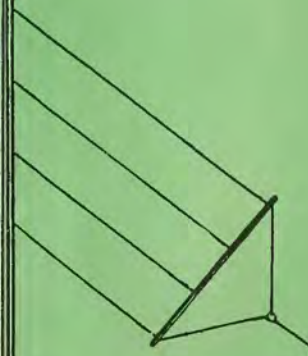
RADIO AGE

The Magazine of the Hour

Price 25 cents

JUNE, 1923



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By Frank D. Pearne

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By Our Readers

Complete Corrected List of Broadcasting Stations

More Late Hook-ups!

OFFICIAL NEWS MEDIUM FOR NATIONAL BROADCASTERS' LEAGUE

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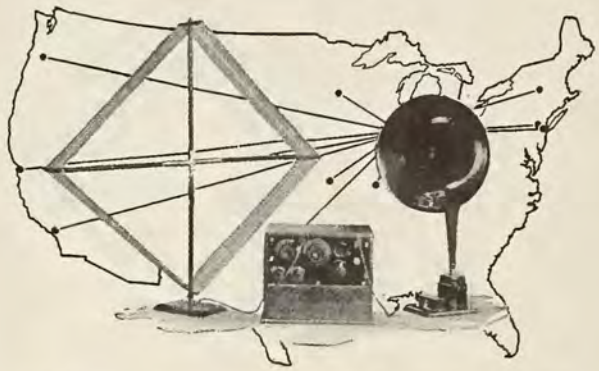

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All manuscripts must be mailed not later than midnight, June 10th, to receive consideration. Judges will be F. D Pearne, Technical Editor of Radio Age and E. J. Wiggins. Chief Engineer of the Electrical Research Laboratories.

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Electrical Research Laboratories
Dept. M 2515 Michigan Ave., Chicago

ERLA

RADIO AGE

The Magazine of the Hour

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Showing 'Em How

RADIO AGE has made a specialty from the first issue forward of publishing articles and illustrations which enable radio beginners and more advanced radio students to build their own receiving sets. In fact this magazine was started more than a year ago with that avowed intention. For that purpose it acquired the services of technicians who were best able to instruct our readers in construction and operation.

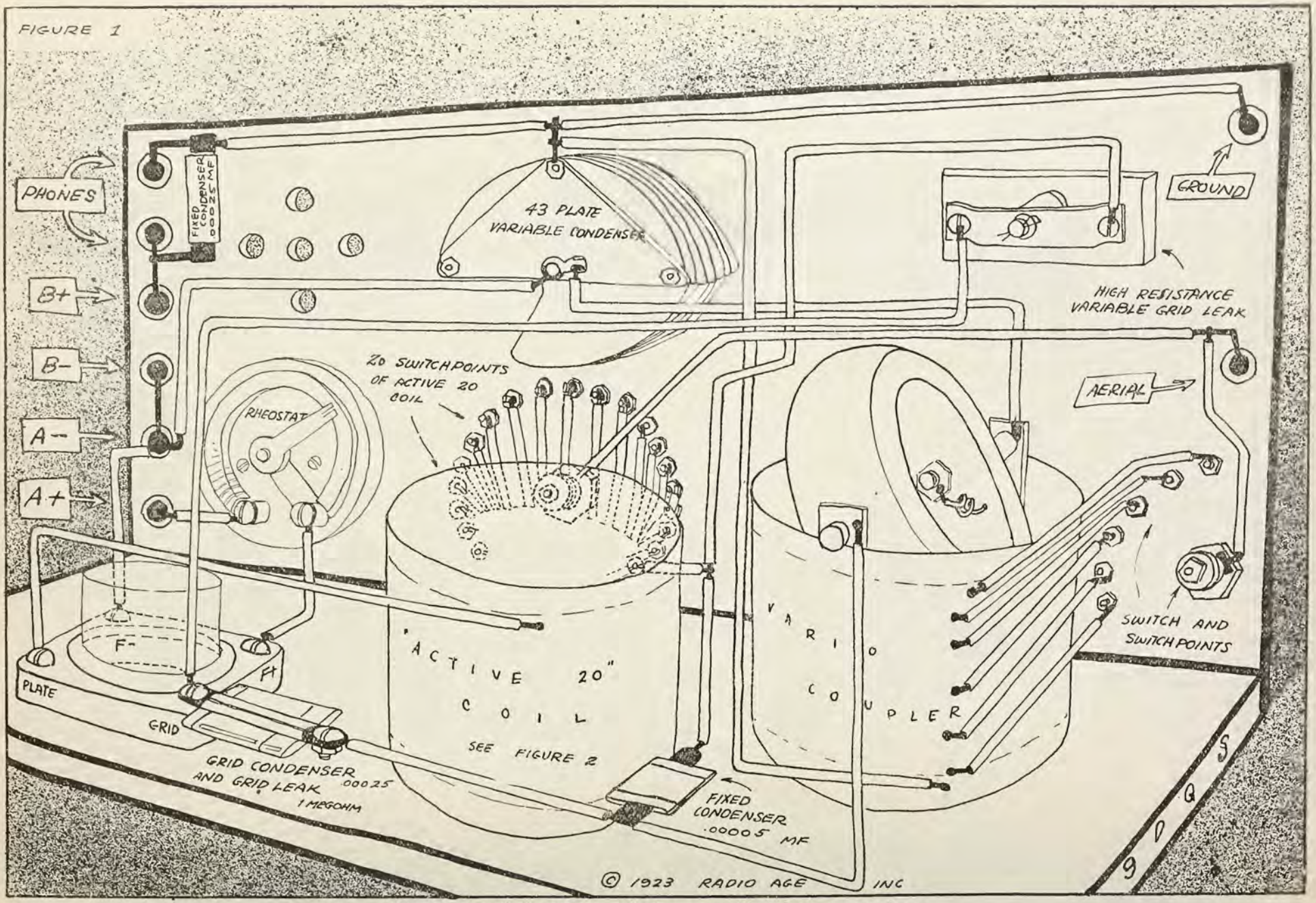
The other day a foremost manufacturer of radio receiving sets raised the question with us as to whether such a continuous course of instruction in making home sets would not logically decrease the demand for ready-made complete sets. In other words was not Radio Age injuring the business of the manufacturer of complete sets?

Our answer was an emphatic negative. Every reader of Radio Age who makes his own set and operates it successfully converts an indeterminate number of other persons in his neighborhood to radio enthusiasm. Some of his neighbors will proceed to subscribe to Radio Age and make their own sets. A far greater number will begin to look about for a ready-made set, because this greater number are either not technicians or they have not the necessary time to drill panels, wind coils and hook up a circuit.

It follows, of course, that the more home construction is encouraged the greater the demand for parts and accessories at the radio shops. But that is not the point. It is the construction of sets at home that shows communities what radio sets can do and makes communities want the manufacturer's radio sets.

In any event a careful program of instruction to the home laboratories brings growing circulation and therefore does not need justification. It justifies itself.

—The Editor



Back panel diagram of the new Kaufman receiver

RADIO AGE
"The Magazine of the Hour"
M. B. SMITH, PUBLISHER
PUBLISHED MONTHLY
FREDERICK SMITH, EDITOR

The New Kaufman Circuit

By F. D. PEARNE

IN THESE days, when new circuits are born overnight, it is a pleasure to occasionally discover something which is really original and worth while. Most of the so-called new circuits only consist of old ones made over, or changed in such a way that better results are obtained. The Kaufman circuit described in this issue has a basic action which is new and never before used. It is the invention of Mr. Wolff Kaufman who modestly claims that he is not a radio engineer, to which he attributes the fact that had he been an engineer, he probably would have been so deeply ensnared in the conventional circuits of today, that he would not have stumbled onto the new idea.

While we don't doubt Mr. Kaufman's word, it might be well to say right here, that he has slipped over a pretty good circuit for an amateur, and we hope that he will continue to "stumble" onto more of them and give us all a chance to hear about them. The ease of control and the elimination of interference, which are characteristic of this circuit, not to mention the simplicity of the arrangement, will at once appeal to the amateur who wants to try all the new ones.

With the use of an ordinary vario-coupler, it may be adjusted to any wave length up to 1000 meters, which is a wide range to cover without the loss of considerable energy on account of "dead end" effects.

The set is easily constructed and is sensitive to both local and long distance reception. Referring first to the conventional drawing shown in Figure 3, he shows how the oscillations are conducted from the aerial into the set in two paths, one path taking a course through the "active 20 coil" which will be explained later, and the other passes through the aerial inductance to the ground. This aerial inductance consists of the ordinary primary winding of the vario-coupler with its usual contact taps for the switch, with no change excepting that it will be noticed that a 43 plate variable condenser is connected between this aerial inductance and the rotor. This gives a combination inductive and capacitative coupling between the two coils of the coupler.

The energy usually is transferred from one coil of the coupler to the other by induction only, but in this case it is further aided by the capacity of the condenser. The energy in the plate circuit, passes through a certain number of turns on the active 20 coil, where it divides, one part of this circuit being tuned in resonance with the energy coming in on the primary circuit, impressing itself upon the primary coil of the coupler, while the other portion is tuned to the energy impulses of the grid, reaching the grid through the .00005 fixed condenser. This of course all occurs at radio frequency.

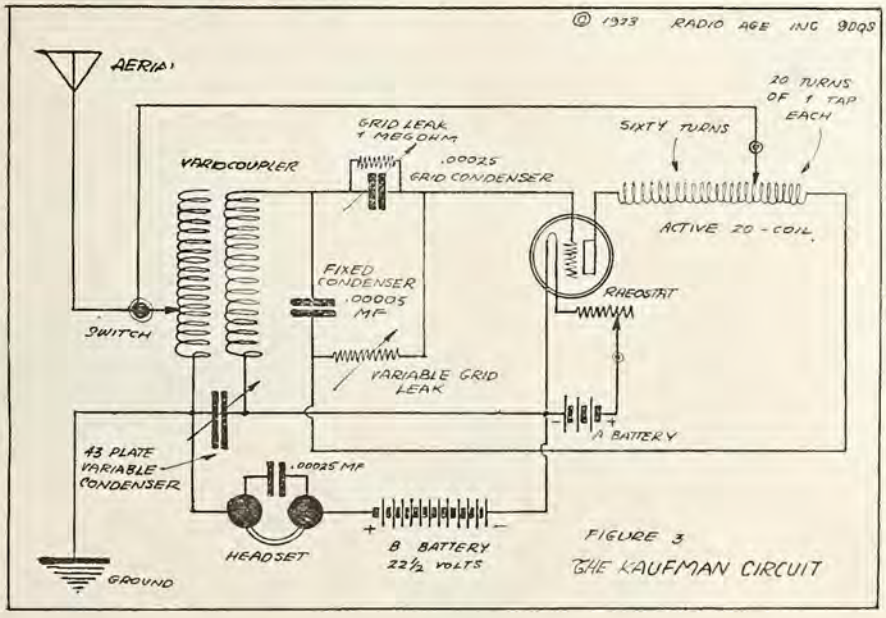
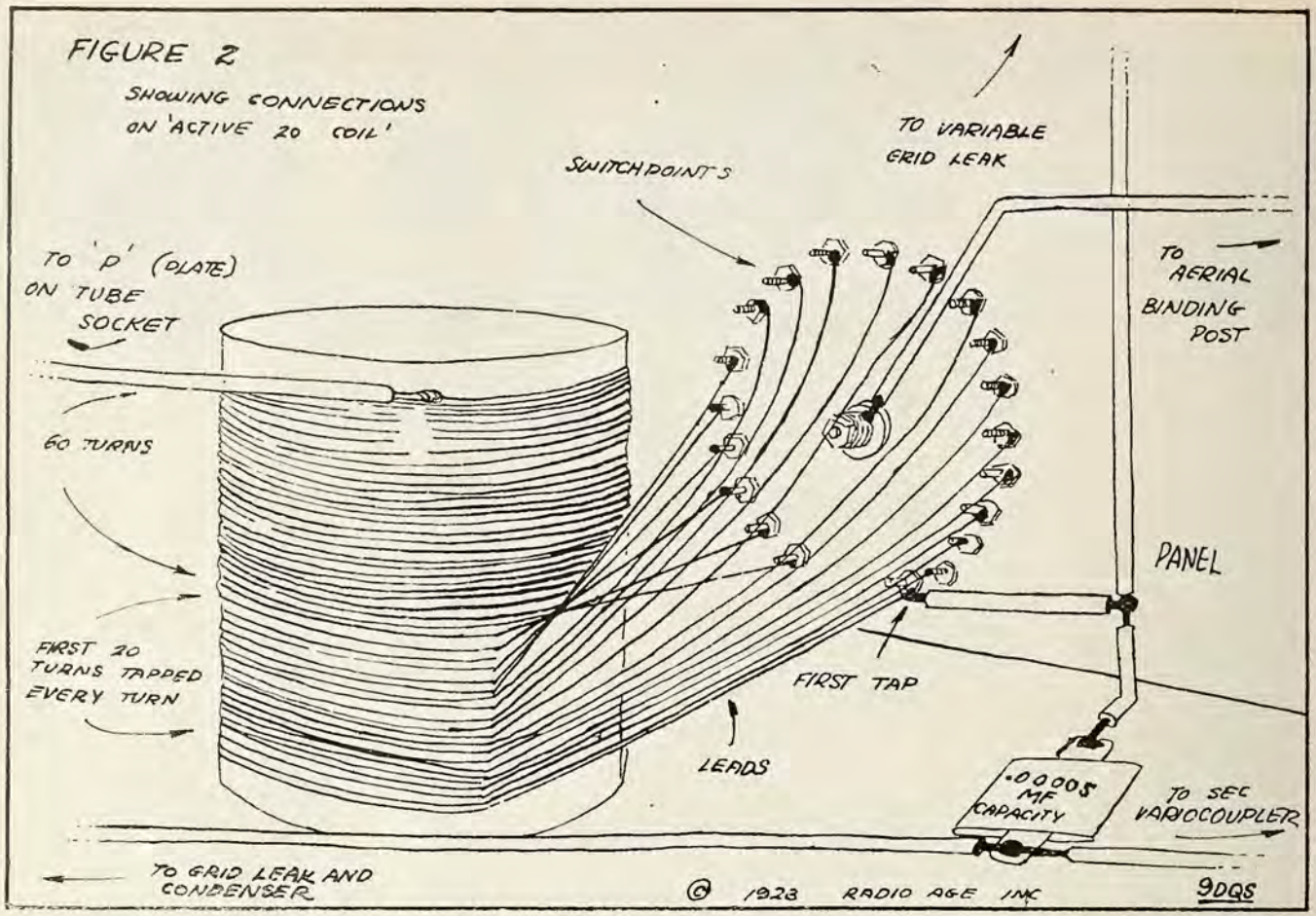


FIGURE 3
THE KAUFMAN CIRCUIT

Now while this is going on the detector tube has rectified some of the energy received from the aerial, and passed it around by way of the active 20 coil to the aerial inductive. From here, the radio frequency, or rectified energy takes the easiest path down through the head phones and "B" battery. While this has been going on, the radio frequency energy which was sent through the primary of the coupler, has been passed from the primary to the secondary to the grid of the detector tube.

Mr. Kaufman states that it has been found that the standard regenerative circuit makes use of but little more than 50 per cent of the energy received upon the aerial, but he believes that the excellent results obtained in his circuit are due to the fact that he reaches nearly 100 per cent by



supplying rectification at more than two points. By his arrangement the incoming wave is only partially rectified at first, but later, after being tuned to resonance, is almost all rectified. By this clever arrangement all the several rectifications are added together, resulting in a great increase in the signal strength.

The addition of the second grid leak shown on the drawing some distance below the usual leak is absolutely necessary, as the circuit will not operate, or at least will not function very well without it. Just what the action of this second leak is, Mr. Kaufman states that he does not know, but hopes to explain it in detail later. The grid condenser is of the fixed type having a capacity of .00025 M. F. This is shown in the drawing as being of the variable type, but this is not necessary, but will aid in the final adjustment.

It will be noted that the condenser connected across the active 20 coil and the grid circuit is designated as .00005 M. F. This is a very small capacity as condensers go, but this has been found to be just right for this purpose and a condenser of any other capacity must not be substituted. The rest of the circuit with the exception of the active 20 coil is made up of the standard apparatus which can be obtained at any radio store, and is plainly shown in the drawing.

The Active 20 Coil.

Figure 2 shows a drawing of the active 20 coil, which, while not hard to build may be found a little tedious on account of the many taps which must be taken off from the winding. A pasteboard, or bakelite tube, having a diameter of 3⅞ inches on the outside is used for the job. This should be about 5 inches in length and is wound with 80 turns of No. 22 cotton or silk covered magnet wire. In order that no short circuit will be made where the taps are taken off, it is better to use double insulation on the wire. Wind 60 turns without bringing out any taps and beginning with the 61st. turn bring out a tap on each turn.

This will make 20 taps in all, which should be connected up to the switch in their regular order as shown in Figure 2. Standard switch levers with knobs can be obtained in any length from 1 1 to 1½ inches. As it will require almost the entire space of the circle in the mounting, to accommodate the 20 taps, it is suggested that a switch lever of at least 1¼ inches in length be used, as this will not crowd the contact points too close together.

The taps as shown in Figure 2, are taken off from the lower end of the coil, the starting end of the coil being connected to the plate connection of the socket and the last tap of the switch is connected to the .00005 M. F. condenser. If these connections are reversed, the set will not function at all, so one should be careful to see that the connections shown on the drawing are faithfully followed out.

Panel Arrangement.

Figure 1. is a rear view of the panel showing same fastened to a baseboard fastened to it for the purpose of mounting those parts of the set which are not located on the panel. The arrangements of the parts as shown in this drawing is merely a suggestion and it is not necessary that they be mounted exactly as shown, however this layout, will be found to be about as good and compact as any which may be made. In any event the grid condenser must be placed on the grid contact of the socket, so that this lead

(*Continued on page 23.*)

What About Your Antenna?

By FELIX ANDERSON,

Radio 9DQS.

WHILE riding downtown on a certain branch of the elevated railroad of Chicago, I caught a bit of conversation between two BCL's (Broadcast Listeners), who were discussing the various merits and demerits of the antennas and their construction as they appeared on the roofs of the houses we passed. Evidently they were dyed-in-the-wool fans, and their conversation—I didn't mean to eavesdrop, but I couldn't really help hearing what they said—as I heard it, intimated that from their actual personal experiences, they had found that by giving proper attention to the aerial systems of their receiving sets, they had almost doubled their receiving ranges, and had increased the volume of their sets to a remarkable degree.

Probably less attention has been given to the aerials of receiving and transmitting sets than any other part of the entire radio system, and a few practical suggestions to the reader, as to the type, construction and care of antennae, are certainly in order.

Many of our BCL friends were smitten with the radio craze in midwinter, and with the usual haste of a fan, looked over the house he occupied, and probably several adjacent houses, went to a radio supply store, procured antenna wire and as fast as possible, strung an antenna between two elevated points without regard to theory, efficiency, appearance, or any other points in particular, except to have a wire up in the air, and call it an aerial. Now in all probability, haste can be justified because I am sure that no one is especially enthusiastic about hanging over a cornice or clawing up over a roof or a gable in bitter cold weather, trying to make an approved splice or an ultra soldered connection.

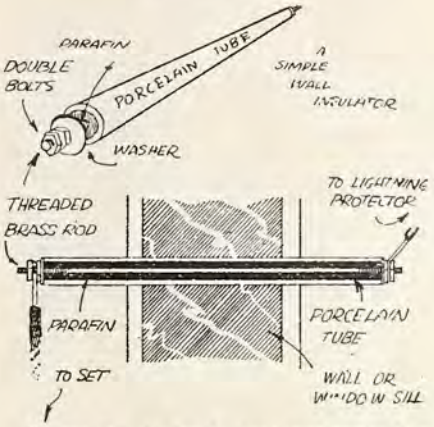


Figure 2. A simple, inexpensive lead-in insulator can be constructed from a few odds and ends which usually are found in an experimenter's junk box. The efficiency of such an arrangement amply pays for the time expended in construction.

But now that more clement weather is here, there is an opportunity to overhaul these hastily constructed antennas and apply some newly acquired knowledge to a new and better system. Much research work, experimentation and calculus has proved conclusively that an aerial is vastly something more than a wire strung between two elevated points in the air.

Recent tests have brought about the conclusion that probably the most ideal aerial for a BCL is a single wire from seventy to one hundred feet long, with a height of about thirty to forty feet above the ground. A longer antenna will give more volume, but for the real DX (long distance) BCL, something which will tune to a sharp wave and assist in shutting out interference is desired. Hence the shorter aerial. Length may be added, to be sure, but is it advisable to keep the antenna at a maximum height of from 35 to 40 feet.

If a more elaborate system is desired, a small inverted "L" type or a small cage of about 6 inches in diameter may be used and about the same dimensions as the single wire adhered to. However a single wire is more immune to static and to other atmospheric disturbances, and tunes very much sharper.

