago. This note is not only an expression of appreciation but also an attestation of the truth of your advertising. During the past half hour I have tuned in stations "ALL OVER THE DIALS" at leisure, and can adjust reception with the leak almost equal to a variable condenser.
I feel constrained to add that while waiting for reply and then receipt of leak from you, there has been on the set a fixed leak and condenser of well known and thoroughly reliable make, and fairly good reception has been enjoyed, but during this half-hour only test thus far the results are inexpressibly beyond expectation.
Have been a radio fan only about four years, but I feel I have sufficient knowledge and experience to recognize a good thing upon fair trial. Your promptness and desire to satisfy your trade, in this case has won for you another "BRETWOOD BOOSTER." Thank you.
The Rev. WALTER G. BARLOW,
Bishopville, Md.

Very many thanks foryourkind letter of the 21st ult. and for the grid leak, which works perfectly. I have tried four different makes of grid leaks. The Bretwood "has 'em beat."
M. SAWYER,
Box 238, Los Gatos, Calif.

Received your grid leak and wish to say that none can compare with it when it comes to clearing up reception.
JOHN A. BLACKBURN,
5328 Warren Ave., Norwood, Ohio.

Enclosed find P. O. money-order for $3.00. Please send me two of your Variable Grid Leaks. I am using one and it works fine. Please mail them as soon as possible.
W. H. PERRY,
119 Congress St., Buffalo, N. Y.

Received your grid leak and many thanks. It is the best $1.50 that I have spent for radio equipment.
ED. JENKINS,
703 E. Main St., Louisville, Ky.

Enclosed herewith find check for $1.50 for one Bretwood Grid Leak. I am using your leak and find it far superior to any others. This is my third Bretwood.
J. C. WHITE,
422 W. Wooster St., Bowling Green, Ohio.

Will you please send me by return mail two Bretwood Variable Grid Leaks. I enclose herewith check for $3.25, the 25c being for a special handling stamp, as these leaks are needed at once. The leaks are the only satisfactory instrument on the market. I find them absolutely essential in the construction and operation of sensitive experimental receivers.
ED. J. WHITTIER,
The American Appraisal Co.,
Milwaukee, Wis.

I want to thank you for your leak, it makes the set 100% better. I was going to have a Diamond of the Air built, but since I have added your leak to my set I am now down in the dining room of the first floor and the set is on the second floor. I can hear the set just as plainly as if I were up there. I can hear every player in any band or music which is on air. The first night I gave the leak a very good test, and I got four stations in Chicago, one in Detroit, one in Canada, one in Atlanta, Ga., and several others without any noise. All were good and clear. It is going to make me spend more money, as I will have to get a good loud speaker. The horn I have now is a Manhattan Jr., and is good and clear, but as soon as your leak is installed the howling present when using three tubes is immediately stopped.
LEON E. COLE,
5816 Tilbert St., Philadelphia, Pa.

Grid Leak received and tested out, and find it is the only variable leak I ever used that is really variable. Enclosed find $1.50, for which please send me another one.
F. E. STAYTON,
Box 240, Ardmore, Okla.

Thank you for introducing me to the Bretwood Variable Grid Leak! I have installed one in my Three-Circuit Tuner, according to your instructions, and find that it does all you said it would—and more. I am now recommending the Bretwood to all my friends, and those who have used this wonder grid leak have nothing but high praise for it. The fact that it can be adapted for any hookup makes it invaluable to the experimenter.
Although I have only used the Bretwood leak for three weeks I have pulled in several of the weaker stations which were inaudible before, and the microphonic noises which were decidedly pronounced before have entirely disappeared.
Please accept my best wishes for your continued success and also for the Bretwood Grid Leak.
S. R. HUBBS,
180 Quincy St., Brooklyn, N. Y.

Let me say that the Bretwood Grid Leak improves the set 100%.
J. E. McGINNISS,
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I wish to take this occasion to thank you for your courtesy in furnishing me with your very excellent Grid Leaks. I have installed one with your Condenser on my own personal radio set, and am delighted with the results.
R. W. DeMOTT,
Experimenter Pub. Co.
53 Park Place, N. Y. C.