Tests have shown that, due to corrosion, many aerials have decreased as much as twenty per

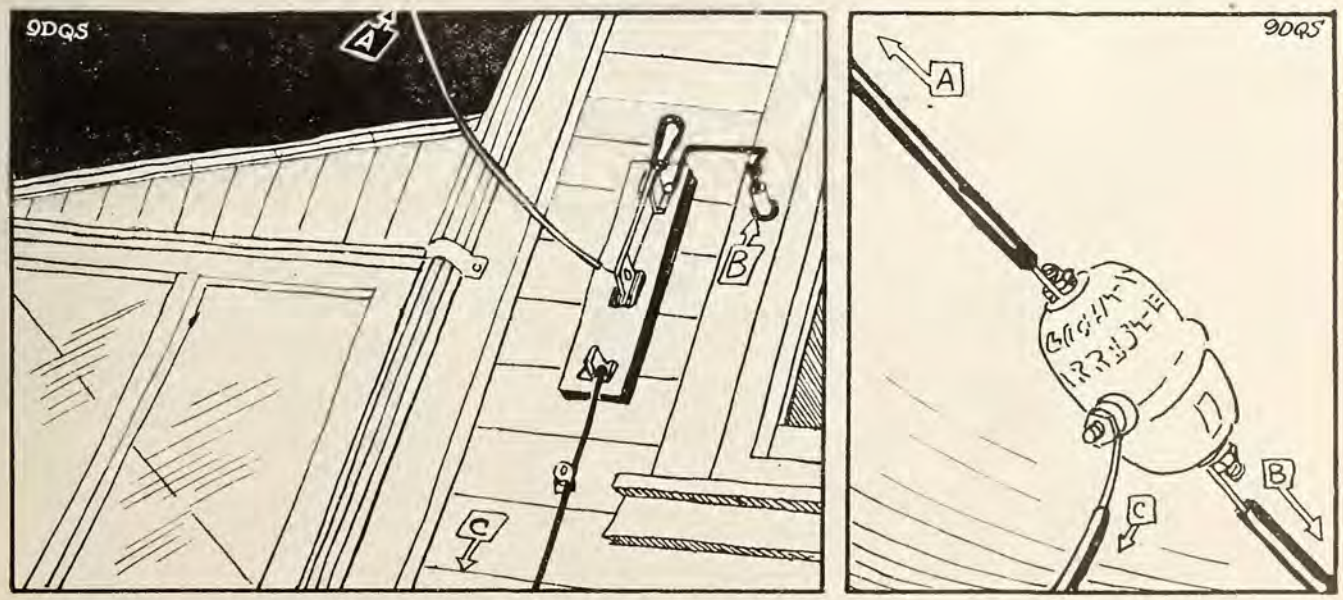


Figure 1. On the left, connections on the lightning switch are shown, A going to the antenna, B to the set and C to a separate lightning switch ground. On the right, a type of lightning arrester now on the market, with the connections A to antenna, B to the set, and C to a separate ground.

Don't throw aerial or guy wires over wires which you do not know anything about. A severe shock, even death, may be the consequence of your thoughtlessness.

cent in efficiency. All bare antenna wires copper, bronze or aluminum are subject to corrosion after a period of a few weeks, especially so in cities, where smoke, soot and grime are likely to collect on the aerial wires. This oxide and sulphide adds to the resistance of the system, and of a consequence signal strength is decreased. The ideal wire to use in such a case, is a number 12 or 14 enameled solid copper wire. Of course, indoor antennas are not subject to this defect.

Much has been said about antenna insulator, and it has been found that a long corrugated glazed surfaced porcelain insulator, carefully constructed to drop moisture and snow is about the most ideal type of insulator to use. Antennas should be lowered at frequent intervals, and these insulators should be cleaned of soot and grime, as they do not function as well with a thick layer of highly resistant foreign matter.

For the ideal aerial the lead in should be firmly soldered to the collecting portion of the aerial, and should be brought down to the lightning arrester, on the outside of the building. Many good types are now on the market, which can be connected with ease, and which will serve the purpose very well. If a lightning switch is to be used, it should be connected up as in Figure 1. As summer approaches, it is imperative that this lightning hazard be attended to.

The danger of lightning does not really exist in the lightning actually striking the wires, but in the fact that the aerial acts as a condenser which is capable of accumulating a powerful charge of electricity, which if not properly dissipated into the ground may discharge into some nearby object from the lead-in end of the aerial. If the object is inflammable, dire results may follow.

From the lightning arrester, the wire should be lead into the building through a well thought out arrangement. Never take a bare wire through a window and close the sash down on it expecting to receive long distance; 9½ times out of 10 you won't. The cheapest lead in you can make, is a porcelain tube, extending 3 or 4 inches outside of both sides of the wall with a brass rod imbedded in parafine as shown in Figure 2. An insulator of this kind is inexpensive and has so many good qualities that a few moments work constructing it will amply repay the reader to install one.

Once inside the house, the aerial lead should be made as short as possible, to the set. From the set, the wire should go to the ground, which will be treated in a separate article in a succeeding issue. At no time should the antenna run parallel to the ground lead of the set for any great distance.

In the course of conversation between the two BCL's on the elevated train, the subject of deaths due to the throwing of aerial wires over high tension power lines, was entered upon, and in connection with this, it should be emphasized that under NO circumstances should a novice or another radio fan so place his antenna that it crosses wires of any nature. Current newspaper accounts probably sound a more convincing argument in this connection when they publish articles relating the tragedy of some careless BCL who has met an untimely end merely because this oft sounded warning was disregarded.

If poles are used, they should be firmly guyed in order that no casualities might might occur due to falling masts, etc.

Never take a chance at climbing a pole which in any way looks doubtful. Numerous instances have been brought to my notice where dire results were unwittingly accorded due to such hazardous ventures. If a pulley is used, a good stout hemp nonshrinkable rope should be used, and should it in any way show wear—pull another one through, it's cheaper, will save time and perhaps your neck. Never pull antenna halyard quite tight. Allow room to give for wind, sleet, snow and shrinkage.

Careful placing of an antenna is always advisable. Never place it parallel to power lines as the interference from this source is a never ending amount of trouble. It should be placed as near to right angles as possible. If a tree is near your aerial move the aerial, as every little leaf and fibre in the tree will act as a miniature wireless sponge, and after they get through soaking up the signal, there won't be much left for your set to acknowledge.

Don't climb masts or structures that are in any way doubtful. The fellow who does it deserves to be classed in the same category as the one who looks into the wrong end of a loaded shotgun!

If you can't put up an aerial because of any of the above reasons, put in an indoor antenna in the attic, or use the lighting system of your home, in connection with any of the standard plugs now on the market. Unusual results have been obtained with this type of antenna, and it has often solved the problem of an adverse landlord. If none of the above methods can be realized, install a loop aerial set, with a suitable receiver.

As a last straw, don't despair, for if you have any problems of this nature, send them to the technical department of this magazine with the concise description and sketch of the matter involved and it will be answered in the usual way through our technical department of questions and answers.

Washington Y. M. C. A. on Air

The Washington YMCA has filed an application for a 50-watt Class A station with the Department of Commerce. A feature of the new transmitting set, located in the "Y" building on G St., is that the plate voltage is derived from a 468 unit storage battery instead of the usual method of employing a direct current generator. This station will broadcast talks on religion, education and physical culture, paying especial attention to matters of interest to boys. The station has been inspected, and it is expected that a license will be issued to the YMCA within a few days, assigning a wave length of 283 meters.

Broadcasters Win Big Point in Music Fight

IT is with deep gratification that the National Broadcasters' League is enabled to announce to broadcasters, as well as to millions of receiving set owners who love music, that a very important point has been gained in the league's effort to restore popular programs. This good news to broadcasters and fans is embodied in a special telegram to the National Broadcasters' League headquarters signed by M. E. Tompkins, chairman of the committee on broadcasting relations of the Music Publishers' Association of the United States. This announcement is in effect that the association members who wish to do so may permit broadcasters to use their catalogue without fee. The telegram from Mr. Tompkins reads as follows:

New York, N. Y.,
National Broadcasters' League,
Frederick A. Smith, Secretary,
Chicago, Illinois.

Action reported morning papers does not bind any members National Association sheet music publishers. Members accepting proposal committee permitting until further notice broadcasters right to use catalogues without fee will individually notify all broadcasting stations. Suggestions of committee were accepted by majority vote. Send complete list membership your league so our membership can address them.

(Signed) TOMPKINS
Chairman Committee Broadcasting Relations.

Broadcasters and music-loving fans will be further pleased to know that the committee taking this action represents the group of music publishers of the United States who produce a large part of the highclass songs and musical compositions. This association has no connections with the American Society of Composers, Authors and Publishers.

Representatives of the National Broadcasters' League have continued their efforts to bring about an arrangement with the authors and composers, but without results. The league representatives apparently have only succeeded thus far in convincing the authors' and composers' organization that under no circumstances will the broadcasters submit to a direct tax for the use of copyrighted music.

However, this situation is not so dark as it looks. While the authors' and composers' society claims to maintain control of the popular music production, there are scores of independent music publishers who have shown immediate interest in plans of the league for distribution of music to broadcasting members. Several of the biggest producers of popular or jazz numbers already have submitted to the league their catalogue with absolute authority to select for broadcasting the numbers regarded as most desirable.

As the May issue of Radio Age indicated, the supply of popular music is not at all confined to so limited a source as the neighborhood around 45th Street and Broadway, New York.

On the contrary, all over the country there are good song writers, good music composers and enterprising publishers eager to cooperate with the National Broadcasters' League, and not only restore good musical programs for radio, but vastly improve them.

Further details as to how this great movement in behalf of radio is being conducted by the National Broadcasters' League are being mailed to the members as rapidly as developments justify. It now looks as if the music situation would be adjusted permanently and on an extremely satisfactory basis, both from an artistic and financial viewpoint, both for the broadcasters and music loving fans.

Following is the official detailed announcement of the Music Publishers' Association of the United States as sent to Radio Age by mail following its telegraphic advice. The statement shows the attitude of the Association relating to radio music generally.

Official Announcement.

Permission to broadcast copyrighted music by radio without charge, pending the time the radio broadcasting situation is stabilized and placed on a commercial basis, is recommended to publishers by the Music Publishers' Association of the United States in a report of its special Committee on Radio Broadcasting, which has been accepted and adopted by the Association. Most of the publishers of popular music through action of the American Society of Composers, Authors and Publishers, recently forbade broadcasting stations to use their music except upon payment of a license fee to the society, thus precipitating an acute controversy between the popular publishers and the radio broadcasters.

M. E. Tompkins of G. Schirmer, Inc., publishers, Chairman of the Committee, in a statement issued yesterday said: "Our Association, which has been in existence since 1895, represents particularly the so-called 'standard' publishers, which make up a majority of its forty-nine members, as distinct from publishers of popular music although a number of the latter also are members.

"Our committee has been carefully investigating the broadcasting of copyrighted music since last November. In our report, just adopted by the Association, we point out that music publishers are vitally interested in radio broadcasting as a great future user of music and that our rights in the use of our copyrighted music in public performances must be protected. However, we appreciate the fact that radio broadcasting is still in a chaotic and experimental state and that, while ultimately it will have to be placed on a commercial basis if it is to develop its potentialities, nevertheless the commercial side of the broadcasting problem has not yet been solved.

"In view of these facts and also because we desire to cooperate in developing the music possibilities of radio, we believe that we should allow the use of our copyrighted musical compositions for broadcasting without charge for the present, and without prejudice in our rights."

While the action of the Music Publishers' Association does not bind its members, but merely recommends, it is understood that most of the large standard publishers in its membership will follow the recommendations of the Association. The following representative standard publishers have definitely decided to follow the recommendations: Carl Fischer, G. Schirmer, Inc., C. H. Ditson Company, John Church Company Boosey & Company, and Hinds, Hayden & Eldredge of New York City; Oliver Ditson Company and B. H. Wood Music Company of Boston; Paul A. Schmitt of Minneapolis and Clayton Summy of Chicago.

The action of the Music Publishers' Association will make available over the radio a great quantity of the best modern music by orchestra, band, choral and individual performers, and copyrighted arrangements and orchestrations of the world's best music of all time.

The decision of the publishers was based largely upon the following facts and conditions with respect to radio broadcasting, according to the report of the committee:

"The outstanding fact about radio broadcasting from the standpoint of both willingness and ability of broadcasting stations to agree at present to some practical form of compensation for use of copyrighted musical compositions, is their failure, as yet, to find a method of collecting a proper share of the expenses of broadcasting from its beneficiaries, that is from either the various elements of the radio industry or the receiving public. This, of course, does not in any way affect the merits of the question, but it is clear that it does present per-

plexing difficulties to the broadcasting companies.

"While the possibilities of the radio as a transmitter of educational and current informational matter undoubtedly are great, it is generally expected by those who have investigated this question, including radio experts themselves, that entertainment must comprise the popular feature of it. Music has been found essential to the success of nearly every form of public entertainment, and to this radio broadcasting appears to be no exception. Music is the one broadcasting possibility of almost universal appeal.

"Up to the present time the music broadcasted by radio has not, generally speaking, been of a sufficiently high quality to be a factor of importance in creating a further public appreciation and demand for music itself. Eliminate ing the novelty feature of radio, it is very doubtful if the musical side of it would as yet have had any great public appael. Much of the music broadcasted is merely that of a phonograph or reproducing piano, not a little of which is really for advertising purposes. With rare exceptions, no truly great artists have performed over the radio.

"It is not unreasonable to expect, however, that ultimately such scientific perfection of radio broadcasting and receiving apparatus will be attained and arrangements made with so much of the world's best musical talent that radio will be an established and important source of music on a commercial basis. When and if this time arrives, it will be vital to the welfare of the music publisher that the radio branch of the music industry should properly recompense the publishing branch, upon which it will be dependent for its existence and prosperity. The failure of publishers in the meantime to safeguard their rights may make the future enforcement of them difficult.

"The difficulties of establishing radio broadcasting on a commercial basis, which apparently is necessary before it can become an important direct source of revenue to those who participate in it, including copyright owners, are great but not unsurmountable. While it is impossible to predict how the problem will finally be worked out, nevertheless there are several possible solutions. Many persons believe that radio broadcasting must be placed under government regulations and control. Under such conditions all producers of radio equipment who are the commercial beneficiaries of broadcasting could be licensed and the proceeds used to pay the expenses of broadcasting. Some even expect that the radio may ultimately be of such universal use that the government can undertake broadcasting as a public function. It is perhaps more likely, however, that through the control of basic patents a few radio companies can develop broadcasting and reimburse themselves by including the expenses in the price of the patented radio parts or from fees received for licenses granted to other manufacturers. Another possibility is that the radio interests will be able to finance broadcasting as a common promotional problem of the industry, perhaps cooperatively through a trade association. Although seemingly impossible, science may yet produce a method by which the receipt of radio messages can be confined to those who pay for the service.

"Whatever the method proves to be, it must and soon will be found by the radio industry. The radio broadcasters will then be able, and undoubetedly willing, to reimburse all who are essential to the success of their business and those services they use, including owners of copyrighted musical compositions."

The President of the Music Publishers' Association is George Fischer, of J. Fischer & Bro., New York.

They Start Young

Babies now cry for radio. The new national pastime has invaded the nursery and many mothers are adopting radio waves as pacifiers. A mother of six children, the oldest eleven years old, writes WGY, the Schenectady broadcasting station of the General Electric Company that her youngest child, aged fourteen months, is already a fan. Mrs. Robert Barber of Rensselaer, N. Y., writes as follows:

"I wonder if it would interest you to know that I think I have the youngest radio listener. My baby is fourteen months old and she walks to the desk where I have my crystal set and points for me to open it. When there is anything she sits with the ear phones just as nice as any large person but as soon as it stops she takes off the phones and starts to scold for more.

"I have six children and they all like to listen. I have two sets of phones and they separate them."

Got Mules by Radio

Recently while in Atlanta on a radio inspection trip, Commissioner Carson of the Department of Commerce, was advised that his best team of mules had disappeared from his farm in a nearby state, and later being in the broadcasting station of a local paper he let the loss be broadcast, with a description.

A few days afterwards when in Nashville, he was advised that his mules had been found wandering miles from home. Whether radio was responsible for their discovery or not cannot be proved, the Commissioner says, but he believes it was instrumental in their release from temporary confinement. "I was glad to get them back," he added, "they were good mules."

Radio Baby

WGY, the Schenectady broadcasting station of the General Electric Company has been honored by a Wisconsin family. A brand new baby, according to the father, has been named after the Schenectady station. He is Wallace Gordon Yadon and he lives in Delavan, Wisconsin. M. E. Yadon, the father, is advertising manager for the Bradley Knitting Company.

Churches Converted

Have you ever wondered how a radio broadcasting station with its fixed equipment manages to send out religious services weekly from churches many miles away from the sending station?

The operating staff of WGY, the Schenectady, N. Y., station of the General Electric Company has so developed church service broadcasting that thousands of letters of appreciation are sent in from far and near.

The installation necessary for broadcasting the services of the Second Presbyterian Church of Amsterdam, N. Y., April 22, is typical and will give the radio fan an idea of how it is accomplished.

In the church were four microphones, two of them spares for emergency use. One microphone and a spare were placed at the reading desk to get the words of the clergyman in scripture reading, prayer, sermon and announcements and a microphone and spare were hung above and in front of the choir and organ. These microphones or pick-ups were the only evidence to the congregation that the service it was hearing was going out to countless thousands many miles away. There is nothing in the church installation to distract the attention of the congregation from the service.

At one side of the church, hidden from view but in a position where he could follow the service, was stationed one of the WGY staff who switched the microphones on and off as the service progressed. If the minister was speaking, his microphone was brought into the circuit and the choir microphone was switched off.

Two other operators were situated in an adjoining room where a portable control equipment had been installed. In this room one of the operators controlled the amplification of speech and music. The amplifying outfit consisted of two 5-watt tubes, one 50-watt tube and other necessary apparatus. Sufficient amplification was used to overcome line noise on the twenty miles of telephone wire necessary to carry the electrical oscillations set up in the microphones to the control room of WGY in Schenectady, N. Y. The second operator in the side room was in constant communication by special land wire with the control room at WGY.

In the control room in Schenectady the church services were again amplified, this time on equipment which consisted of one 5-watt tube and two 50-watt tubes. From this point the electrical oscillations passed to the power apparatus and were impressed on the modulator and oscillator tube going thence to the antenna and the air.

Between church and control apparatus the church service passed through three exchanges of the New York Telephone Company—the Amsterdam exchange, the Schenectady exchange and exchange of the General Electric Company.

A New High Speed Code System

By LUTHER M. MEREDITH

EIGHTY years ago Professor Morse, with the invention of his system of electric telegraph, originated a code or alphabet, which from its invention derived the name, Morse code. Various adaptations and changes have been made, resulting in various codes, among them the Continental Morse alphabet, navy and others. The basic principle of all these codes lies in the different time units for dots, dashes and spaces, dashes being three times the length of time duration of a dot with the spaces for words and sentences of a still longer time length than that of a dash. Morse's system, invented before the era of telephone, alternating arc, and radio transmission, during the eighty years since its invention, has outlived its period of utility, the rapid strides in the development of all forms of communication having made necessary various kinds of high speed telegraph systems, none of which have been entirely satisfacrory.

In radio, there are numerous examples of its inefficiency. The present methods of operating large radio telegraph stations, sending, whether accomplished automatically or by hand, has no relation to the nature of the antenna current. The average antenna currents, ranging from two to three hundred amperes are, in the course of transmission interrupted or modified in a manner, long recognized as inefficient, without regard to the point of phase when the transmitting key is opened or closed, and a large flow of current is discontinued or changed whether the nature of the current is positive or negative, at zero or at maximum.

The sudden breaking or changing of a high frequency alternating current results in a group of harmonics being radiated. Bearing in mind that a flow of so great an antenna current, being interrupted in this manner it can be readily understood, that the nature of these harmonics will be of great strength, causing broadened tuning and consequently interference, a problem which is already causing too much disturbance.

The speed rate at which the Morse code can be efficiently recorded, whether by ear or machine is limited, due to the nature of some of the characters of the alphabet being similar, and in order that they may not be incorrectly recorded must be stressed. The characters S and H of this alphabet are good examples of this defect. The letters S . . . and H . . . . require three and four signals of the same sign, and consequently

Gen. George O. Squier

are not as legible as letters such as A . — or — . the letter N. The illegibility of some of the characters in the alphabet as above, retard the speed of the whole alphabet, so the time durations shall correspond. Therefore transmitting costs are higher, than they ordinarily would be, were it that this defect did not exist. Much money and time could have been saved if the code now in use had been designed to meet our original needs. The letter E for instance, the most common letter in English, is composed of the signal . (dot), while the letter O ranging second in importance in the language comprises the signals — — — (three dashes) requiring many more times the duration of the letter E, which of course is quickly recognized as inefficient.

Squier's New System.

Various methods have been invented and tried, but all of them, due to the use of the time durations between letters or characters, have proved inefficient and inadequate. Maj.-Gen. George O. Squier, chief officer of the Army Signal corps, has devised a new system based upon the old code, but with a new basic theory as to the method of transmission. His invention promises to revolutionize the methods of code transmission of radio, telegraph and cable communication.

Briefly, General Squier uses an alternating current, varying the amplification of intensity of each half cycle of alternating current to represent a dot, dash or space. By the use of this system, six different arrangements are possible. To select the most efficient arrangement is the present problem now under way, and it may probably lead to some new heretofore undiscovered arrangements.

In the alternating current system, there are no consecutive signals of the same sign, the difference lying in the different nature of the amplitudes. Therefore the characters being alike in time value, and not in amplitude or sign, will enable their transmission at a speed of 2.65 times faster than heretofore attained in commercial or official radio, telegraph or cable transmission. The advantages of the increase of speed, nearly three times that of any former system, are readily seen.

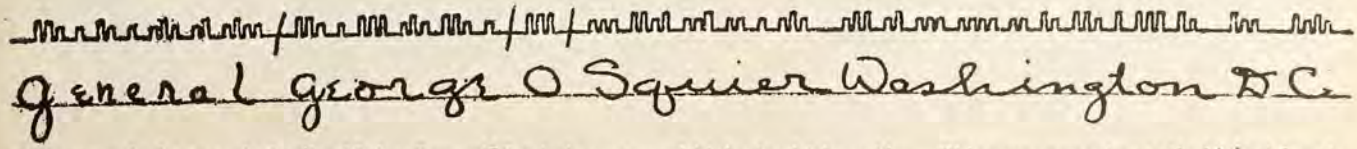
Under the old alphabet, O being composed of three dashes, required eleven units of time, while under Major General Squier's system this all-important letter is transmitted in three units, a decided saving in time, being nearly three times as fast.

The new system promises a method whereby atmospheric disturbances will become a negligible factor in code reception, and with the use of the new system of a modulated alternating current, sharper waves and closer tuning will be possible with decreased interference.

Harmonics will be dispensed with, due to the fact that the current is modulated, and not broken, and the transmission of more traffic between stations who formerly were interfered with by so called pure waves from other stations transmitting, will be more reliable and speedy.

The system is the result of nearly eight years of research and experiment, having its origin in 1915, when a new alphabet for cable communication was being invented.

General Squier again has proven his inventive ability, and the value of his system will doubtless be recognized at the next International Technical Conference on Telegraphy.



Tape record of transmission by Major General Squier's system of high speed telegraphy. This arrangement uses the highest humps for dashes, next highest for dots, the spaces between words and letters having no height.

Pick-Up Records from Our Readers

Stockton, Ill.

Radio Age:

I am a subscriber to your valuable magazine, and would not trade it for any of the other present day radio magazines on the market.

I notice you have a column of PICK-UPS BY READERS, and would like to submit the following list of stations heard with a simple hook-up during three hours and ten minutes of actual listening: KHJ, Los Angeles, Cal., 1650 Miles; WHAS, Louisville, Ky., 366 miles; WJZ, Newark, N. J., 810 miles; WHB, Kansas City, No., 337 miles; WAAP, Wichita, Kans., 503 miles; WWJ, Detroit, Mich., 347 miles; WOC, Davenport, Ia., 50 miles; KYW, Chicago, Ill., 134 miles; WDAP, Chicago, Ill., 134 miles; WLAG, Minneapolis, Minn., 237 miles; KSD, St. Louis, Mo., 250 miles; WOH, Indianapolis, Ind., 260 miles; WOAN, Lawrenceburg, Tenn., 500 miles. WMC, Memphis, Tenn., 493 miles; WSB, Atlanta, Ga., 662 miles; WGM, Atlanta, Ga., 662 miles; WDAJ, College Park, Ga., 665 miles; WWAC, Fort Worth, Tex., 797 miles; WGY, Waco, Tex., 811 miles; WGY, Schenectady, N. Y., 803 miles; WLW, Cincinnati, O., 353 miles; KLZ, Denver, Colo., 819 miles; WCX, Detroit, Mich., 347 miles; KDKA, East Pittsburgh, Pa., 543 miles.

Giving an approximate total of about 12,870 miles for 3 Hours 10 minutes of hard listening, and as an average traveling at about 4,000 miles per hour!

Very truly yours,

JOHN MAHER,

(Note—Mr. Maher's hook-up is shown in Figure 1.)

Escanaba, Mich.

Radio Age:

I recently purchased a copy of Radio Age, and I was startled to find a description of a hookup similar to the one I have been using with very good results.

For my circuit, two variocouplers must be wound. They cannot be purchased, as the windings do not apply to this set. They must be made exactly to the following specifications:

The line variocoupler, or antenna coupler, should have its primary coil wound with 60 turns of No. 20 D C C wire. Start winding 12 turns above the rotor shaft, next leaving a one-half inch space for the rotor shaft, and continue the winding until the entire remaining 48 turns have been wound. Taps should be taken off this coil as follows: Upper 12 turns of coil should be tapped every 4 turns, the remaining 48 turns tapped every 8 turns. The rotor should be wound with 34 turns of No. 22 D C C, 17 turns on each side of the shaft.

The tickler variocoupler should be of the same dimensions, the stator being wound with 26 turns of No. 20 D C C wire with 8 turns above the rotor shaft and 18 turns below it. The primary of this coil is not tapped. The rotor coil is wound the same as that of the antenna coupler. The two couplers must be in inductive relation, not spaced more than six inches apart. Connections are made as in Figure 2.

This instrument has the loudest regeneration up to the distortion point of any set I have ever operated. It brings in stations on any average antenna from all parts of the country. Chicago stations have been heard using a bed spring as an antenna. At times I use no antenna at all for local stations.

Very truly yours,

A. J. BAUMGARDNER,

(Note: This circuit is very similar

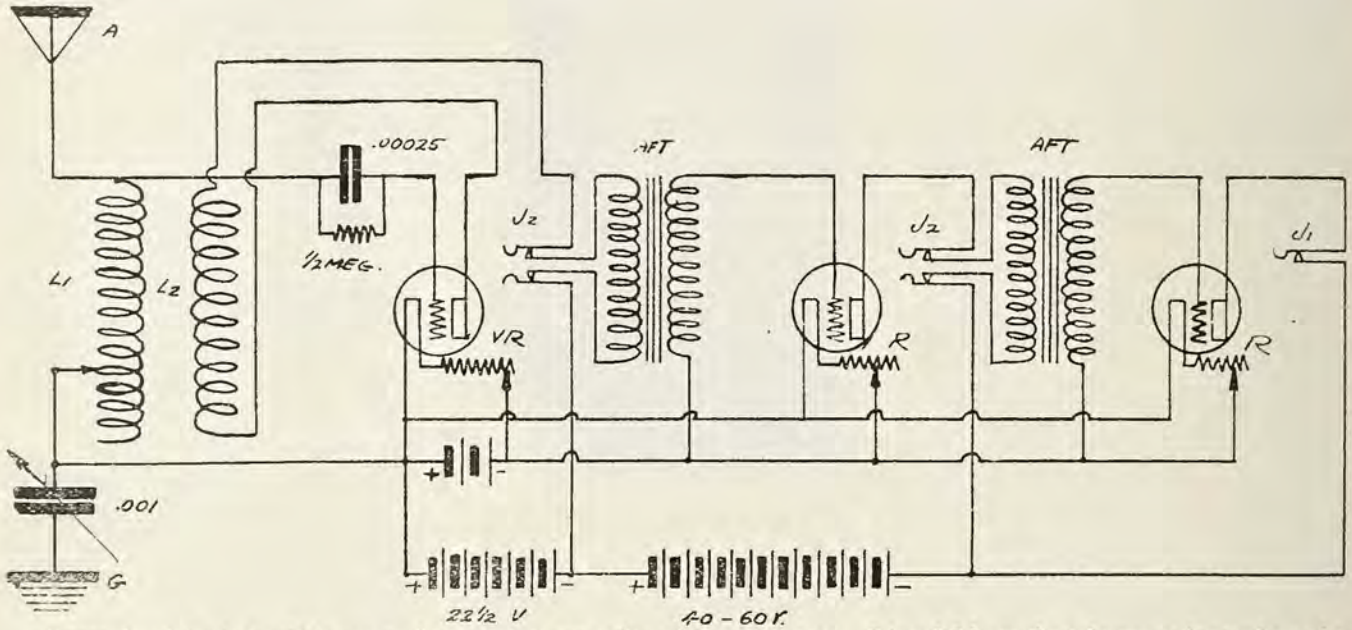


Figure 1. A hookup which many of our readers are using with great success. L1 and L2 are the primary and secondary of a variocoupler. The condenser in the ground lead is a 43 plate. J1 is a single circuit jack, while J2 are double circuit jacks. AFT, audio frequency transformer.

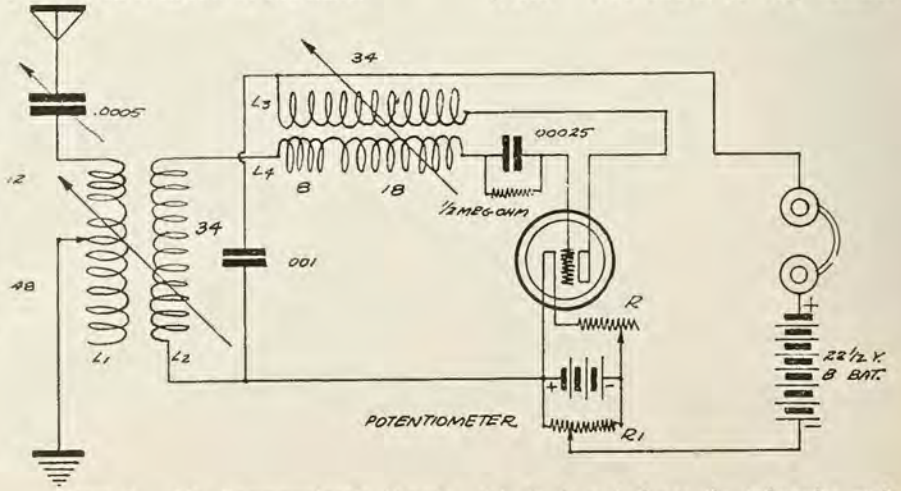


Figure 2. Mr. Baumgardner's Circuit. L1, 2, 3, and 4 are the primaries and secondaries of rewound variocouplers. The antenna condenser is a 23 plate. The condenser shown across the plate and grid return circuits, should be a .001 fixed telephone condenser.

Pick-up Records from Our Readers

to the circuit published in our April issue, of the one tube antenna set by Mr. Raymond Chessevent.—The Editor.)

In our April number we published a communication from one of our readers, Mr. John A. Barnes, 5911 MacPherson Ave., St. Louis, Mo., containing account of stations received on a two slide, one tube set with a one wire antenna. Mr. Barnes now writes:

"I have received so many requests for the hookup of my set I wrote you about that I am sending it to you hoping it may be of some service to your readers."

Mr. Barnes' circuit appears in Figure 3.

Mr. Paul G. Smyth writes:

"I am enclosing herewith a diagram of a circuit which can be made into an ideal portable set, so that it may be transported for summer use. This set was used in a suit case, with a loop antenna one and one-half feet across, and fine results were obtained from local stations. On a regular antenna stations as far as Denver, Colorado, have been received. KYW of Chicago came in at several intervals with loud-speaker intensity."

Considering that Mr. Smyth lives in Brookline, Mass., his circuit must be a good one. His connections are made as in Figure 4.

"I have built a radio set as described and have found it very satisfactory. Am receiving WGY and WEAF as clear and loud as any Chicago stations. Also received WOC, WDAF and WLAP all with one detector tube.

"This set of mine is the laughing stock of the neighborhood because I have it built in a small wooden store box."

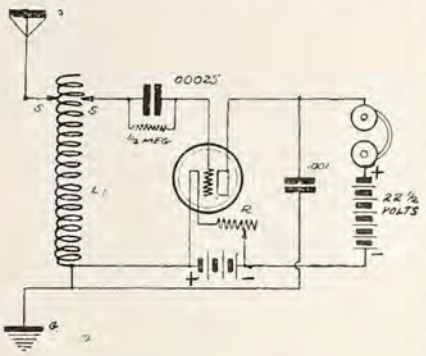


Figure 3. This circuit utilizes a tuning coil L 1, with S as the two sliders. A vernier rheostat should be used in this circuit, as the filament control is a big factor in the tuning of the set.

Here's a Hook-Up

Conrad Herchem, 1729 Galena Street, Milwaukee, Wis., writes:

"I experimented on a hook-up for a crystal set and I got such good results that I wish you would publish this in your magazine so that others may have the same fun as I have had. The hook-up is as follows: The winding is on a paper tube four inches in diameter and ten inches long, the main winding is of No. 26 dc wire. Eight taps are taken off; the first tap after five turns the second after ten turns; the third after fifteen turns, fourth after twenty turns, etc. The tickle coil is of No. 26 also. The windingsgYi fty turns on half."

Summer Park Concerts

Although the broadcasting of the Government's band concerts by NAA, Arlington, will cease during the summer months, radio fans within several hundred miles of Washington will be able to pick up some concerts if the plans of the Chesapeake & Potomac Telephone Company are carried out.

By June 15, this company now hopes to complete its new station in Washington and start broadcasting the open air public concerts from the White Lot and local parks where the Marine, Navy and Army bands will play almost daily

Through the aid of a new portable "input apparatus" recently perfected by the telephone engineers, the Chesapeake and Potomac company expects to furnish the added juice necessary to pick up concerts and transmit them by wire to their station for radio broadcasting. This apparatus is mounted on a motor truck and can be dispatched anywhere in the city where something is to be broadcast.

Representatives of the company say that it is sometimes difficult to relay speeches and music from private residences via telephone lines to broadcasting stations due to lack of current, but with the new booster they expect to overcome this handicap.

Important speeches and concerts also will be put on a land line to New York and broadcast simultaneously from WEAF on a different wave length, telephone officials state.

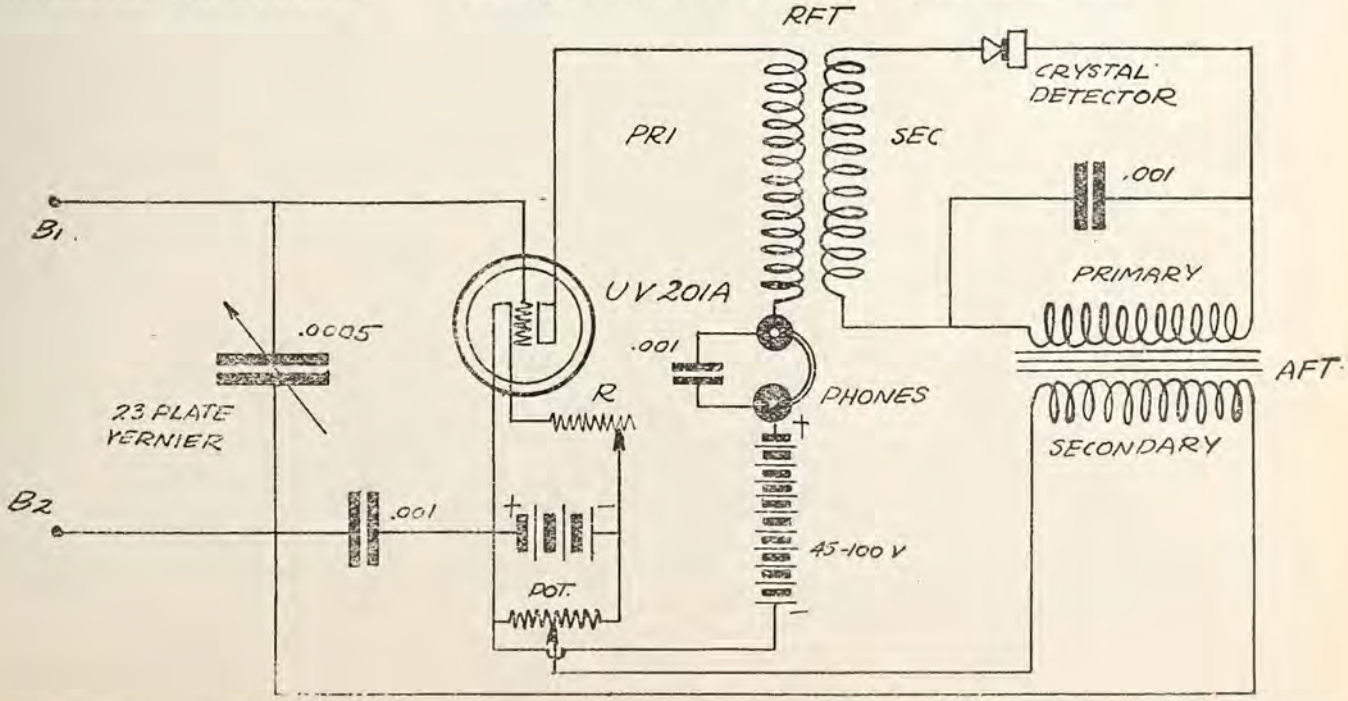


Figure 4. A one tube reflex circuit with which one of our readers says he is getting long distance stations. Either a loop antenna or regular antenna may be used on this set. If a regular aerial is used, a variocoupler secondary should be connected to B1 and B2. Otherwise the loop is connected to the same posts. RFT is a radio frequency transformer, while AFT is an audio frequency transformer of a 10 to 1 ratio.

Passing of WJZ

Already radio is old enough to have its traditions and its memories of past glories. Old WJZ, the Newark station, which made the bedtime story famous, and was one of the pioneer stations to assist in putting radio on the map in the United States, is no more.

On May 15 the station, which was operated by the Radio Corporation of America and the Westinghouse Electric & Manufacturing Company, was closed. Only the old familiar call signal was retained. Hereafter WJZ will mean the call of the Broadcast Central station whose lofty aerials are atop the Aeolian building, Fifth avenue and Forty-second street, New York City.

Broadcast Central, the new radio station of the Radio Corporation of America, which has been the subject of considerable speculation among radio listeners who have heard the station testing with call 2XR, was opened May 15.

Located in the heart of the city's musical and theatrical district, where entertainment of the highest order is ever available, this station offers to the American public elaborate programs with a degree of faithfulness in reproduction that marks the beginning of a new era in radio broadcasting. The wires which tower 400 feet above the street on Aeolian Hall, at Fifth Avenue and 42nd Street, provide two antennas, and this superstation will transmit two broadcast programs simultaneously, on different wave lengths.

The closing of station "WJZ" at Newark coincided with the opening of Broadcast Central. The well-known call "WJZ" was retained for transmission from the Aeolian Hall station on 455 meters while the call "WJY" is used for the other wave length of 405 meters, both of which wave lengths have recently been allocated to the new station.

The new station is fitted with a double antenna and two independent transmitters which permit a dual program to be broadcast, one, that of classical or serious entertainment; the other, popular airs, dance music and lectures.

The Radio Corporation of America has made a thorough analysis of the types of programs best suited to the requirements of the public and this study has revealed the fact that generally, the radio public may be divided into two classes, those who prefer classical or similar entertainment and those desiring dance music and popular airs.

Not only will transmission be carried on from the two studios which are a part of the station, but the main recital hall of Aeolian Hall has been connected to a switchboard in the station thus providing at frequent intervals another source of the finest music obtainable.

To guard against interruption in programs, two spare transmitters are installed together with the necessary controlling apparatus which will enable the operator to make an instantaneous change from one set to another should any trouble develop.

Broadcast Central is a model station both in electrical design and operating facilities incorporating the most advanced ideas of RCA engineers. One of the outstanding improvements is the "checking up" of the broadcast programs for clearness in transmission. This is accomplished by a "moving picture" device connected with the antenna which shows at a glance the perfection in reproduction of music or voice as the radio waves leave the antenna. Any distortion occurring during a rendition may be instantly corrected by the operator who watches the electrical vibrations as they radiate into space.

Class B Calls and Waves

Thirty-four Class B stations, each with a territorial zone, have been licensed by the Department of Commerce to start operating on May 15.

The zone waves originally designated for Seattle and Portland have been transferred; Seattle has been assigned the 455 meter wave on 660 kilocycles, and Portland, 492 meters, or 610 kilocycles.

A special wave for Class B stations in Madison, Wis., and vicinity may be designated as 345 meters if a station qualifies.

Specific B Waves by Stations

The calls and waves for thirty-four Class B stations follow:

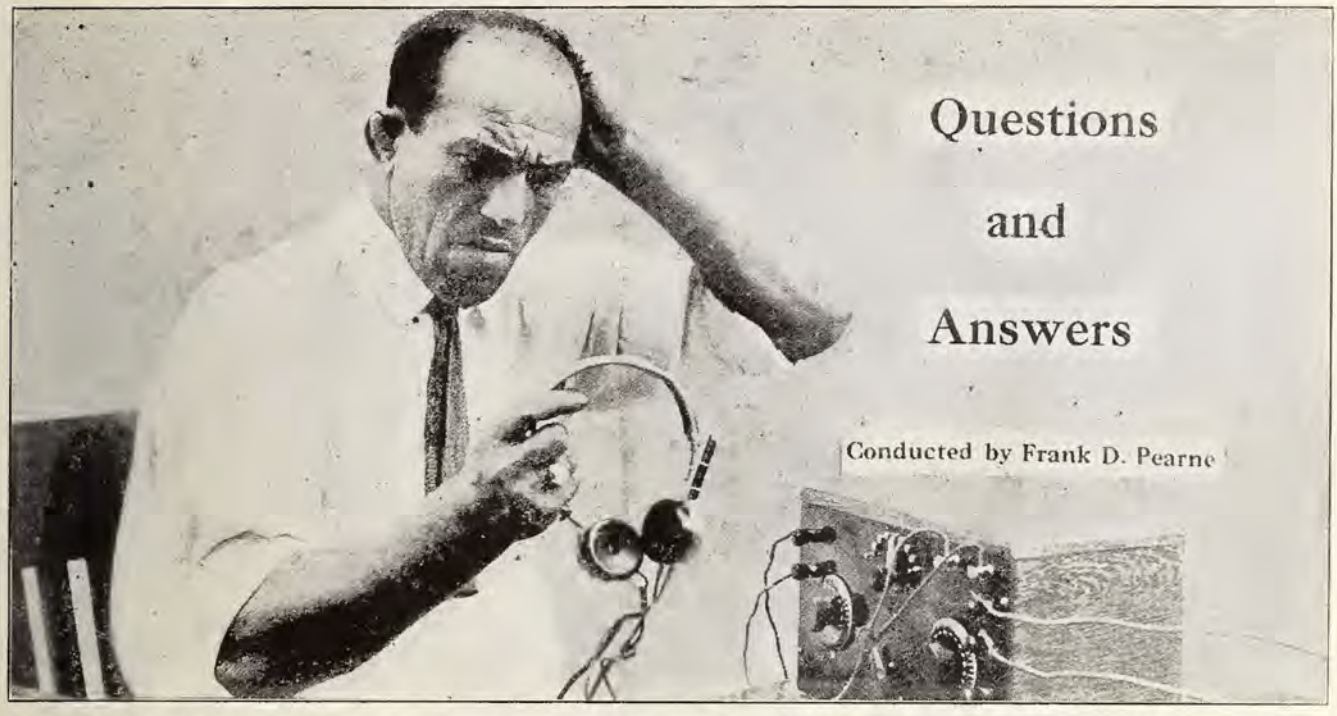
	Call	Wave
California:		
Los Angeles, Earle C. Anthony	KFI	(395 or 469)
Los Angeles Times-Mirror	KHJ	(395 or 469)
San Francisco, Hale Bros. Inc.	KPO	(509 or 423)
San Francisco, Mercantile Trust Co.	KFDB	509
Georgia:		
Atlanta, Constitution	WGN	429
Atlanta, Journal	WSB	429
Illinois:		
Chicago, Westinghouse Elec. & Mfg. Co.	KYW	345
Chicago, Daily News	WMAQ	448
Iowa:		
Davenport, Palmer School of Chiropractic	WOC	484
Kentucky:		
Louisville-Courier Journal and Times	WHAS	400
Massachusetts:		
Springfield, Westinghouse Elec. & Mfg. Co.	WBZ	(337)
Michigan:		
Detroit, Free Press	WCX	517
Detroit, News	WWJ	517
Minnesota:		
Minneapolis, Cutting & Washington Radio Corp.	WLAG	417
Missouri:		
Kansas City Star	WDAF	411
Sweeney School Co.	WHB	411
St. Louis, Post Dispatch	KSD	546
New Jersey:		
Newark, Bamberger & Co.	WOR	405
New York:		
New York, American Tel. & Tel. Co.	WBAY	492
New York, Western Electric Co.	WEAF	492
New York, Radio Corporation	WJY	405
New York, Radio Corporation	WJZ	455
Schenectady, General Electric Co.	WGY	(380)
Troy, Rennselaer Polytechnic Inst.	WHAZ	(380)
Oregon:		
Portland, Oregonian	KGW	(492)
Ohio:		
Cincinnati, U. S. Playing Card Co.	WSAI	309
Pennsylvania:		
Philadelphia, Gimbel Bros.	WIP	509
Philadelphia, Lit Bros.	WDAR	(395)
Philadelphia, Strawbridge & Clothier	WFI	395
Philadelphia, Wanamaker	WOO	509
Pittsburgh, Kaufmann & Baer Co.	WCAE	(?)
Tennessee:		
Memphis, Commercial	WMC	500
Texas:		
Dallas, News & Journal	WFAA	476
Fort Worth, Star Telegram	WBAP	476

Stations with waves in parentheses are not definitely assigned.