I have received the Grid Leak you sent me and it is perfect. It is surely wonderful the way it works. Please send me another by return mail for a friend.
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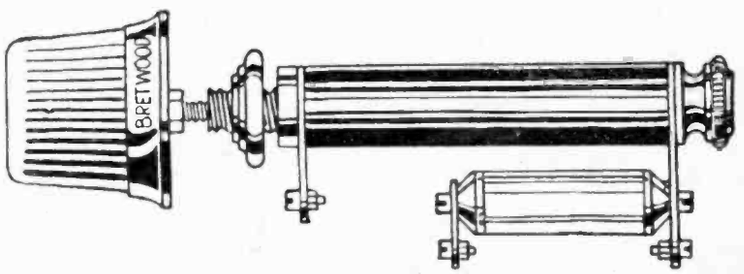

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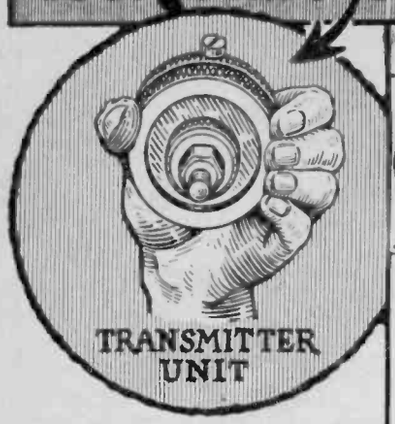

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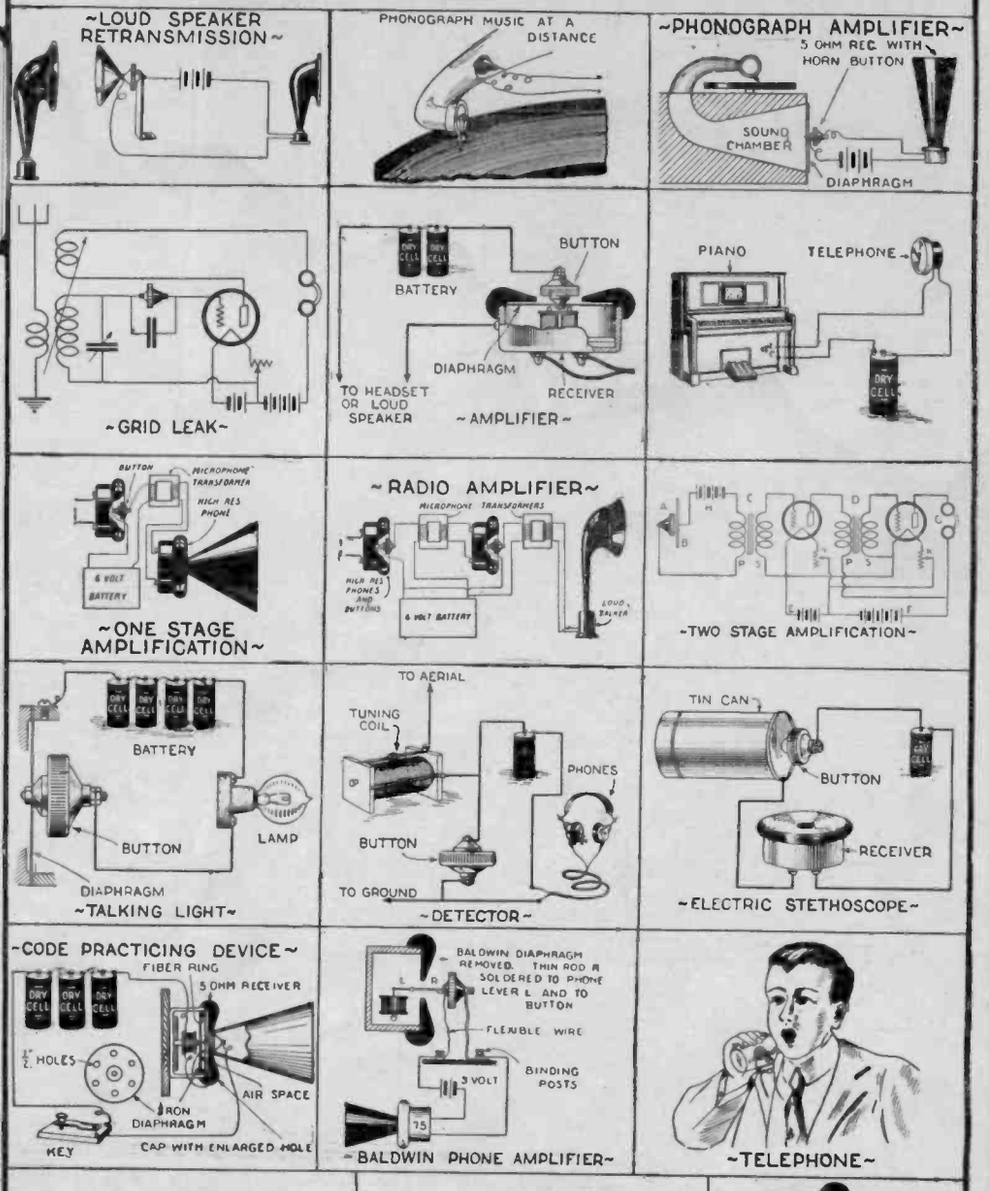

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