New Wave for NAA

Since May 10, Arlington NAA has been broadcasting governmental information on the 435 meter wave instead of 710. This change was made in connection with the Department of Commerce's new schedule.

Talks on the standard radio frequency signals, being transmitted by the Bureau of Standards from time to time from WWV, are an added feature of the Commerce Department's broadcasting schedule from NAA, Tuesdday evenings be-



The technical department sends out many replies to questions in each day's mail. This service heretofore has been free to all but in order to assure this service to our subscribers this direct reply method hereafter must be restricted to those fans who are on our subscription list.

Fans who are not subscribers may obtain this service by enclosing 50 cents with their question and the reply will be mailed at once, accompanied by circuit diagram where illustration is needed.

All inquiries should be accompanied by self-addressed and stamped envelope.

E. T. S., Chicago, Ill.

Question: I made the WD 11 tube circuit of the March issue, and it works beautifully, in fact I get stations from all parts of the country. Now I want to build a two stage amplifier, using W D 11 tubes for amplifiers, in this set. What transformers must I use on the first and second stages? Please explain primary and secondary windings on the transformers. Must I use vernier rheostats in the amplyfying circuits? I burned out two W D 11 tubes although the filament showed a faint red, when my rheostats were turned about half way up. What is wrong?

Answer: In Figure 1, I am printing a diagram of the circuit you speak of in connection with a two step amplifier, using W D 11 tubes. Carefully note the manner of connections on the dry cells which are connected up in parallel to give the required amperage for the W D 11 tubes when used as amplifiers. For the first stage use a 10 to 1 ratio transformer, and on the second a 5 to 1 or 3 to 1 ratio. Transformers are usually marked P and B+ for primary connections, and G (grid) and F— (filament Negative) for secondary connections. You will not need vernier rheostats in the amplyfing circuits. The reason you burned out your tubes was probably due to either a shorted connection or an excessively strong battery. Would advise that you look back into the May issue of the Radio Age, and learn how to protect your tubes with fuses.

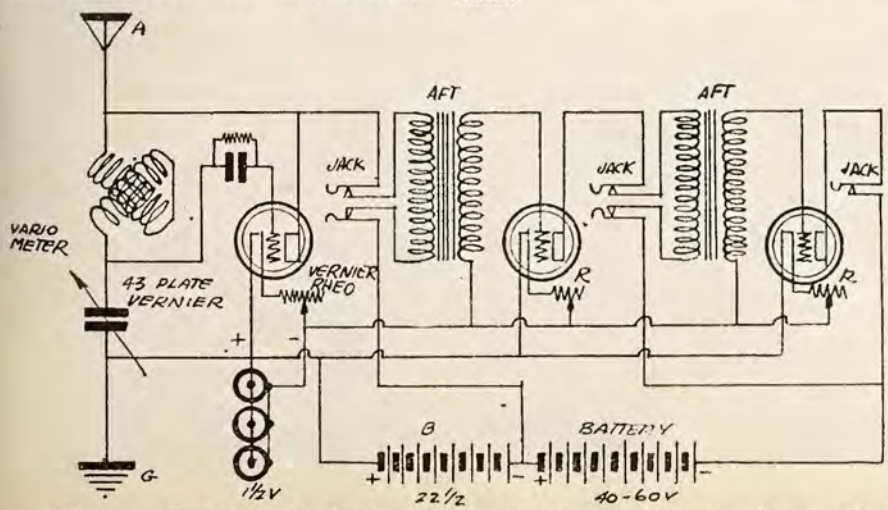


Figure 1. Using WD 11 tubes for amplifiers on the single variometer circuit. Note the connections on the dry cells which give the necessary extra amperage when more than

L. H. P., Kansas City, Mo.

Question: I would like to obtain a hook-up for a crystal set that would receive from 75 to 100 miles. If there is such a hookup will you please print it?

Answer: I am showing in Figure 2 a hookup which has been giving unusual results over greater distances than which you ask for. Tuning is exceptionally fine, which is accomplished with the variometer shown in the circuit. It will no doubt satisfy any crystal BCL.

J. H. H., Cameron, Mo.

Question: Please publish a diagram of the Kopprasch circuit. I have heard that it is giving very good results. Can it be used with a W D 11 tube?

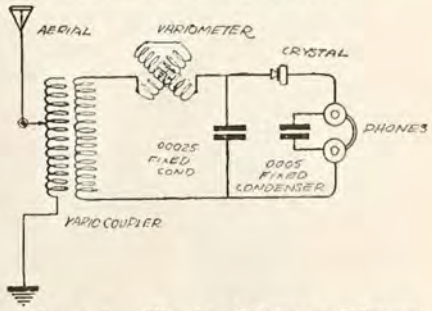


Figure 2. The Long Distance Crystal Hookup, which is giving very good results over extremely long distances. Tuning is accomplished with the variocoupler and variometer shown in the circuit.

Answer: The Kopprasch circuit and the details of construction appeared in the April number of Radio Age. However, I am enclosing herewith a diagram of the circuit in question. It is giving very good results in connection with the

Questions and Answers—Continued

I. W. F., Chicago, Ill.

Question: I would like to change my loose coupler crystal receiving set into a one tube set. Please send me a drawing showing how this is done.

Answer: Figure 3 will show you how to properly connect your former crystal set to a tube and increase your range.

E. J. P., Memphis, Tenn.

Question: I am constructing the two circuit crystal detector receiving set on pages 6 to 10 of the April number of Radio Age. Now everything has been made very plain in the instructions with the exception of coil tube P. Shall I begin winding the wire in the same direction as on coil tube S? Please send me full instructions on how to wire up this coil, as I am very much interested in this set.

Answer: The primary coil P is constructed as follows: On a cardboard tube 4 1-4 inches in diameter and 5 inches long wind 90 turns of number 22 wire. Tap the first 10 turns every single tap, thereafter tapping only every 10th turn, until the winding is complete with 90 turns. The taps are brought out to switch points and soldered. Two switches are connected to the antenna and ground respectively, the switches making contact with the switchpoints. The wire on this coil should be wound in the same direction as on the coil S.

E. P., Dallas, Texas.

Question: I have a few questions that I would like to ask you. I want to put one step of audio and one step of radio frequency amplification to my present set which consists of two variometer, vario-coupler and variable condenser in the aerial circuit. Do you think it a good plan? If so, please send me a complete hook-up of the circuit. Why is it, that the Chicago stations are not picked up in this city very frequently? I have had my set for about six months and only rarely do I pick up Chicago stations. How come? I hear WOC, WWJ, WLAG, and others quite frequently.

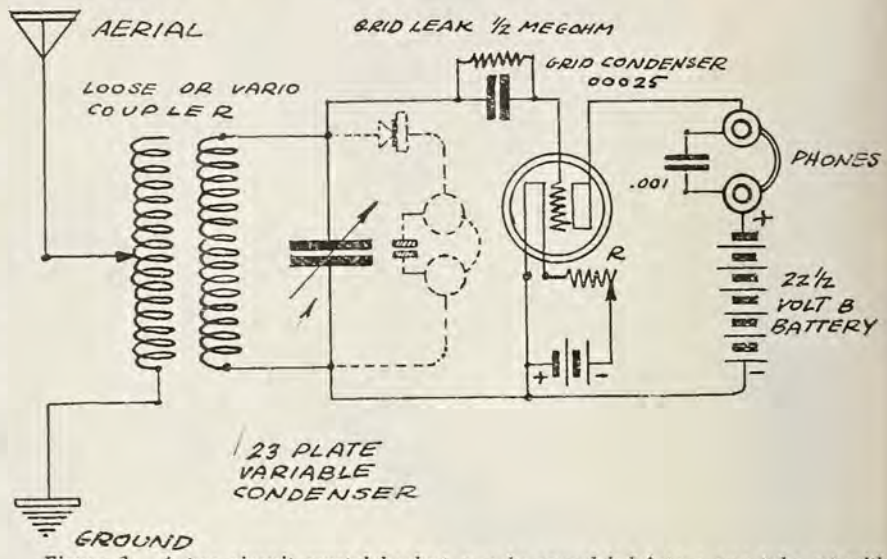


Figure 3. A two circuit crystal hookup can be remodeled into a one tube set with the few simple changes as indicated in the circuit diagram.

Answer: Figure 4, shows you how to correctly connect up your present apparatus with one step of radio frequency amplification. To do this, you will not need a grid variometer, the tuning of this part of the circuit being done with a 23 plate condenser. A 3 plate vernier condenser connected across the primary of the RF transformer will help in tuning. The probable reason you do not hear Chicago stations is that your location is not favorable to reception from this region.

A. E. C., Washington, D. C.

Question: I recently hooked up the Kopprasch Circuit described in the April issue of RADIO AGE, but have been unsuccessful in bringing anything in. Perhaps I do not know how to tune it, or it may be some other trouble. I tuned as follows: Plate varimeter at maximum (windings parallel), turned condenser until a hissing was heard, then grid variometer, following this procedure on each tap. The hissing increased by adjusting the grid variometer until suddenly a deafening screech resulted but nothing more, though I readjusted the plate variometer and also the other dials. At several points on the condenser a knock or click resulted in the phones, but adjustment of variometers merely changed this to a hiss or screech. What can you suggest?

Answer: The probable causes for poor results with the Kopprasch circuit which you have constructed might be traced to an improperly adjusted grid leak or probably too high a plate battery potential. Would suggest that you procure a tapped plate battery and try reducing the voltage until the set spills over very gently. After this has been done adjust the grid leak until the signal is clearest. The noise you write of, might also be caused by a poorly made connection, so I would advise that you go over the set and make sure that no descrepancy in wiring exists. The best way to tune is to set the plate variometer and the condenser of the set until it oscilates slightly, and then tune around with the taps and grid variometer until a signal is heard. Smooth out with the plate variometer and condenser, until the signal is loudest and clearest.

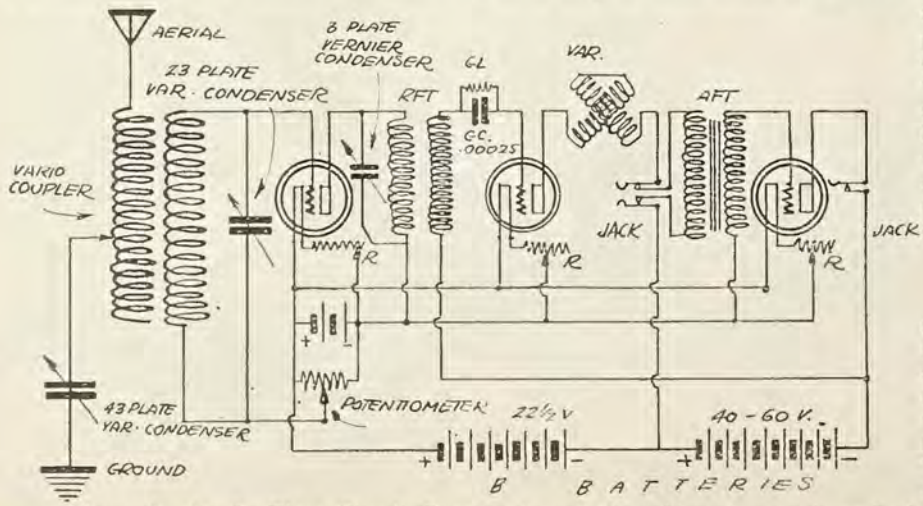
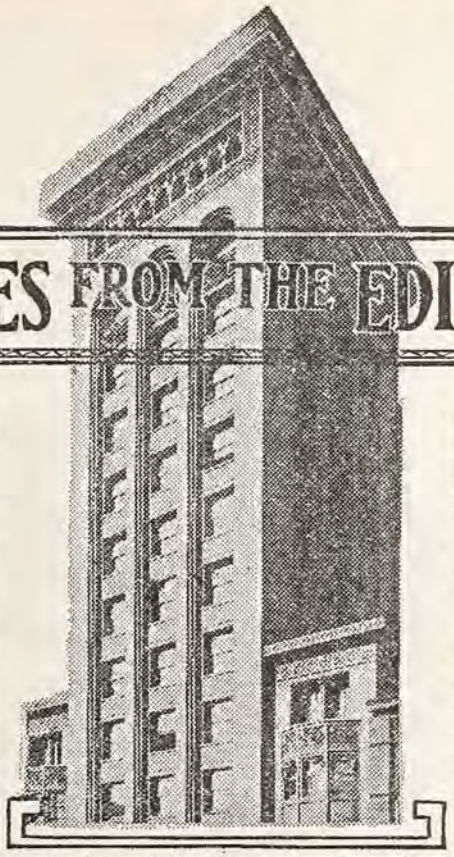


Figure 4. In the Three Circuit Regenerative set, the grid variometer is omitted when radio frequency amplification is added, and the tuning is accomplished with a 23 plate vernier condenser across the secondary of the variocoupler.

An English radio enthusiast who thinks nothing of sitting up until 4 o'clock in the morning to get American broadcasting stations, reports receiving the entire program of WGY, the Schenectady, N. Y., station of the General Electric Company, on four different evenings. The most remarkable feature was his reception on a single tube or valve—as the English call them—homemade receiving set. He is J. H. Brittain and he lives at Eccles, Lancashire, England.



THOUGHT WAVES FROM THE EDITORIAL TOWER

WENDELL Hall, song writer and singer, recently has proved that radio can make a song hit. The American Society of Composers, Authors and Publishers, contends that radio does not create a demand for the songs and musical compositions copyrighted by the society but rather diminishes the demand for such songs and musical numbers.

Whether that be true, and whether the accompanying demand made by the authors and composers that a tax be paid for use of copyright music be justified, Mr. Hall has recently put over a great seller through the singing of his own song "Mellow Moon" from Station KYW, Chicago.

It is another contention of the authors and composers that persistent broadcasting of feature numbers from theatrical productions results in diminished box office receipts at the theaters where those numbers are being produced. This contention also appears to be answered by the fact that grand opera was broadcast throughout the 1922-23 season and that the season's receipts at the Chicago auditorium showed a material increase over those of the preceding season.

SEVERAL months ago Radio Age published an article calling attention to the fact that the necessary use of storage batteries in connection with radio receiving sets made it difficult for the man on the farm to keep his set going. Necessity for recharging of batteries, without facilities of electric light wiring, forced the farmer to carry his batteries to town or possibly to attempt to use batteries removed for the purpose from his automobile.

It was a difficulty that seriously impeded the popular growth of radio in the rural districts. At the time the article was written there seemed no way out of the difficulty.

But now, with the agile way radio has of leaping over obstacles, the engineers have designed sets equipped with tubes which may be efficiently operated with dry batteries, which do not have to be recharged and which are much smaller and lighter than the cumbersome and untidy storage battery.

It only goes to show that radio is irresistible. There is to be steady progress, let the obstacles be what they may. It is the farmer's chance to get in on the entertainment and news bulletin service that has delighted millions in the towns and cities.

SOME newspapers, otherwise progressive and alert, persistently remain aloof from radio. Several reasons may be assigned for this. One of them is that the publishers and editors of those newspapers are unfamiliar with radio. The same sort of editors and publishers remained aloof while the phonograph was taking the place of the old mechanical music box. The same editors and publishers were skeptical about the automobile as a practical means of conveyance. The same editors and publishers were sure that the moving picture was either a passing toy or a basis of stock promotion schemes.

Now, with their advertising columns filled with automobile, moving picture and phonograph advertisements some of them still are waiting to see whether this radio thing is not a dangerous innovation. They perhaps wonder whether it would not be best to be off with the old love before they are on with the new.

The newspaper editors and publishers who have given space to radio departments and who have actually established broadcasting stations as a part of their newspaper service are reaping the benefits of their competitors' indecision.

Many newspapers appear to figure that if radio broadcasting from their own station would not increase their circulation, or even their direct advertising, that such a station would be an extravagant incumbrance

We want to ask the editors and publishers of newspapers a question:

When the millions of radio fans listen daily to programs from St. Louis, for example, do those fans not eventually associate a city with the name of a newspaper that broadcasts the programs? Among those millions of fans are there not thousands of individuals who are directly or indirectly associated with the business of advertising nationally? Would it not be the inclination of those individuals to take it for granted, in placing such national advertising, that the newspaper that had been making the entire country listen to its radio programs, probably would make the best advertising medium in the particular city in which the broadcasting newspaper was located?

We grant readily that such a broadcasting newspaper might not be at all the best advertising medium in its city but would not there be a country-wide impression that it was the best medium and after a sufficiently long period had elapsed might not this impression actually result in making that newspaper the best medium?

We don't know. So we ask.

Radio on the Farm?—Let These Farmers Tell You

Appreciation of the entertainment brought to the farmhouse by radio is expressed by Peter C. Swartz in a recent number of The Wisconsin Agriculturist. Radio eventually will find its best friends of all on the American farms. Already it is taking hold. Read what Mr. Swartz has to say:

Radio and Wireless!

How common these words get when one has a radio machine, and other words also become common and very familiar, such as antenna or aerial wire, insulators, variocouplers, variable condensers, tuning coil, detector and amplifier tubes, receiving head sets, magnavox or loud speaker, "A" and "B" batteries, etc.

At first one wonders if he will ever learn how to run or operate or install a radio outfit, but that wears off readily if you have some one who has some experience when you install. It took less than three hours to install ours. We just put a baled hay wire around the cupola of one of the barns and another around the chimney of the house, and stretched our copper antenna wire from these baled hay wires, grounded the radio machine to the water pipes, connected the "A" and "B" batteries and then tuned in the machine.

Behold, there was the voice of a man talking from Madison, and when he finished they announced the next would be music by a band.

"You can't fool me," the hired girl said, "pretending that you heard a man talk and now hear music with that little contraption, and the little wire you put up." In the next twenty seconds she lost her bet.

Radio has come to stay forever. It's a godsend to us farmers. No matter how far from the city we live or what city is nearest you, radio connects you to cities thousands of miles away. It's almost unbelievable how fast wireless with electricity works when it carries the human voice or music 186,000 miles per second or nearly seven and one-half times around the world in just one second.

Five Preachers in a Box.

It comes faster than a flash, hits our antenna wire and the radio machine transforms and amplifies the original words or music. It does even greater things than that. Sunday evening, March 25, 1923, our machine had five different ministers cooped up in it at one time from five different cities. If we did not like one we tuned him out and tuned in another.

Yes, can you imagine that the radio machine you see in the picture gave us a sermon from a minister in Schenectady, New York, and in a second with a slight turn of the variable condenser we heard the minister preaching in Davenport, Iowa. This is given just as an example. It was storming, snowing and blowing and cold outside, hard and disagreeable to go to church for many on such nights; and then you only hear one minister, while the radio gave us five and we could have our choice right at home where it was warm.

Markets Immediately.

The air is now full of radio. You cannot see it. You cannot hear it. You cannot feel it. Yet it is sent out and is in the air everywhere. With a radio machine it's all yours, free of charge. We have listened to concerts that would cost $3.00 a seat but at home with the radio cost us nothing. We just picked them out of the air.

Live stock is sold in Chicago. A few minutes later we hear what they brought also how many cars of each and all the news around the yards.

The price of all the grains at the board of trade, vegetable markets of all kinds, everything on the commission row, even the price of sugar, and prices of all the different kinds of hay, weather forecast, latest news and many other things can be picked out of the air.

Radio gives us these markets and weather reports nearly twenty-four hours before our daily papers get them to us. We know more about our farming business than ever before. We are right in touch with the markets, weather, and outside world. Radio on the farm is really a godsend.

It has come to stay. It will keep thousands and thousands of girls and boys on the farm. It gives them the music, songs and talks of the bright lights in the city, and they can have their choice. Every night the air is full. Dixie land. My those darkies are spicey. The hundreds of talks and news given out over radio are short, snappy and very educational on hundreds of subjects.

You may ask what is the limit in distance of hearing things over a radio in Wisconsin. It's anywhere in the United States and parts of Canada. I'll prophesy they'll have radio machines for us farmers in the future so we can hear anything sent out anywhere over the world.

Ted Roush, of Highland County, O., also is a booster of farm radio. Read what he says in the following, published in Crosley's Weekly:

"We have had a radio in our home just one year. As farmers we would like to give our experience for the benefit of our brother farmers, who might not own one as yet, but who are somewhat interested.

"A year ago, after becoming interested in radio we decided to make our own set and were very successful.

"At first we made a detector set only, but later put on two stages of amplification and a horn. We can truthfully say, after one year, that we would not exchange our wireless set for the most expensive phonograph on the market, and by this I do not mean to run down the phonograph.

"Of course, at first we were much excited over our radio and listened to concerts, markets, sermons, lectures, etc., half of the night. But after the newness wore off, we just watched the programs and listened to the best of what we wanted.

Daily Programs.

"Now we go on at 10 o'clock every morning and get the markets and weather report; then at 12:30 again we hear the daily news flashes. If we want to get markets later, we can get them at one o'clock. There is hardly an hour during the day but what there is something going on, such as music, lectures, baseball and football reports. Any one interested in these games can hear them as played, i. e., they will tell how each player is working, what the excitement is and everything that transpires.

"During the harvest season we depended quite a bit on the weather fore cast. We did not get any hay wet and were very successful with our harvest, never cutting down with the promise of rain.

"At one time a neighbor called me on the phone and asked about the weather for the following day, and we informed him it was likely to rain. That night we got a heavy rainfall. On seeing him a few days later he said that he had hay down and did not know whether to cut down more or put up what he had

(*Continued on page* 26)

Use of Rubber for Radio Parts

THE unprecedented demand for radio instruments is indicated by statistics which show that during the past year the number of broadcasting stations increased from 80 to 581. The number of receiving instruments—in operation within a radius of 100 miles of New York City alone is said to be 500,000, serving a nightly radio audience of more than 2,000,000.

Radio experts are beginning to question the reliability of electrical characteristics based only upon direct current or comparatively low frequency alternating current measurements. Electrical tests made at the tremendously high frequencies of the average broadcast carrier wave require extremely sensitive instruments involving the use of insulating materials which permit the smallest possible electrical losses.

In the recent stage of development the tendency in construction of radio receiving instruments is improvement in quality and elimination of mere cheapness of part. Radio instrument building is stabilizing on quality, and therefore consideration is being given to the special dielectric characteristics of hard rubber as an insulating material of the best sets.

The superior insulating qualities of radio instrument parts was undisputed for years in the development of wireless communication. It still remains unsurpassed as an insulating material by any of the hard molded plastic compositions, the use of which in molded parts became enormous during the unprecedented rise of radio in popular interest. The principal reason for this seems to be the facility with which the phenolic resin compounds can be molded in highly finished pieces with or without metal inserts. Volume production, rather than absolute superiority of dielectric quality, is naturally the controlling factor from a manufacturing standpoint.

Radio Panels

Some hard rubber compounds are more suitable than others for radio insulations. In general, hard rubber compounds possess in a high degree those characteristics most necessary for insulating materials employed in making radio panels and such molded parts as dials, knobs, sockets, insulators, etc.

It is well known that high frequency currents are difficult to control, and consequently radio receiving apparatus is best when designed and made of materials which permit the smallest possible electrical losses.

Radio engineers have determined that there are four most important characteristics to be considered in panel or other insulating material. These are phase angle difference, dielectric constant resistivity, both volume and surface, and the tendency to absorb moisture.

Phase Difference

Phase difference is a property which expresses the heating of the material and at radio frequency largely determines the radio frequency voltages the material will stand without injury and power loss in insulating parts. It introduces resistance in the circuit and diminishes selectivity. The phase difference should be the lowest possible.

Dielectric Constant

Dielectric constant is an important factor in the material used in making the condenser. It determines the amount of alternating current which flows when an alternating voltage is impressed on the condenser. It also helps in determining how much the condenser heats and the high frequency voltage at which the insulating material is injured.

Resistivity.

Surface and volume resistivity determine the resistance to the passage of an electric current across the surface or through the insulation. The higher the resistivity the better the insulation.

Absorption of Moisture

Absorption of moisture has a most important effect on many of the electrical properties of the material, especially on phase difference and resistivity. Insulating material should therefore absorb no moisture and have a high surface finish to produce the best results throughout all seasons and in climates where humidity is a serious factor.

A hard rubber compound best suited for radio use, besides possessing these necessary electrical characteristics, must be nonporous, non-absorbent, permanent, easily, quickly and accurately molded and machined with ordinary tools without danger of chipping. It must also be low in free sulphur content, and the sulphur must be fixed in the compound so that it will not come to the surface or "bloom."

One of the most successful special compositions of hard rubber designed for radio panels is known as Radion. This material is produced with satin-like finish in black, brown and in a skilful representation of the grain of mahogany. This material ranks high in the four most important requirements for radio insulations.

The authoritative tests of Radion are as follows:

1. Low Phase Angle Difference.....0.5 to 0.6
2. Low Dielectric Constant.....3.9
3. High Resistivity (Megohms-cm).....1.0 x 10.8
4. Low Absorption of Moisture—
   In Air.....005% to .02%
   In Water.....08% to .11%

The results show phase difference of ½ dielectric constant of ½ and absorption of moisture of 1-14 of the same characteristics for phenolic and laminated phenolic materials.

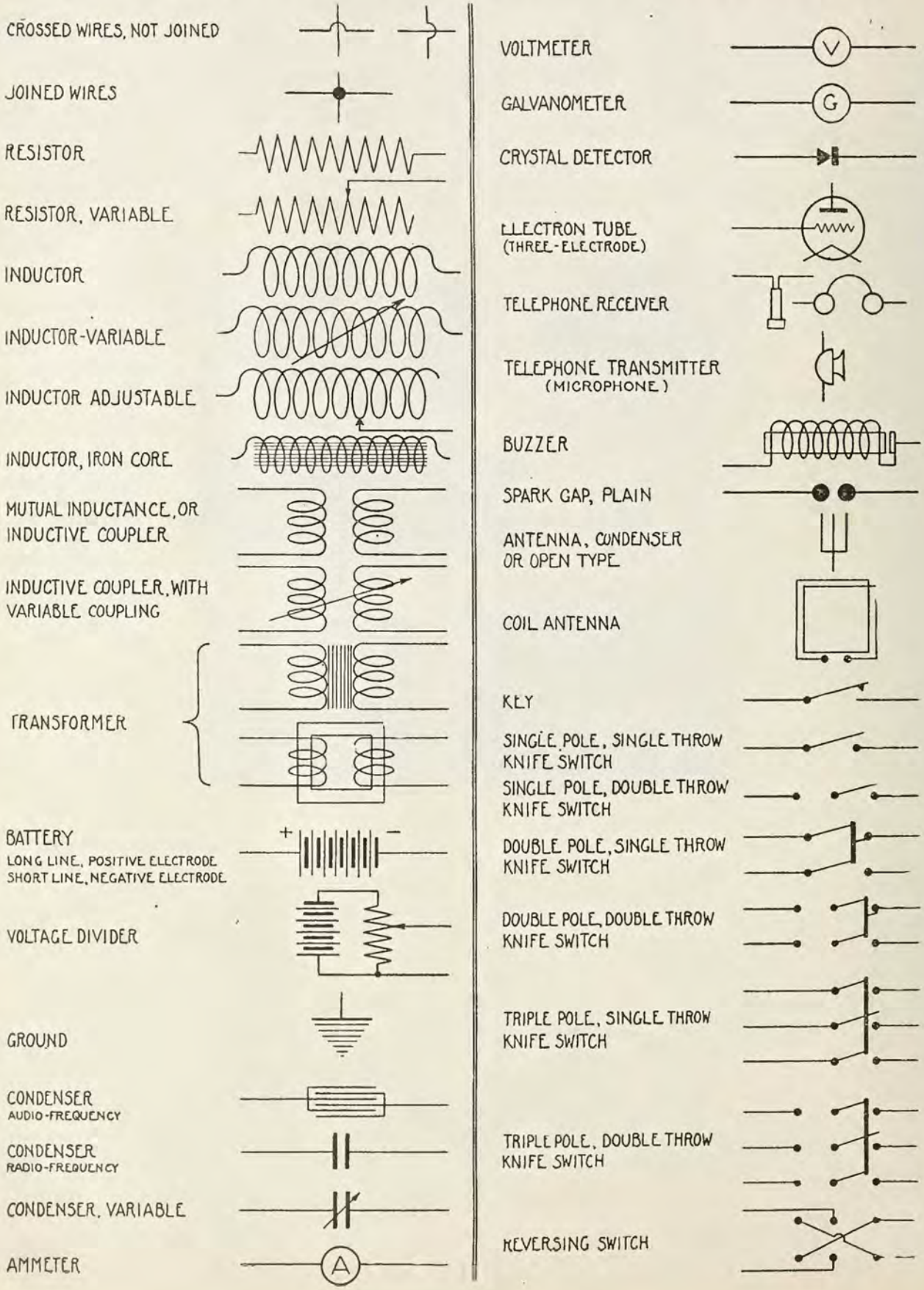
It is interesting to note that hard rubber sheet in the form of panels is practically only half the price of panels made of the various phenolic resin compositions either pure or composite. The reason is that in sheet form hard rubber is vulcanized in very large volume at each curing, therefore notwithstanding the fact that the time of vulcanizing may be several hours, the labor cost of the output is low considered either on a weight or volume basis.

The advantages of employing only the best insulating material in the construction of radio instrument parts is shown in the following quotation from a leading radio engineer:

"Current leakage between binding posts or other mounted metalic parts of

(*Continued on page 30*)

Symbols Used in Radio Age Diagrams



An Army in Field Depends Upon Radio

By CARL H. BUTMAN

WASHINGTON, D. C.—Efficient communication in the Army is coming more and more to depend upon radio, and in order to keep abreast of its rapid development, the Signal Corps of the U. S. Army maintains a complete radio research laboratory at Camp Alfred Vail, N. J. At this modern laboratory, the development of new and special apparatus for the several arms of the service is planned and perfected. A number of America's foremost radio engineers there are engaged upon radio problems. A radio school for military students is also conducted at Camp Vail, where men from the different corps are trained as experts.

Functions of the Signal Corps do not comprise radio communication solely, but include all means of signaling running from visual, through the pigeon service, line telegraphy, cables, telephone work including field service to the latest methods of radio communication. The Signal Corps also includes a meteorological and electric time services.

In the time of war, a Signal Officer pointed out recently, victory or defeat has sometimes hung upon the transmission of a single message, and the importance of communication is so great that no engagement can be successful without a well-planned system of communication. In the Army, efficient communication systems are maintained in time of peace as well as war. This makes it necessary for the Signal Corps to keep up-to-date, and, when possible, to be a little ahead of the times. Many commercial devices and systems now used were originated in the Signal Corps for military use long ago.

The Army Radio Net.

Today a network of radio stations extends to all quarters of the country, with a message center in Washington. High powered stations carry dispatches from coast to coast in record time, and no military command is out of touch with Washington for an appreciable length of time.

The installation of a system of modern, one and one-half kilowatt vacuum-tube stations connecting all centers of military activity has been practically completed. For the trans-continental circuit, stations have been established at New York, Washington, Indianapolis, Omaha, Salt Lake City and San Francisco, with one nearing completion at Cheyenne. Similar stations have also been installed at Atlanta and St. Louis. In addition, all the important Flying Fields will soon be connected with the radio system. Most of the big stations are equipped with remote control apparatus permitting operation of a transmitter at some distance and the reception of incoming messages by loops and six stage radio-frequency amplifiers in the main offices. Communication is maintained through these sets by means of the continuous wave telegraphy method but the stations are also equipped for radio telephone and buzzer, modulated radio telegraphy.

Field Operations

The importance of radio to an Army in the field was shown during the operations of the First American Army in the Meuse-Argonne battle, when six hundred radio receiving sets were used for receiving airplane reports alone. The operation and maintenance of these receiving sets required the services of about five thousand radio specialists, most of them recruited from the ranks of American amateurs at the outset of the war.

Radio for communication between infantry regiments and battalions is the most important link in action. Front line wired telephone and telegraph communication is constantly interrupted by shell fire and bombs. Farther to the rear, wire communication is more dependable, and there radio becomes more of an auxiliary service.

With the exception of brigade to regiment communication, which is spark radio, all ground radio within an American field army is of the vacuum-tube or continuous-wave type.

In army corps headquarters, as well as large artillery and air units, powerful vacuum-tube sets installed on tractors are employed. Divisions and regimental units in the field are equipped with compact chest-type tube sets. In advanced posts, "V"-shaped antenna supported by 20 feet bamboo poles are used. Battalion and regimental communication is handled on the small portable SCR-77 loop set, using tubes for both transmission and reception. Special portable sets have also been made up for cavalry, which are good for them 60 to 500 miles and are transported by mules.

Supervision in Samoa

Although the radio regulations for New Zealand have been extended to apply to Samoa, it is reported that more latitude is given the amateurs, and that an effort to regulate broadcasting stations is being made before interference begins. Samoa is designated as the fifth New Zealand radio district with the officer in charge of the Apia radio station as inspector of local reception and transmission.

Except that it is necessary to secure a license and pay a small license fee, amateurs are unrestricted in radio reception, but licenses are not to be issued for circuits which cause interference. Amateur transmitting stations in Grade I require the supervision of a licensed operator and are assigned on wave lengths between 150 meters and 180 meters, the power being limited to 50 watts. Grade II operators are restricted to a 140 meter wave, and five watts in power. All amateur transmission is prohibited between 7 and 8 p. m.

Welcome, WJAZ

Probably the most picturesquely located high power broadcasting station in the United States is the new station installed by E. F. McDonald of the Chicago Radio Laboratories in the Edgewater Beach hotel, Chicago. The studio and operating room are enclosed in triple plate glass in richly appointed chambers off the Marine dining room of the hotel on the main floor. The operator of the studio may be observed by those in the dining room.

On the east side the waves of Lake Michigan roll up to within a few feet of the foundation of the building.

The studio is draped in cherry-red velvet and is not only perfectly soundproof but is an outstanding example of the modern trend toward elegance in appointment and decoration.

Mr. McDonald is to be congratulated on having installed such a station in so central a location. The formal opening of the station on Saturday night, May 12, was an occasion that interested radio and musical circles generally.

The modulation acquired by the operators of the station was instantly acclaimed as approaching perfection. Mr. McDonald also indicated a fine discrimination in the selection of his musical numbers. Those who have been listening in on WJAZ are expressing the belief that the station will be accepted as the standard of excellent transmission and of quality entertainment, at least in the Middle West.

With such equipment and with such a favorable impression already established on music lovers it is expected that the station will carefully avoid those advertising stunts which certain other stations have used to boost receiving sets, automobile bumpers, and what not.

590 Stations

Washington, D. C.—The process of allocating new wave lengths and reclassifying radio broadcasting stations is a slow one. Department of Commerce Radio officials have announced they would issue a complete list of the three classes stations with their wave lengths until about May 15, when the Class B stations started operating on their exclusive national waves.

On May 4, there was a total of 590 broadcasting stations, including 32A, 32B and 528 C stations. During the last month 23 new stations were licensed, ten were transferred from Class C on 360 meters to Class A, and 14 were dropped from the Department's lists.

Sixteen new stations in eleven different states were licensed during the past week, among them were two churches, two colleges, a high school, a military unit and a newspaper.

Complete Corrected List of U. S. and Canadian Broadcasting Stations

Complete Each Issue

THE list of broadcasting stations on these pages is brought up to date each month by additions of new stations and deletion of those which have suspended operation. The list is the product of a vast volume of correspondence and its completeness is due in large measure to the assistance of our special news service in Washington, D. C. Suggestions, corrections and additional data will be welcomed from readers. Broadcasters: Send in your program schedules.

Wave lengths assigned to stations by the Department of Commerce, so far as the announced, will be found in a table on another page.

1XAD, Pawtucket, R. I. 1000 miles; Special license experimental; Standard Radio & Electric Co.
KDKA, E. Pittsburg, Pa.; Class B station Westinghouse Elec. & Mfg Co.
KDN, San Francisco, Calif.; Leo J. Meyberg Co.
KDOW, Steamship America, New York.
KDPM, Cleveland, Ohio; Westinghouse Elec. & Mfg. Co.
KDPT, San Diego, Calif.; Southern Elec. Co.
KDYL, Salt Lake City, Utah; news music, entertainment, Telegram Publishing Co.
KDYM, San Diego, Calif.; Savoy Theatre.
KDYQ, Portland, Ore.; Oregon Inst. Technology.
KDYS, Great Falls, Mont.; Class B, Great Falls Tribune.
KDYW, Phoenix, Arizona; Smith Hughes & Co.
KDYX, Honolulu, T. H; 12:15 to 1:15 p. m., stock reports and weather; 6:30 to 7:30 p. m., music, lectures; Sunday, 11 a. m. to 12:30 p. m., sermons; Honolulu Star-Bulletin, Ltd.
KDZB, Bakersfield, Calif.; Frank E. Seiffert.
KDZE, Seattle, Wash.; Rhodes Co.
KDZF, Los Angeles, Calif.; Automobile Club of Southern California.
KDZG, San Francisco, Calif.; Cyrus Pierce & Co.
KDZH, Fresno, Calif.; Fresno Evening Herald, Class B.
KDZI, Wenatchee, Wash.; Electric Supply Co.
KDZK, Reno, Nev. Wednesday 8 to 9 p m; Friday 8 to 9 p m. Musical and news features; Nevada State Journal, Nevada Machinery & Electric Co.
KDZQ, Denver, Colo. Pyle & Nichols, 1247 Broadway.
KDZR, Bellingham, Wash; 261 meters, 50 watts; Bellingham Pub. Co.
KDZX, San Francisco, Calif.; Glad Tidings Tabernacle.
KFAD, Phoenix Ariz.; Class B, McArthur Bros. Mercantile Co.
KFAE, Pullman, Wash.; State College of Washington.
KFAF, Denver, Colorado; George S. Walker, Western Radio Corporation; musical programs, news items, etc., daily except Tuesday and Sunday, 8 to 9 p m; mountain standard time.
KFAJ, Boulder, Colo.; University of Colorado.
KFAN, Moscow, Idaho; Electric Shop.
KFAP, Butte, Mont.; Standard Pub. Co.
KFAQ, San Jose, Calif.; City of San Jose.
KFAR, Hollywood, Calif.; Studio Lighting Service Co.
KFAT, Eugene, Ore. Monday, Wednesday and Saturday 8 to 9 p m Music; Sunday 8:30 to 9:15 Church Services; Pacific Radio Co.
KFAU, Boise, Idaho; Class B, Boise High School.
KFAV, Venice, Calif.; Abbott Kinney Co.
KFAW, Santa Anna, Calif.; Class B, Radio Den.
KFAY, Central Point, Ore.; W. J. Virgin Milling Co.
KFAZ, Reddley, Calif., C. H. Weatberll.
KFBB, Havre, Mont.; F. A. Buttrey & Co.
KFBC, San Diego, Calif.; W. K. Azbill.
KFBD, Hanford, Calif.; California Radio Lab.
KFBE, San Louis Obispo, Calif.; R. H. Horn.
KFBG, Tacoma, Wash.; First Presbyterian Church.
KFBH, Marshfield, Ore.; Thomas Musical Co.
KFBK, Sacramento, Calif., 2,000 miles; daily, 3 to 4 p m and 6 to 6:30 p m; Sunday and Thursday 8 to 9 p m; Kimball-Upson Co. and Sacramento Union.
KFBL, Everett, Wash.; Leese Bros.
KFBU, Laramie, Wyo.; N. S. Thomas.
KFBC, Phoenix, Ariz.; Nielson Radio Supply Co.
KFCD, Salem, Ore.; F. S. Bartin.
KFCF, Walla Walla, Wash.; Frank A. Moore.
KFCH, Billings, Mont.; Elec. Service Station.
KFCK, Colorado Springs, Colo.; Colorado Springs Radio Co
KFCL, Los Angeles, Calif.; Los Angeles Union Stock Yards.
KFCM, Richmond, Calif., Richmond Radio Shop.
KFCQ, Casper, Wyo.; Motor Service Station.
KFCP, Ogden, Utah, Ralph W. Flygare.
KFCV, Houston, Tex., Fred Mahaffey, Jr.
KFCY, Le Mars, Ia.; Western Union College.
KFCZ, Omaha, Nebr.; Omaha Central High School.
KFDA, Baker, Ore.; Adler's Music Store.
KFDB, San Francisco, Calif.; Mercantile Trust Co.
KFDD, Boise, Idaho; St. Michael's Cathedral.
KFDO, Bozeman, Mont.; Everett H. Cutting.
KFDP, Des Moines, Ia.; Hawkeye Radio & Supply Co.
KFDS, San Francisco, Calif.; John D. McKee.
KFDU, Lincoln, Nebr.; Nebraska Radio Electric Co.
KFDV, Fayetteville, Ark.; Gilbreeb & Stinson.
KFDY, Brookings, S. D.; South Dakota State College of Agriculture and Mechanical Arts.
KFDL, Denver, Colo.; Knight Campbell Music Co.
KFDJ, Corvallis, Ore.; Oregon Agri. College.
KFDC, Spokane, Wash.; Radio Supply Co.
KFDF, Casper, Wyo.; Wyoming Radio Corp.
KFDR, York, Nebraska; Bullock's Hardware & Sporting Goods.
KFDX, Shreveport, La.; First Baptist Church.
KFDZ, Minneapolis, Minn.; Harry O. Iverson.
KFEB, Taft, Calif.; City of Taft.
KFEC, Portland, Ore.; Meier & Frank Co.
KFEJ, Tacoma, Wash.; Guy Greason.
KFEL, Denver, Colo., Winner Radio Corp.
KFEP, Denver, Colo., Radio Equipment Co.
KFEQ, Oak Nebraska; J. L. Scroggin.
KFEQ, Oak, Nebraska; J. L. Scroggin.
KFER, Ft. Dodge, Iowa; 231 meters, 10 watts; Auto Electric Service Co.
KFEV, Douglas, Wyo.; Entertainment and weather; Radio Electric Shop.
KFEX, Minneapolis, Minn; 261 meters, 100 watts Augsburg Seminary.
KFEY, Kellogg, Idaho; Bunker Hill & Sullivan Mining & Construction Co.
KFFZ, Dallas, Texas; 226 meters, 20 watts; A. G. Barnes Amusement Co.
KFEZ, St. Louis, Mo.; American Society of Mechanical Engineers.
KFFA, San Diego, Calif.; Dr. R. C. Shelton.
KFFE, Pendleton, Ore.; Eastern Oregon Radio Co.
KFFO, Hillsboro, Oregon; Dr. E. H. Smith.
KFFP, Moberly, Missouri; First Baptist Church.
KFFQ, Colorado Springs, Colo., Marksheffel Motor Co.
KFFR, Sparks, Nev.; Jim Kirk.
KFFV, Lamoni, Iowa; Graceland College.
KFFX, Omaha, Neb; 278 meters, 250 watts; The McGraw Co.
KFFY, Alexandria, La; 275 meters; 100 watts; Pincus & Murphy Inc.
KFGB, Pueble, Co., Loewenthal Bro.
KFGC, Baton Rouge, La; 254 meters, 100 watts; Louisiana State University.
KFGD, Chickasha, Okla.; 248 meters, 20 watts; Chickasha Radio & Elect. Co.
KFGF, Mt. Vernon, Wash.; Buchanan, Stevens & Co.
KFGH, Stanford Univ., Calif.
KFGJ, St. Louis, Mo.; 266 meters, 100 watts; Nat'l Guards Missouri 138 Infantry.
KFGL, Arlington, Oregon; Arlington Garage.
KFGM, Abilene, Texas; 233 meters, 100 watts; Abilene Daily Reporter.
KFGP, Cheney, Kansas; 229 meters, 10 watts; Cheney Radio Company.
KFHA, Gunnison, Colo.; Colorado State Normal School.
KFHB, Hood River, Oregon; P. L. Boardwell.
KFHC, Norman, Oklahoma; 254 meters, 10 watts; University of Oklahoma.
KFHD, St. Joseph, Mo.; 226 meters, 10 watts; Utz Electric Co.
KFHF, Shreveport, La 266 metere, 150 watts; Central Christian Church.
KFGQ, Boone, Iowa; 226 meters, 20 watts; Crary Hardware Co.
KFGZ, Berrien Springs, Mich; 268 meters, 10 watts; Emmanuel Missionary College.
KFGX, Orange, Texas; 250 meters; 500 watts; First Presbyterian Church.
KFGY, Baudette, Minn; 224 meters, 15 watts; Gjelhayg's Radio Shop.
KFHH, Neah Bay, Wash.; Ambrose McCue.
KFHI, Wichita, Kansas; 224 meters, 20 watts; Charles V. Dixon.
KFHJ, Santa Barbara, Calif., Fallon Co.
KFID, Iola, Kansas, 246 meters, 20 watts; Ross Arbuckle's Garage.
KFHL, Oskaloosa, Ia.; 227 meters, 10 watts; Penn College.
KFIQ, Yakima, Wash.; 224 meters, 50 watts; Yakima Valley Radio Broadcasting Association.
KFHR, Seattle, Wash.; Star Electric & Radio Co, Paul Franklin Johnson, Altadena Radio Lab.
KFI, Los Angeles, Calif.; radius covers entire U. S. and Canada; Daily, 6:45 to 11 p. m. Sunday 10 to 11 a. m., 4 to 4:30 and 8 to 11 p. m.; entertainment and educational features; station operates three remote control stations; Earle C. Anthony, Inc.
KFIB, St. Louis, Mo.; 214 meters, 10 watts; Franklin W. Jenkins.
KFIF, Portland, Ore.; Benson Tech. Student Body.
KFIC, Denver, Colorado; 224 meters, 15 watts; Philip Laskowitz.
KFIU, Gridley, Calif.; The Precision Shop.
KFV, Yakima, Wash.; Foster-Bradbury Radio Store.
KFZ, Spokane, Wash.; Doerr-Mitchell Elec. Co.
KGB, Tacoma, Wash., Sunday: 5 to 7:30; Daily: 7 to 9 p. m. (except Thursday) News, Sport bulletins, lectures, entertainment, weather, tide tables, bedtime stories, time, etc.; Tacoma Daily Ledger station operated by the William A. Mullins Electric Co.
KGG, Portland, Ore.; Hallock & Watson Radio Service.
KGN, Portland, Ore.; Northwestern Radio Mfg. Co.
KGO, Altadena, Cal. 2500 miles; every Saturday 8 to 9:30 p m Musical program;
KGU, Honolulu, Hawaii, Waikiki Beach, Marion A. Mulroney; Honolulu Advertiser
KGW, Portland, Ore.; Oregonian Pub. Co.
KGY, Lacey, Wash.; St. Martin's College, (Rev. S. Ruth).
KHJ, Los Angeles, Calif.; Daily except Sunday: 12:30 p. m. to 1:15 p. m. news and concerts; 7 to 7:30 p. m. Children's Half Hour; 8 to 9:30 p. m. De Luxe program of music, news and educational features; Sunday: 10 to 11 a. m. Scripture reading, sermon, prayer and sacred musical program; Pacific time; Times-Mirror company.
KHQ, Seattle, Wash.; Louis Wasmer.
KIJ, Sunnyside, Calif.; The Radio Shop.
KJQ, Stockton, Calif.; C. O. Gould.
KJS, Los Angeles, Calif.; Bible Inst. of Los Angeles.
KLB, Pasadena, Calif.; J. J. Dunn & Co.
KFDH, Tucson, Ariz.; Univ. of Arizona.
KLS, Oakland, Calif.; Warner Bros.
KLX, Oakland, Calif.; Tribune Pub. Co.
KLZ, Denver, Colo.; Class B, 485, Reynolds Radio Co.
KMAZ, Macon, Ga., Mercer University.
KMC, Reedley, Calif.; Lindsay-Wetherill Co.
KMJ, Fresno, Calif. Max. 2576 Miles; Musical program, San Joaquin Light & Power Corp.
KMO, Tacoma, Wash., Love Electric Co.; Tacoma Times.
KNI, Eureka, Calif.; T. W. Smith.
KNJ, Roswell, New Mexico; 1000 miles; Every evening at 8; news, weather reports, stock market, concerts and sermons; Roswell Public Service Co.
KNN, Los Angeles, Calif.; Bullocks.
KNT, Aberdeen, Wash.; North Coast Products Co.
KNV, Los Angeles, Calif.; Radio Supply Co.
KNX Los Angeles, Calif.; Electric Lighting Supply Co.
KOA, Denver, Colo.; Y. M. C. A.
KOB, State College, N. Mex.; time signals and weather reports 12 noon and 10: p m, mountain time; music and lectures Monday, Wednesday and Friday, 7:30 to 8:30 p m; New Mexico College of Agriculture and Mechanical Arts.
KOE, Spokane, Wash.; Spokane Chronicle.
KOP, Detroit, Mich., Detroit Police Dept.
KOQ, Modesto, Calif., Modesto Evening News.
KPO, San Francisco, Calif., Hale Bros.
KQI, Berkeley, Calif., Univ. of California.
KQP, Hood River, Oregon; Apple City Radio Club.
KQV, Pitteburgh, Pa., Doubleday-Hill Elec. Co.
KQW, San Jose, Calif., Chas. D. Herrold.
KQY, Portland, Ore; 1,000 miles, Monday, Tuesday, Saturday, 9 to 10 p m; Wednesday, Thursday, Friday, 6 to 7 p m; Stubbs Electric Co.
KRE, Berkeley, Calif., Maxwell Electric Co.
DSC, San Jose, Calif., O. A. Hale & Co.
KSD, St. Louis, Mo.; 1700 miles; grain, livestock, cotton, New York stocks, poultry and butter market, metal market, official weather and news at 9:40, 10:40, 11:40, 12:40, 1:40, 2:40 and 4 p m; 8: p m 400 meters, musical and other features; Pulitzer Publishing Co., St. Louis Post Dispatch.
KSL, San Francisco, Calif., The Emporium.
K8S, Long Beach, Calif., Prest & Dean Radio Research Lab.
KSU, Wenatchee, Wash.
KTW, Seattle, Wash., First Presbyterian Church.
KUO, San Francisco, Calif., Examiner Printing Co., San Fran. Examiner.
KUS, Los Angeles, Cal. 500 miles; setting up exercises daily, 7 to 7:30 a m and 12:00 noon to 12:30 p m; concert, 65 voices, 6 to 6:45 p m, Wednesdays and Fridays; City Dye Works.
KUY, Del Monte Calif., Coast Radio Co.
KWG, Stockton, Cal. Daily Market reports, music and news 4 to 5 p m; Music, 2 to 3 p m, Sunday; Tuesdays and Fridays, music, 8 to 9 p m. Portable Wireless Telephone Co.
KWH, Los Angeles, Calif., Los Angeles Examiner.
KXD, Modesto, Calif., Herald Publishing Co.
KYI, Bakersfield, Calif., Alfred Harrell.
KYJ, Los Angeles, Calif., Leo J. Meyberg Co.
KYQ, Honolulu, T. H., The Electric Shop.
KYW, Chicago, Ill.; Westinghouse Elec. & Mfg. Co. 345 meters.
KZM, Oakland, Calif., Western Radio Inst.; Preston D. Allen
KZN, Salt Lake City, Utah, The Deseret News.
KZV, Wenatchee, Wash., Wenatchee Battery & Motor Co
NOF, Anacostia, D. C., U. S. Navy Dept.
PWX, Havana, Cuba, Cuban Telephone Co.
WABD, Dayton, Ohio; 286 meters, 10 watts; Parker High School.
WAI, Dayton, Ohio, McCook Field, U. S. Army.
WAAB, New Orleans, La., Valdemar Jensen.
WAAC, New Orleans, La., Tulane Univ.
WAAD, Cincinnati, Ohio, Ohio Mechanics Inst.
WAAF, Chicago, Ill., Chicago Daily Drovers Journal.

Complete Corrected List of U. S. and Canadian Broadcasting Stations

WAAE, St. Louis, Mo., St. Louis Chamber of Commerce.
WAAH, St. Paul, Minn.; Commonwealth Electric Co.
WAAJ, Boston, Mass., Eastern Radio Inst.
WAAK, Milwaukee, Wis., Gimbel Bros.
WAAL, Minneapolis, Minn., Minnesota Tribune Co. & Anderson-Beamish Co.
WAAM, Newark, N. J. 200 miles; musical and code, every week day 11 to 11:55 a m, 3 to 4 p m; Wednesday evenings 8 to 9; I. R. Nelson Company.
WAAN, Columbia, Mo., Univ. of Missouri.
WAAP, Wichita, Kans., United Elec. Co.; Otto W. Taylor.
WAAQ, Greenwich, Conn., New England Motor Sales Co.
WAAS, Decatur, Ga., Georgia Radio Co.
WAAT, Jersey City, N. J., Jersey Review.
WAAW, Omaha, Neb., Omaha Grain Exchange.
WAAY, Youngstown, Ohio, Yohrling Rayner Music Co.
WAAZ, Emporia, Kans.; Daylite 100 miles; nite 500-1000 miles; each Tuesday and Thursday from 7 to 8 p m. Acknowledge all communications at 7:15 p m. The Hollister Miller Motor Co.
WABA, Lake Forest, Ill; 266 meters, 100 watts; Lake Forest College.
WABB, Harrisburg, Pa; 266 meters, 10 watts; Dr. John B. Lawrence.
WABC, Anderson, Ind; 299 meters, 10 watts, Fulwider-Grimes Battery Co.
WABD, Dayton, Ohio; 286 meters, 10 watts; Parker High School.
WABE, Washington, D. C; 283 meters, 50 watts; Y. M. C. A.
WABF, Mt. Vernon, Ill; 234 meters, 250 watts; Mt. Vernon Register-News Co.
WAGB, Jacksonville, Fla; 248 meters, 10 watts; Arnold Edwards Piano Co.
WAJT, Marshall, Mo., Kelly-Vawter Jewelry Co.
WAJU, Yankton, S. D., Yankton College.
WABH, Sandusky, Ohio; 234 meters, 100 watts; Lake Shore Tire Co.
WBAA, W. Lafayette, Ind., Purdue University.
WBAD, Minneapolis, Minn., Sterling Elec. Co. & Journal Printing Co.
WBAE, Peoria, Ill., Bradley Polytechnic Inst.
WBAF, Moorestown, N. J., Fred M. Middleton.
WBAG, Bridgeport, Pa., Diamond State Fibre Co
WBAM, New Orleans, La., I. B. Rennyson.
WBAN, Paterson, N. J., Wireless Phone Corp.
WBAD, Decatur, Ill.; 100 miles; occasional music; sermons; James Millikin Univ.
WBAP, Fort Worth, Tex.; 4000 miles; Markets and News; Feature concert Monday to Friday inclusive; 9:30 p m to 10:45 p m, Central Time; Quiet nights Saturday and Sunday. The Star-Telegram.
WBAQ, South Bend, Ind., Myron L. Harmon.
WBAU, Hamilton, Ohio, Republican Publishing Co.
WBAV, Columbus, Ohio, Erner & Hopkins Co.
WBAW, Marietta, Ohio, Marietta College.
WBAX, Wilkes-Barre, Pa., John H. Stenger, Jr.
WBBA, Newark, O.; 240 meter, 20 watts; Newark Radio Lab.
WBBC, Sterling, Ill; 229 meter, 50 watts; Sterling Radio Equipment Co.
WBL, Anthony, Kans., T. & H. Radio Co.
WBS, Newark, N. J.; Radius 500 mi.; Musical and Educational, week days: 10:30 to 11 a. m.; 1:00 to 1:15 p. m.; 2:15 to 2:30 p. m.; 7:30 to 8:30 p. m.; Sundays, 9 to 10:30 a m; 1 to 3 p m; D. W. May, Inc.
WBT, Charlotte, N. C. 1200 miles; 11: a m weather report 485; 4:30 p m mechanical music; 8: p m Market Report; 8:30 Tuesday and Friday regular concert; 7:30 p m Sunday, Church Southern Radio Corp.
WBU, Chicago, Ill., City of Chicago.
WBZ, Springfield, Mass., Westinghouse Elec. & Mfg. Co.
WCAB, Newburgh, N. Y., Newburgh Daily News; Newburgh News Printing & Pub. Co
WCAC, Fort Smith, Ark., John Fink Jewelry Co.
WCAD, Canton, N. Y., St. Lawrence University.
WCAE, Pittsburgh, Pa.; 12:30 news and reports; 3:30 weatehr reports; 4:15 Closing Market reports; 7:30 Late news and lecture; 8:30 musical programs; Kaufmann Baer Co.
WCAG, New Orleans, La., Daily States Pub. Co.
WCAH, Columbus, O. Daily program 11:30 to 12:30; Every Tuesday evening at 7. musical program; C. A. Entrekin Electric Co.
WCAI, San Antonio, Texas, Southern Equipment Co.
WCAJ, Univ. Place, Neb., Nebraska Wesleyan University.
WCAK, Houston, Texas, Alfred P. Daniel.
WCAL, Northfield, Minn., St. Olaf College.
WCAM, Villanova, Pa., Villanova College.
WCAD, Baltimore, Md., Sanders & Stayman Co.
WCAR, San Antonio, Texas, Alamo Radio Elec. Co.
WCAS, Minneapolis, Minn., Wm. H. Dunwoody Industrial Inst.
WCAT, Rapid City, S. Dak., South Dakota School of Mines.
WCAU, Philadelphia, Pa.; 1000 miles; Daily 10:30 a. m.; 2:30 p. m.; 6:30 p m; regular concert 10 to 12 noon; Tuesdays, Fridays, Saturdays; Durham & Co., Inc.
WCAV, Little Rock, Ark., J. C. Dice Elec. Co.
WCAW, Omaha, Nebr., Woodmen of the World.
WCAX, Burlington, Vermont, University of Vermont.
WCAY, Milwaukee, Wis., Kesselman O'Driscoll Co
WCBB, Greenville, O.; 240 meters, 100 watts; K. & K. Radio Supply Co.
WCE, Minneapolis, Minn., Findley Elec. Co.
WCK, St. Louis, Mo., Stix Baer & Fuller.
WCM, Austin, Texas, Univ. of Texas.
WCN, Worcester, Mass., Clark University.
WCX, Detroit, Mich., Detroit Free Press.
WDAC, Springfield, Ill., Ill Watch Co.
WDAD, Lindsburg, Kas.; Central Kansas Radio Supply.
WDAE, Tampa, Fla., Tampa Daily News.
WDAF, Kansas City, Mo., also Kansas City Star.
WDAG, Amarillo, Texas, K. Laurence Martin.
WDAG, Brownsville, Pa., Hartman-Riker Elec. & Mach.Co.
WDAH, ElPaso, Tex.; Trinity Methodist Church.
WDAI, Syracuse, N. Y., Hughes Electrical Corp.
WDAJ, College Park, Ga., Atlanta & West Point R. R. Co.
WDAK, Hartford, Conn., Hartford Courant.
WDAL, Jacksonville, Fla., Florida Times Union.
WDAO, Dallas, Texas, Automotive Elec. Co.
WDAP, Chicago, Ill., markets, and concerts 360; Daily on all business days: 9:30 a. m. receipts and shipments; estimated car lots; local weather report; opening futures market in wheat, corn, oats, rye, barley, pork, lard and ribs. 10 a. m. Future quotations, live stock receipts and prices; 10:30 a. m. futures quotations; 11 and 11:30 a m. same; 12 noon, futures and cash grain prices; 12:30 and 1 p. m. futures quotations; 1:20 p. m. closing futures quotations and high and low for day. Cash grain prices. Gross bids for cash grain to arrive. 6 p. m. closing quotations; news items. On Saturdays closing prices at 12:05 p. m. instead of 1:20 p. m. Visible supply changes sent when posted. Regular concert schedule 10 p. m. Tuesdays, Thursdays and Saturdays. Sunday evenings 9 p. m. and 10 p. m. Chicago Board of Trade official station.
WDAR, Philadelphia, Pa.; Lit Brothers.
WDAS, Worcester, Mass., Samuel A. Waite.
WDAU, New Bedford, Mass., Slocum & Kilburn.
WDAX, Centerville, Iowa, First Nat'l Bank.
WDAY, Fargo, N. D.; 244 meters, 50 watts; Fargo Radio Service Co.
WDM, Washington, D. C., Church of the Covenant.
WDT, New York, N. Y., Ship Owners Radio Service.
WDZ, Tuscola, Ill., James L. Bush.
WEAA, Flint, Mich., Fallain & Lathrop.
WEAB, Fort Dodge, Iowa, Standard Radio Equip. Co
WEAD, Atwood, Kans., Northwest Kansas Radio Supply Co.
WEAE, Blacksburg, Va., Virginia Polytechnic Inst.
WEAF, New York City, N. Y., Western Electric Co.
WEAG, Edgewood, R. I., Nichols-Hineline-Bassett Lab.
WEAH, Wichita, Kans., Wichita Board of Trade and Lander Radio Co
WEAI, Ithaca, N. Y., Cornell University.
WEAJ, Vermilion, S. Dak., University of South Dakota.
WEAK, St. Joseph, Mo., Julius B. Abercrombie.
WEAM, North Plainfield, N. J., Borough of N. Plainfield.
WEAN, Providence, R. I., The Shepard Co.
WEAO, Columbus, Ohio, Ohio State University.
WEAP, Mobile, Ala., Mobile Radio Co.
WEAQ, Berlin, N. H., Y. M. C. A.
WEAT, Tampa, Fla., John J. Fogarty.
WEAU, Sioux City, Iowa, Davidson Bros. Co.
WEAV, Rushville, Nebr., Sheridan Elec. Service Co
WEAX, Little Rock, Ark., T. J. M. Daly.
WEAY, Houston, Texas, Will Horwitz, Jr.
WEAZ, Waterloo, Iowa, Donald Redmond.
WEB, St. Louis, Mo., The Benwood Co., Inc.
WEH, Tulsa, Okla., Midland Refining Co.
WEV, Houston, Texas, Hurlburt-Still Elec. Co.
WEW, St. Louis, Mo., St. Louis Univ.
WEW, St. Louis, Mo., Market and weather reports at 9 a. m., 10 a. m., and 2: p m; no other regular program; St. Louis University.
WEY, Wichita, Kansas, Cosradio Co.
WFAA, Dallas, Texas. A. H. Belo & Co.
WFAW, Miami, Fla., 1500 miles; 7:30 to 9 p. m. concerts including Arthur Pryor's Band evenings and W. J. Bryan Sunday School, Sunday a m; Miami Daily Metropolis & Electrical Equipment Co.
WFAB, Syracuse, N. Y., C. F. Woese.
WFAC, Superior, Wis., Superior Radio Co.
WFAF, Poughkeepsie, N. Y., H. C. Spratley Radio Co.
WFAQ, Waterford, N. Y., Radio Engineering Lab.
WFAH, Port Arthur, Texas, Elec. Supply Co.
WFAJ, Asheville, N. C., Hi-Grade Wireless Instrument Co.
WFAK, Brentwood, Mo., Domestic Electric Co.
WFAM, St. Cloud, Minn., Granite City Elec. Co. and Times Pub. Co.
WFAN, Hutchinson, Minn., Hutchinson Electric Service Co.
WFAQ, Cameron, Mo., Cameron Radio Co. and Mo. Wesleyan College
WFAT, Sioux Falls, S. Dak.; also Argus-Leader.
WFAU, Boston, Mass., Edwin C. Lewis.
WFAV, Lincoln, Nebr., Univ. of Nebr. Dept. of Elec. Engineering.
WFAZ, Charleston, S. Carolina, S. C. Radio Shop
WFI, Philadelphia, Penn., also Strawbridge & Clothier.
WGAC, Brooklyn, N. Y., Orpheum Radio Stores Co.
WGAD, Ensenada, Porto Rico, Spanish-American School of Radio-telegraphy
WGF, Des Moines, Iowa 300 miles; Musical and entertainment Tuesday and Friday 7:30 p m; Church Services Sunday at 5 p m or 7:45 p m as announced; Special programs as announced Register and Tribune.
WGAH, New Haven, Conn., New Haven Elec. Co.
WGAJ, Shenandoah, Iowa, W. H. Gass.
WGAL, Lancaster, Pa., Lancaster Elec. Supply & Construction Co.
WGAM, Orangeburg, S. C., Orangeburg Radio Equip. Co.
WGAN, Pensacola, Fla., Cecil E. Lloyd.
WGAQ, Shreveport, La., Glenwood Radio Corp.
WGAR, Fort Smith, Ark., Southwest American.
WGAU, Wooster, Ohio; 226 meters, 20 watts; Marcus G. Limb.
WGAV, Savannah, Ga., B-H Radio Co.
WGAW, Altoona, Pa., Ernest C. Albright.
WGAX, Washington Court House, Ohio, Ohio Radio Elec. Co.
WGAY, Madison, Wis., North Western Radio Co.
WGAZ, South Bend, Ind., South Bend Tribune.
WGI, Medford Hillside, Mass., Am. Radio & Research Corp.
WGL, Philadelphia, Pa., Thos. F. J. Howlett.
WGM, Atlanta, Ga., Atlanta Constitution.
WGR, Buffalo, N. Y., Federal Tel. & Teleg. Co.
WGV, New Orleans, La., Interstate Elec. Co.
WGY, Schenectady, N. Y., General Elec. Co.
WHA, Madison, Wis., Univ. of Wis.
WHAA, Iowa City, Ia; 500 miles; 8:30 p m, Monday, instruction; Tuesday, concert Wednesday, popular lecture; Friday, University News; public lectures and concerts irregularly; State University of Iowa.
WHAB, Galveston, Texas, Clark W. Thompson (Fellman's Dry Goods Co.)
WHAC, Waterloo, Iowa, Cole Bros. Elec. Co.
WHAD, Milwaukee, Wis.; Marquette Univ.
WHAE, Sioux City, Iowa, Automotive Elec. Service Co.
WHAG, Cincinnati, Ohio, Univ. of Cincinnati.
WHAH, Joplin, Mo; radius, 1384 mi.;Concerts, markets, weather, etc. Tuesday and Thursday evenings: 8 to 10; Daily except Sundays: 10 a. m. to 2 p. m.; Saturday night special: 11 to 12:30; Hafer Supply Co.
WHAI, Davenport, Iowa, Radio Equip. & Mfg. Co.
WHAJ, Bluefield, W. Va., Bluefield Daily Telegraph and E. K. Klitts.
WHAK, Clarksburg, W. Va., Roberts Hdwe. Co.
WHAL, Lansing, Mich., Lansing Capitol News.
WHAM, Rochester, N. Y. Daily—Weather reports 2:40 p. m.; Organ 2:45, 5:00, 6:45; Orchestra 3:00, 7:00; Bed-time stories, Sport results, Business reports and market reports, the latter on 485 meters, 7:15 p m; Sunday—Radio Chapel Service, 3:15 p m; University of Rochester.
WHAD, Savannah, Ga., Frederick A. Hill; every evening 8 to 9; Saturday nights, 12:30 1:30 a. m.
WHAP, Decatur, Ill., Dewey L. Otta.
WHAQ, Washington, D. C., Semmes Motor Co.
WHAR, Atlantic City, N. J., Paramount Radio & Elec. Co.
WHAS, Louisville, Ky., Courier Journal and Louisville Times Co.
WHAV, Wilmington, Del., Wilmington Elec. Spec. Co.
WHAW, Tampa, Fla. 100 miles; 12 to 1, 4 to 5 p m, music; Pierce Electric Co.
WHX, Des Moines, Iowa; 300 miles; 5:45 p m to 6:15 p m Daily; 8:00 p m to 10 p m Wednesday evenings; Central Standard time; Iowa Radio Corp.
WHAY, Huntington, Ind., Huntington Press.
WHAZ, Troy, N. Y., Rensselaer Polytechnic Inst.
WHB, Kansas City, Mo., Sweeney Auto & Tractor School.
WHD, Morgantown, W. Va., W. Va. University.
WHK, Cleveland, Ohio, Warren R. Cox.
WHN, Ridgewood, N. Y., Times Printing & Pub. Co.
WHU, Toledo, Ohio, Wm. B. Duck Co.
WIAB, Rockford, Ill., Joslyn Automobile Co.
WIAC, Galveston, Texas, Galveston Tribune.
WIAD, Ocean City, N. J., Ocean City Yacht Club.
WIAE, Vinton, Iowa, Mrs. Robt. E. Zimmerman.
WIAF, New Orleans, La., Gustave A. De Cortin.
WJAG, Norfolk, Nebr; 200 miles News and Markets 12:15, 3:30 and 5:30 p. m The Huse Publishing Co. The Norfolk Daily News.
WIAH, Newton, Iowa, Continental Radio & Mfg. Co.
WIAI, Springfield, Mo., Heer Stores Co.
WIAJ, Neenah, Wis., Fox River Valley Radio Supply Co.
WIAK, Omaha, Nebr.; 7:45 a. m. Livestock receipts; 9:10 a. m. Livestock receipts and opening on hogs; 10:15 a m rainfall and temperature report and weather forecast for Nebraska and Iowa, Livestock market; 12 m cattle, hog and sheep market; 1:50 p m rainfall and temperature report and weather forecast for Nebraska and Iowa; market detail; 3:50 p m complete market reports and estimated receipts for next day; Daily Journal-Stockman.
WIAD, Milwaukee, Wis., School of Engineering.
WIAP, Springfield, Mass., Radio Development Corp.
WIAQ, Marion, Ind., Chronicle Pub. Co.
WIAR, Paducah, Ky., Musical 3:30 to 4 p. m. and 7 to 8 p. m. except Sundays Paducah Evening Sun; Albert Bennett, operator.
WIAS, Burlington, Iowa, Hawk-Eye Home Elec. Co.
WIAT, Tarklo, Mo., Leon T. Noel.
WIAU, Le Mars, Iowa, Am. Trust & Savings Bank.
WIAV, Binghamton, N. Y., N. Y. Radio Lab.
WIAW, Saginaw, Mich., Saginaw Radio & Elec. Co
WIAY, Neenah, Wis; 224 meter, 100 watts; Fox River Valley Radio Supply Co.
WIK, McKeesport, Pa., K. & L. Elec. Shop.
WIL, Washington, D. C., Continental Elec. Supply Co.
WIP, Philadelphia, Pa., Gimbel Bros.
WIZ, Cincinnati, Ohio, Cino Radio Mfg. Co.
WJAR, Lincoln, Nebr., American Radio Co.
WJAD, Waco, Texas, Jackson's Radio Engrng. Lab.
WJAF, Muncie, Ind; 1800 miles; 7:30 to 8 Monday, Wednesday, Friday evening music; 8:30 to 7 p m Saturday, music; 3:30 to 4 every afternoon, News; 10:30 to 12 M Sundays, Church service. Smith Electric-Muncie Press.

Complete Corrected List of U. S. and Canadian Broadcasting Stations

WJAJ, Dayton, Ohio 200 miles; Sunday 8:40, 9.15 Religious; Wednesday 9.15. 9:45 Entertainment; Friday 9:15 to 9:45 Entertainment. Y. M. C. A.
WJAK, Stockdale, Ohio White Radio Lab.
WJAM, Cedar Rapids, Iowa, Evening Gazette.
WJAN, Peoria, Ill; 280 meters, 100 watts; Daily except Sunday: 9 a. m. Peoria Livestock; 9:15 a. m. Special Weather Information; 11:30 a. m. weather, opening livestock and market quotations; 1:30 p. m. Closing livestock and markets, official weather information; talk to women by Phyllis Ann; Monday and Thursday, government agriograms; 5:30 p. m. baseball reports during season; Tuesday, Thursday and Saturday, special concerts as announced at 9:15 p. m.; One musical number preceeds each broadcasting. Peoria Evening Star.
WJAP, Duluth, Minn. 1500 miles; Sunday 11 a m, 12:30 p m Church Service and organ recital; First Methodist Church, Rev. Chas. N. Pace, Pastor. Monday 8: p m to 9 p m, musical; Thursday 8 p m to 9 p m, musical; Kelley Duluth Co.
WJAQ, Topeka, Kans., Capper Publications.
WJAR, Providence, R. I., The Outlet Co., J. Samuels & Bros.
WJAS, Pittsburgh, Pa., Pittsburgh Radio Supply House.
WJAT, Marshall, Mo., Kelley-Vawter Jewelry Co.
WJAX, Cleveland, Ohio, Union Trust Co.
WJAZ, Chicago, Ill., Chicago Radio Lab.
WJD, Granville, Ohio; 229 meters, 50 watts; Richard Harris Howe.
WJH, Washington, D. C., White & Boyer Co.
WJX, New York, N. Y., De Forest Radio Telephone & Teleg. Co
WJZ, New York, Radio Corp. of America; Aeolin Hall, 455 meters.
WKAA, Cedar Rapids, Ia.; Daily; weatther reports, crop reports, government reports; Mondays, Thursdays and Saturdays: music; H. F. Paar.
WKAC, Lincoln, Neb., Star Pub. Co.
WKAF, Wichita Falls, Texas, W. S. Radio Supply Co.
WKAH, West Palm Beach, Fla., Planet Radio Co.
WKAK, Okemah, Okla., Okfuskee County News.
WKAL, Orange, Texas, Gray & Gray.
WKAN, Montgomery, Ala., Alabama Radio Mfg. Co.
WKAP, Cranston, R. I., Dutee W. Flint.
WKAQ, San Juan, Porto Rico, Radio Corp. of Porto Rico.
WKAR, East Lansing, Mich., Mich. Agrl. College.
WKAS, Springfield, Mo., L. E. Lines Music Co.
WKAV, Laconia, N. H., Laconia Radio Club.
WKAW, Beloit, Wis; 242 meters, 10 watts; Turner Cycle Co.
WKAX, Bridgeport, Conn., Wm. A. MacFarlane.
WKAY, Gainesville, Ga., Brenau College.
WKC, Baltimore, Md., Jos. M. Zamoiski Co.
WKN, Memphis, Tenn., Riechman-Crosby Co.
WKY, Oklahoma City, Okla., Oklahoma Radio Shop.
WLZ, Fairfield, Ohio, U. S. Army.
WLAC, Raleigh, N. C., N. C. State College.
WLAG, Minneapolis, Minn., Cutting & Walsh Radio Corp.
WLAH, Syracuse, N. Y., Samuel Woodworth.
WLAJ, Waco, Texas, Waco Elec. Supply Co.
WLAK, Bellows Falls, Vt., Vermont Farm Machine Co.
WLAL, Tulsa, Okla., Tulsa Radio Co.
WLAN, Houlton, Me., Putnam Hdwe. Co.
WLAP, Louisville, Ky., W. V. Jordan.
WLAQ, Kalamazoo, Mich., A. E. Schilling.
WLAS, Hutchinson, Kans., Hutchinson Grain Radio Co.
WLAT, Burlington, Iowa, Radio Specialty Co.
WLAV, Pensacola, Fla.; daily musical program, 8 to 9 p m; The Electric Shop.
WLAW, New York, N. Y., New York Police Dept.
WLAX, Greencastle, Ind., Greencastle Community Broadcasting Station.
WLAY, Fairbanks, Alaska, Northern Commercial Co.
WLAZ, Warren, Ohio, Hutton & Jones Elec. Co.
WLB, Minneapolis, Minn., Univ. of Minn.
WLK, Indianapolis, Ind., Hamilton Mfg. Co.
WLW, Cincinnati, Ohio, Crosley Mfg. Co.
WMA, Anderson, Ind., Arrow Radio Lab.
WMAB, Oklahoma City, Okla., Radio Supply Co.
WMAC, Cozenovia, N. Y, 750 miles; music 11: p m; Cleve B. Meredith.
WMAD, Rockport, Mo., Atchinson County Mail.
WMAE, Dartmouth, Mass., Round Hills Radio Corp.
WMAG, Liberal, Kans., Tucker Elec. Co.
WMAH, Lincoln, Nebr., General Supply Co.
WMAJ, Kansas City, Mo., Drovers Telegram.
WMAK, Lockport, N. Y., Norton Labs.
WMAL, Trenton, N. J, 100 miles; 7:30 to 9 p m, Mondays and Thursdays, musical programs, lectures etc; Trenton Hardware Co.
WMAM, Beaumont, Texas, Beaumont Radio Equip. Co.
WMAN, Columbus, Ohio, First Baptist Church.
WMAP, Easton, Pa., Utility Battery Service.
WMAQ, Fair Store Building, Chicago; 4:35 to 5 p m, daily; 7 to 7:30 p m, Monday, Wednesday, Friday and Saturday; 7 to 8 p m, Tuesday and Thursday; 9:15 to 10 p m daily; Chicago Daily News and Fair Department Store.
WMAR, Waterloo, Iowa, Waterloo Elec. Supply Co.
WMAT, Duluth, Minn., Paramount Radio Corp.
WMAV, Auburn, Ala., Polytechnic Inst.
WMAW, Wahpeton, N. D., Wahpeton Elec. Co.
WMAX, Ann Arbor, Mich., K. & K. Radio Supply Co.
WMAY, St. Louis, Mo., 600 miles; Religious services Sunday, 11 a m and 8 p m; Tuesday at 7 p m; Kingshighway Presbyterian Church.
WMAZ, Macon, Ga., Mercer University.
WMH, Cincinnati, Ohio, Precison Equipment Co.
WMU, Washington, D. C., Doubleday-Hill Electric Co.
WNAB, Bowling Green, Ky., Park City Daily News.
WNAC, Boston, Mass.; Monday 4 to 5 p. m. (silent at night) Tuesday 4 to 5 p. m. and 7 to 8:30 p. m. Wednesday 4 to 5 p. m. 9:30 to 11 p. m. Thursday 4 to 5 and 7 to 8:30 p. m. Friday 4 to 5 and 8 to 9:30 p. m. Saturday 4 to 5 and 9:30 to 11 p. m. The Shepard Stores; J. J. Fanning, announcer; Samuel Curtis, operator.
WNAD, Norman, Okla., Okla. Radio Engineering Co.
WNAL, Omaha, Nebr., R. J. Rockwell.
WNAN, Syracuse, N. Y., Syracuse Radio Telephone Co.
WNAP, Springfield, Ohio, Wittenberg College.
WNAQ, Charleston, S. C., Charleston Radio Elec. Co.
WNAS, Austin, Texas, Radio Corp.
WNAT, Philadelphia, Pa. 1000 miles; Talks, Radio information, music, Chapel Service. Wednesday 7:30 p m; Saturday 7:30 p m; Sunday 2:30 and 4:30; Every day 12:15, 1 p m. Lennig Bros. Co.
WNAV, Knoxville, Tenn., People's Tel. and Tel. Co.
WNAY, Baltimore, Md., Shipowners' Radio Service.
WNAW, Fortress Monroe, Va., Henry Kunzman.
WNAX, Yankton, S. Dakota; 241 meters, 100 watts; Dakota Radio Apparatus Company.
WNJ, Albany, N. Y., Shotton Radio Mfg. Co., Inc.
WNO, Jersey City, N. J., Wireless Telephone Co. of Hudson Co., N. J
WOAA, Ardmore, Okla.; radius 1,500 miles; Tuesdays and Fridays: musical and educational programs; Dr. Walter Hardy; station operated by G. H. Reitz.
WOAC, Lima, Ohio, Maus Radio Co.
WOAE, Fremont, Nebr., Medland College.
WOAF, Tyler, Texas, Tyler Commercial College.
WOAH, Charleston, S. C., Palmetto Radio Corp.
WOAI, San Antonio, Tex.; daily except Sunday 10:30, 12:15, 3, 6 p. m. News, market, weather reports; Wednesday. Concert 7:30 to 8:30 p. m.; Sunday evening concert 9:30 to 10:30 p m; Southern Equipment Co. and The Evening News and The Express.
WOAJ, Parsons, Kans., Erving's Electrical Co.
WOAK, Frankfort, Ky., Collins Hardware Co.
WOAL, Webster Groves, Mo., Wm. E. Woods.
WOAN, Lawrenceburg, Tenn., James D. Vaughan.
WOAQ, Omaha, Nebr. 100 miles; Woodmen of the World.
WOAQ, Portsmouth, Virginia; Portsmouth Kiwanis Club.
WOAR, Kenosha, Wis., Henry P. Lundskow.
WOAS, Middleton, Conn., Bailey's Radio Shop.
WOAT, Wilmington, Del., Boyd Martell Hamp.
WOAU, Evansville, Ind., Bowder Bolling Piano Co.
WOAV, Erie, Pa., Pa. Nat'l Guard.
WOAX, Trenton, N. J., Franklin J. Wolff.
WOAW, Omaha, Neb., 100 miles, Woodmen of the World.
WOAZ, Stanford, Texas, Penick Hughes Co.
WCBB, Greenville, O; 240 meters, 100 watts; K. & K. Radio Supply Co.
WOC, Davenport, Ia. time signals, 10:55 a. m.; weather 11 a. m.; 360 meters, 11:05 opening market quotations, agriograms; 12:00 noon, chimes concert; 2:00 p m, closing stocks and markets, 5:00 p m, educational talk, 5:45 p m chimes concert, 6:30, sandman's visit; 7:00 musical program, 8 p m, lecture. Sundays, religious and musical and religious features, 9 a m to 10 p m; Palmer's School of Chiropractic.
WOI, Ames, Ia., Iowa State College.
WOK, Pine Bluff, Ark., concerts Tuesday and Friday evenings beginning at 9; Sundays, song service and sermons from churches at 11 a. m. and 7:30 p. m., Arkansas Light & Power Co.
WOO, Philadelphia, Pa., John Wanamaker.
WOQ, Kansas City, Mo., Western Radio Co.
WOR, Newark, N. J., L. Bamberger & Co.
WOS, Jefferson City, Mo.; first fifteen minutes of every hour from 8 a. m. to 2: p m; 5 p m, markets and music, 360 meters; Monday, Wednesday, Friday nights, 8 to 9:30 concerts; no Sunday program; Missouri State Marketing Bureau.
WOV, Omaha, Nebr., R. B. Howell.
WOU, Omaha, Nebr., Metropolitan Utilities.
WPA, Fort Worth, Texas, Fort Worth Record.
WPAA, Wahoo, Neb., Anderson & Webster Elec. Co.
WPAB, State College, Pa.
WPAC, Okmulgee, Okla., Donaldson Radio Co.
WPAD, Chicago, Ill., Wiebolt & Co.
WPAF, Council Bluffs, Iowa, Peterson's Radio Co.
WPAG, Independence, Mo., Central Radio Co.
WPAH, Waupaca, Wis., Wisconsin Dept. of Markets.
WPAJ, New Haven, Conn., Doolittle Radio Corp.
WPAK, Fargo, N. D., North Dakota Agricultural College.
WPAL, Columbus, Ohio, Superior Radio & Tel. Equip. Co.
WPAM, Topeka, Kans., Awerbach & Guettel.
WPAP, Winchester, Ky., Theo. D. Phillips.
WPAQ, Frostburg, Md., General Sales & Eng. Co.
WPAQ, Wilmington, Del., Radio Installation Co., Inc.
WPAR, Beloit, Kans., R. A. Ward.
WPAS, Amsterdam, N. Y., J. & M. Electric Co.
WPAT, El Paso, Texas, St. Patrick's Cathedral.
WPAU, Moorhead, MInn., Concordia College.
WPAY, Bangor, Me., Bangor Radio Laboratory.
WPAZ, Charleston, W. Va., Dr. John R. Koch.
WPE, Independence, Mo.
WPG, New Lebanon, Ohio 1500 miles; Program exclusive for the farmer; 12 to 12:15 p m News Flashes; 6 to 6:30 p m, News, Markets; 8 to 9:45 Monday and Wednesday; music and farm program. Nushawg Poultry Farm.
WPI, Clearfield, Pa., Elec. Supply Co.
WPM, Washington, D. C., Thos. J. Williams, Inc.
WPO, Memphis, Tenn., United Equip. Co.
WSAC, Clemson College, S. C.; Clemson Agriculture College.
WQAA, Parkersburg, Pa. 1500 miles; 10:30 p m every evening. Horace A. Beale, Jr.
WQAB, Springfield, Mo., Southwest Missouri State Teachers' College.
WQAC, Amarillo, Texas, E. B. Gish.
WQAU, Waterbury, Conn., Whitall Electric Co.
WQAE, Springfield, Vt., Moore Radio News Station.
WQAF, Sandusky, Ohio, Sandusky Register.
WQAH, Lexington, Ky., Brock-Anderson Elect. Eng Co.
WQAJ, Ann Arbor, Mich., Ann Arbor Times-News.
WQAK, Dubuque, Iowa, Appel-Higley Elec. Co.
WQAL, Mattoon, Ill., Cole County Tel. and Tel. Co.
WQAM, Miami, Fla., Electrical Equipment Co.
WQAO, New York, N. Y., Calvary Baptist Church.
WQAP, Lincoln, Nebr., Am. Radio Co.
WQAQ, Abilene, Texas, West Texas Radio Co.
WQAR, Muncie, Ind., Press Publishing Co.
WQAS, Lowell, Mass.; Prince-Walter Company.
WQAT, Westhampton, Va.; Radio Equipment Corp.
WQAV, Greenville, S. C.; Huntington & Guerry, Inc.
WQAW, Scranton, Pa., Scranton Times.
WQAW, Washington, D. C.; Catholic University.
WQAX, Peoria, Ill.; Radio Equipment Co.
WQAY, Hastings, Nebr., Gaston Music & Furniture Co.
WQAZ, Greensboro, North Carolina; Greensboro Daily News.
WRAA, Houston, Texas, Rice Institute.
WRAB, Savannah, Ga.; Savannah Board of Public Education.
WRAC, Mayville, N. D., State Normal School.
WRAO, Marion, Kansas. Taylor Radio Shop.
WRAF, Laporte, Ind; 224 meters, 10 watts; Radio Club, Inc.
WRAH, Providence, R. I.; Stanley N. Read.
WRAK, Escanaba, Mich.; Economy Light Co.
WRAL, St. Croix Falls, Wis.; Northern States Power Co.
WRAM, Carthage, Ill., Robert E. Compton & Carthage College.
WRAM, Galesburg, Ill., Lombard College.
WRAN, Waterloo, Iowa; 229 meters, 20 watts; Black Hawk Electrical Co.
WRAO, St. Louis, Mo., Radio Service Co.
WRAP, Winter Park, Fla.; Winter Park Electric Construction Co.
WRAS, McLeansboro, Ill.; Radio Supply Co.
WRAU, Amarillo, Texas, Daily News.
WRAV, Yellow Springs, O., Antioch College.
WRAY, Scranton, Pa.; radius 400 mi.; Sunday Chapel service; Wednesday: Selective Musical program, 8:15 to 10; Saturday: 8:15 to 11; Radio Sales Corp.
WRK, Hamilton, Ohio, Doron Bros. Elec. Co.
WRL, Schenectady, N. Y., Union College.
WRM, Urbana, Ill., Univ. of Ill.
WRP, Camden, N. J., Federal Inst. of Radio Telg.
WRR, Dallas, Texas, City of Dallas, Police and Fire Signal Dept.
WRW, Tarrytown, N. Y., Acebig Bros., Tarrytown Radio Research Lab.
WSAA, Marietta, O., B. S. Sprague Electric Co.
WSAB, Cape Girardeau, Mo., Southeast Mo. State College.
WSAC, Clemson College, S. C.; Clemson Agricultural College.
WSAH, Chicago, Ill.; A. G. Leonard, Jr.
WSAJ, Grove City, Pa., Grove City College.
WSAL, Brookville, Ind.; Franklin Electric Co.
WSAP, New York City; Seventh Day Adventist Church.
WSAT, Plainview, Texas, The Plainview Electric Co.
WSAV, Houston, Texas, C. W. Vick Radio Const'n Co.
WSB, Atlanta, Ga., Atlanta Journal.
WSL, Utica, N. Y., J. & M. Elec. Co.
WSY, Birmingham, Ala., Alabama Power Co.
WTAC, Johnstown, Pa., Penn. Traffic Co.
WTAS, Elgin, Ill; 275 meters, 500 watts; Chas. E. Erbstein.
WTAU, Tecumseh, Neb., Rueky Battery & Elec. Co.
WTAW, College Station, Texas, Agricultural and Mechanical College of Texas.
WTG, Manhattan, Texas, Kans. State Agri. College.
WTP, Bay City, Mich., Ra-Do Corp.
WVP, New York, N. Y. Signal Corps, U. S. Army.
WWAC, Waco, Tex; 3000 miles; Weather forecasts 11 a m daily; musical concerts daily, 1:30 p m and on Wednesday and Saturday evenings at 8; Sanger Bros.
WWAD, Philadelphia, Pa., Wright & Wright, Inc.
WWAJ, Columbus, O.; Columbus Radio Club.
WWAX, Laredo, Texas, Worman Bros.
WWAY, Chicago, Ill.; Marigold Gardens.
WWB, Canton, Ohio, Daily News Printing Co.
WWI, Dearborn, Mich., Ford Motor Co.

(Continued on next page.)

Complete Corrected List of U. S. and Canadian Broadcasting Stations

WWJ, Detroit, Mich., Evening News.
WWL, New Orleans, La.; Musical and Educational; Loyola University; operated by Dept. of Physics.
WWX, Washington, D. C., Post Office Dept.
2XAI, Newark, N. J., Westinghouse Elec. & Mfg. Co.
2XI, New York City, A. T. & T. Co.
2XJ, Deal Beach, N. J., Amer. Tel. & Telg. Co.
3XW, Parkersburg, Pa., Horace A. Beale, Jr.
3YN, Washington, D. C., Nat'l Radio Inst.
9ARU, Louisville, Ky., Darrell A. Downard.

Canadian Stations

CFAC, Calgary, Alta., Can. Western Radio Co., Ltd.
CFCA, Toronto, Ont., Can. Toronto Star.
CFCB, Vancouver, B. C., Can. Marconi Co.
CFCE, Halifax, N. S., Can. Marconi Co.
CFCF, Montreal, P. Q., Can. Marconi Co.
CFCH, Iroquois Falls, Ont., Can. Abitibi Power & Paper Co., Ltd.
CFCI, Walkerville, Ont., Can. Motor Products Corp.
CFCN, Calgary, Alta., Can. W. W. Grant Radio, Ltd.
CFCX, London, Ont., Can. The London Advertiser.
CFPC, Fort Frances, Ont., Can. International Radio Develop. Co.
CFTC, Toronto, Ont., Can. The Bell Telephone Co.
CFYC, Vancouver, B. C., Can. Victor Wentworth Odlum.
CFZC, Montreal, Que., Can. Can. Westinghouse Co., Ltd.
CHBC, Calgary, Canada. W. W. Grant Radio, Ltd. (Morning Albertan.)
CHCA, Vancouver, B. C., Can. Radio Corp. of Vancouver, Ltd.
CHCB, Toronto, Can. Marconi Co.
CHCC, Edmonton, Alta., Can. Can. Westinghouse Co., Ltd.
CHCF, Winnipeg, Man., Can. Radio Corp. of Winnipeg, Ltd.
CHCQ, Calgary, Alta., Can. Western Radio Co., Ltd.
CHCS, London, Ont., Can. London Radio Shoppe.
CHCX, Montreal, Que., Can. B. L. Silver.
CHCZ, Toronto, Ont., Can. Globe Printing Co.
CHOG, Vancouver, B. C., Can. Can. Westinghouse Co., Ltd.
CHVC, Toronto, Canada. Metropolitan Motors Co.
CHXC, Ottawa, Ont., Can. J. R. Booth, Jr.
CHYC, Montreal, Que., Can. Northern Elec. Co.
CJBC, Montreal, Que., Can. Dupuis-Freres.
CJCA, Edmonton, Alta., Can. Edmonton Journal, Ltd.
CJCB, Nelson, B. C., Can. James Gordon Bennett.
CJCD, Toronto, Can., T. Eaton, Co.
CJCE, Vancouver, B. C., Can. Vancouver Sun.
CJCF, Kitchener, Ont., Can. News Record, Limited.
CJGG, Winnipeg, Canada. Manitoba Free Press.
CJCH, Toronto, Ont., Can. United Farmers of Ontario.
CJCI, St. John, N. B., Can. McLean, Holt & Co., Ltd.
CJCN, Toronto, Ont., Can. Simons, Agnew & Co.
CJCS, Halifax, N. S., Can. Eastern Telephone & Telegraph Co.
CJCY, Calgary, Alta., Can Edmund Taylor.
CJGC, London, Ont., Can. London Free Press.
CJNC, Winnipeg, Man., Can. Tribune Newspaper Co.
CJSC, Toronto, Ont., Can. Evening Telegram.
CKAC, Montreal, Can. La Presse.
CKCB, Winnipeg, Man. Can. T. Eaton Co., Ltd.
CKCD, Vancouver, B. C., Can. Vancouver Daily Province.
CKCE, Toronto, Ont., Can. Can. Ind. Telephone Co.
CKCK, Regina, Sask., Can. Leader Pub. Co.
CKCR, St. John, N. B., Can. Jones Elec. Radio Co., Ltd.
CKCS, Montreal, Que., Can. The Bell Telephone Co.
CKCZ, Toronto, Ont., Can. Westinghouse Co., Ltd.
CKKC, Toronto, Ont., Can. Radio Equipment & Supply Co., Ltd.
CKOC, Hamilton, Ont., Can Wentworth Radio Supply Co., Ltd.
CKQC, London, Ont., Can. Radio Supply Co.
CKZC, Winnipeg, Man., Can. Salton Radio Eng. Co.

The New Kaufman Circuit

(*Continued from page 4.*)

will be as short as possible. The base-board is fastened to the panel by means of three flat headed screws which should be countersunk so that the head of the screws will be level with the face of the panel.

The five holes shown above the rheostat are for the purpose of observing the brilliancy of the filament of the tube, when the set is enclosed in the cabinet. The arrangement as shown is supposed to slide into the front of the cabinet, in such a way that it may be drawn out at any time to change tubes, or to clear any trouble which might occur through wires becoming crossed, or connections which might come loose. However, if the wires are insulated with rubber tubing, or some other insulating material and the connections are all well soldered, no trouble of this kind may be expected.

If any of the new dry cell type of tubes are used, the rheostat should have from 25 to 30 ohms of resistance, which will give a very close adjustment of the filament control and also will prevent burning out the tube, if one happens to be a little careless in turning the rheostat, but if the ordinary 6 volt detector tube is used, then the regular 6 ohm type of rheostat will answer the purpose. Of course more volume may be obtained by using the standard UV-200, or Cunningham 300 tubes, but these will require the use of a storage battery for heating the filament, which may be objectionable in some cases, and especially so if the set is to be made portable.

Mr. Kaufman's idea in developing this circuit was to make a very efficient set and to do away with the obnoxious squealing and howling so often encountered in other kinds of tuners and in this respect he has done much to improve the results obtained on both local and long distance reception.

The Monthly Service Bulletin of the

NATIONAL BROADCASTERS' LEAGUE

Solely by, of and for Radio Broadcasting Station Owners

IN RESPONSE to the call for opinions from readers on the best way to solve the problem of restoring late popular music to the broadcasting stations many letters and telegrams have been received by the Secretary of the National Broadcasters League.

The call was published in the May issue of this magazine. In brief, it asked the following questions:

Can independent music be supplied so that popular music may feature broadcast programs?

Can this music be supplied without cost or tax?

Will it be possible to so direct such music distribution that an actual profit may be made for broadcast station owners?

Will independent authors, composers and publishers cooperate?

Will the receiving set owner assist in improving his own entertainment?

The answer to all of these questions is affirmative. From most of the states in the country and from provinces in Canada come letters showing deep interest in the music situation. It is significant that not one suggestion has come from any source defending the demand of the American Society of Authors, Composers and Publishers that the broadcasting stations pay a tax on the copyright music issued or controlled by that Society.

Basing their plans on these letters from all sources of radio interest the officers of the National Broadcasters' League have been conducting negotiations with the result that the actual distribution of untaxed music has started.

In the midst of these negotiations individual broadcasters of two cities inaugurated the organization of a few stations for similar purpose, with the exception that broadcasters, under their plan, were asked to invest a sum of money, in most cases equal to or greater than the tax demanded by the American Society of Composers, Authors and Publishers.

OWNERS of broadcasting stations who have not yet joined the National Broadcasters' League, may do so by sending their check for the annual membership fee of $10 to Frederick Smith, Secretary, 500 N. Dearborn St., Chicago.

Membership will entitle broadcasters to periodical information as to developments in connection with broadcasting, intelligence as to steps taken to eliminate interference and news of events in any part of the country affecting broadcasting and broadcasting interests. Also members will receive the official organ of the league for one year.

This nominal fee is required for the cost of issuing circulars and handling the large volume of correspondence. You will find it useful to be associated directly with this clearing house for broadcasting information, which is also a protective institution, offensive and defensive.

It should be kept in mind by all broadcasters that the National Broadcasters' League has no connection whatever with that recently announced grouping of a few stations who assumed a name similar to that of our older organization.

The National Broadcasters' League has no connection with the National Association of Broadcasters which recently met at the Drake Hotel, Chicago, and is not in sympathy with the demand of the National Association for the payment of considerable sums as membership fees by broadcasting stations, already under heavy expense and without present means of reimbursement for their investment or for their operating expenses.

Good, popular music is being selected by the officers of the League and is now being distributed on a periodical schedule which will insure each member station a well-rounded musical program without cost and without fear of legal complications over copyrights. Other branches of this service will be added from time to time.

Such a plan involves a great deal of labor and requires time. Broadcasters should bear in mind that in order to make it successful their full cooperation is essential. It gives the stations release from their worry over broadcasting of musical numbers and stations no doubt will show their appreciation by using the music and adhering, at least in an approximate way, to the schedules arranged.

There is another phase of the situation that should interest millions of owners of receiving sets. They are the ones who benefit from the musical entertainment offered by broadcasting stations. These fans could help right now by writing to their nearest broadcasting station and urging the owner of that station to join the National Broadcasters' League, immediately. The League's offices are at 500 North Dearborn street, Chicago. No station owner need hesitate because of the expense involved as the annual membership dues are only $10 and that sum covers all obligations for the term of one year.

Write your station about this. Tell the broadcasters the League is trying to help radio programs and that cooperation is necessary to bring it about.

Fans who are willing to do their part in obtaining better music and continuous music should sign the blank form printed on page 16 of this issue and send it at once to the National Broadcasters' League, 500 North Dearborn Street, Chicago. Sign and mail now.

Broadcasters Must Not Exceed Their Waves

UNDER the reallocation of wave lengths, six new stations were licensed by radio inspectors of various districts. Texas, Oklahoma, Illinois, Pennsylvania, Louisiana and Indiana each received one station with a wave exclusive for its representative district.

The schedule of Class A stations show that at least twenty distinct wave lengths in each of the nine districts are available for distribution by local inspectors. Three or four wave lengths will be reserved for the best of the local stations in this class, with no immediate adjoining districts having a station operating on a wave of the same length.

By this plan it is believed much interference may be eliminated.

A recent survey of the broadcasting stations show that the Mississippi River basin states have the largest number of stations, with the states of Michigan, Ohio, and West Virginia, together with New York and Pennsylvania, running a close second.

In a recent letter to all radio inspectors, Mr. Hoover points out that all broadcasters must adhere to the new individual waves assigned them, if interference is to be eliminated. Any violation of the reallocation plan of May 15, may result in the suspension of or revocation of license, as provided in Section 2, Act of August 13, 1912.

Beginning May 15, radio inspectors were instructed to carefully check the transmitting wave lengths of stations as far as practicable.

It is highly imperative that the transmitting stations adhere to the waves assigned to them as only careful execution of the plan will result in its success.

Some new regulations and amendments have been passed which provide that limited commercial stations are not open to public service and are licensed for a specific commercial service or services defined in the license. Stations of this class must not transmit to or accept public messages from other stations. No rates are authorized.

Licenses of this class are required for all transmitting radio stations used for broadcasting news, music, lectures, church services, government reports, and such matters, and do not permit the transmission of private or commercial communications.

Broadcasting stations must be operated by or under the supervision of an operator holding a commercial second class license or higher, such operator must be on duty during the entire time the station is being operated.

No testing or experimenting is authorized in broadcasting stations between the hours of 10 a. m. and midnight, local standard time.

Broadcasting stations, the operation of which interferes with the reception of time signals and meteorological signals must remain silent while the signals from such stations are being transmitted.

The reading of telegrams or letters by broadcasting stations will not be construed as point to point communication so long as the signer is not addressed in person and so long as the text matter is of general interest.

CLASSIFIED ADVERTISEMENTS

Six cents per word per insertion, in advance. Name and address must be counted. Each initial counts as one word. Copy must be received by the 5th of month for succeeding month's issue.

MEN-WOMEN-GIRLS WANTED

for U. S. Government Life Jobs. $1140 to $2300 year Steady, pleasant work. Short hours. Paid vacation. Common education sufficient. Experience unnecessary. List, positions and full information free. Write immediately. Today sure. Franklin Institute, Dept. T116, Rochester, N. Y.

PATENTS AND TRADEMARKS

"Patents and Trade-Marks," 64-page Book free, Excellent References. 23 years' experience. Robb, Robb & Hill, 1413 Hanna Bldg., Cleveland, Ohio, 952 McLachlen Bldg., Washington, D. C.

SUBSCRIPTION AGENTS

We want representatives in every community to obtain subscribers for Radio Age. Excellent opportunity for radio enthusiasts to make good money quickly. Write Radio Age, Inc., 64 West Randolph Street, Chicago, Ill.

BOOKS

If you have not bought your Reinartz Book, fully illustrated with hook-ups and clear description of how to make this popular circuit, send $1.50 in money order or check and we will send you the booklet "Reinartz Radio" and place you on the subscription list of Radio Age for six months. Address Radio Age, 64 West Randolph Street, Chicago, Ill.

RADIO OUTFIT AND SUPPLIES

Radio Solder for construction and repairing radio outfits. Three six inch bars 25c postpaid. Hamilton Lead Company, Hamilton, Ohio.

Officers Form Club

The United Service Radio Association was formally organized at the Army and Navy Club in Washington recently by a group of officers from the Army, Navy and other uniformed services of the Government. This club has for its objective the education of commissioned officers in the radio art and the fostering of radio development, through lectures and experiments.

A lecture course by experts on radio was planned following the first practical talk given by Maj. Gen. Geo. O. Squier of the Signal Corps, a member of the association. To date about one hundred officers have joined, including some civilian experts admitted as associate members. At the second session, Capt. J. T. Tompkins spoke on the use of radio in the Navy. The next meeting on May 7 will take place in a government radio laboratory where demonstrations of new radio sets will be made by Major Bender of the Signal Corps.

Officers of the Association are Lt. Col. F. P. Jackson, Q. M. C. President; Captain J. T. Tompkins, USN, Vice President; and Capt. R. B. Connor, USA, Secretary.

Big New Stations

Plans are nearing completion for the erection of two more giant radio broadcasting stations by the General Electric Company, according to an announcement recently made by Martin P. Rice, director of broadcasting for that company

One of the new stations will be located near San Francisco and the other is indefinitely placed at somewhere between the Pacific and Atlantic Coasts. Both will be modeled after General Electric Company station WGY at Schenectady, N. Y., and the experience gained by the engineers in this station, after fourteen months operation, will aid greatly in the plans to give radio listeners in other parts of the country a radio service of the highest transmission quality.

Mr. Rice recently returned from the coast after a tour of inspection. He was accompanied by Harry Sadenwater, engineer in charge of the technical operation of General Electric Company radio broadcasting stations. Sites were investigated in and near Oakland and San Francisco, Cal., in Denver, Colorado and Dallas, Texas.

In each city visited, Mr. Rice received assurance of co-operation from the chamber of commerce and municipal officials who were alive to the advantages and prestige which may accrue to the city which is the home of a powerful broadcasting station.

The expansion of radio broadcasting by the General Electric Company from one to three stations is part of program agreed upon sometime ago by the General Electric Company, the Radio Corporation of America and the Westinghouse Electric. This plan contemplates the erection of nine large broadcasting stations. Of this number the Westinghouse has now three in operation, those at Pittsburgh, Pa., Chicago, Ill., and Springfield, Mass. The Radio Corporation has two stations under construction, one in New York and the other in Washington D. C. The New York station is on top of the Aeolian Building on 42nd Street and will be opened in a short time. The General Electric Company now operates WCY at Schenectady, N. Y., and will have a second station near San Francisco and a third somewhere between the Pacific coast and Schenectady, N. Y.

In discussing the plans of the General Electric Company, Mr. Rice said: "It is our conviction that the future of radio broadcasting will be on a plane of relationship with localized stations similar to that of the national magazine to the local newspapers. Each will have its own functions—the local stations to carry events of local interest and larger and more powerful stations to transmit events of national import and interest."

In Great Britain

Recent developments in England indicate that a strong effort soon will be made to relieve the amateur radio operator in that country from having to pay a proposed increase in license and buy his apparatus from the British Broadcasting Company. Radical steps to break the alleged monopoly are predicted, although they may not remove the bar against foreign manufactured radio telephone sets. If development is to be permitted, the whole situation must be simplified, many believe.

The new Postmaster General is said not to be especially sympathetic toward the present arrangement, but it is felt he will insist that apparatus be of United Kingdom manufacture. Many fans in Great Britain want to make their own receiving sets and utilize some manufactured parts. Today these radio fans can only secure an experimenter's license, but after receiving their permits they can use any kind of a set or part they desire, and listen in on all stations. These licenses, it is reported, remove them from the control of the British Broadcasting Company. It is assumed that they are engaged in experimental work but they undoubtedly listen in on all broadcasting concerts.

The Radio Manufacturers' Association has suggesed abandoning of the present method of securing revenue for the broadcasting company by license fees and royalties, and collecting the amount necessary for adequate revenue from the license fee. Restrictions against the so-called "pirate" would then be tightened.

According to a statement in Parliament, 35,383 experimental licenses have been issued, while as many more applications are on file. It is estimated that 200,000 individuals are using sets without licenses because they cannot secure the licenses they desire.

Radio on the Farm

(*Continued from page 16*)

tell him. We often get the stock markets before our local buyers get them.

Start With a Simple Set.

"It is not only interesting but very educational. We get some wonderful lectures and sermons we would not otherwise be able to enjoy. On bad days and nights we can sit around our own home fire and hear from the radio horn almost any kind of entertainment we choose.

"To those who are interested in radio I would say that if you have any mechanical ability you can buy all of the parts and assemble your set much cheaper than buying one ready-made. There are several good makes on the market that are very reasonable in price. I would suggest getting a vacuum tube set. The detector sets with head phones are very satisfactory but we like the amplifier and horn best. Any one can get the detector first, and then if further interested can add the amplifier and horn later.

"A neighbor boy made a set from paste board boxes and did all of his own work, including winding the spools, etc. His set cost him, including batteries, $35. He gets very fine results and hears all the stations that any one else gets, including Havana, Cuba, Denver, Col., etc.

Uses Flashlight Battery Set

A compact, self-contained portable radio receiving set, which can be carried as easily as a suit case, which requires only flashlight batteries for the filaments of the tubes and which weighs less than 18 pounds, has been perfected by the General Electric Company. An outstanding feature of this set, adding to its portability and desirability for camping trips, is the fact that the new radiotrons, UV-199, are used, which require only 60 milliamperes (.06 amperes) filament current per tube.

This new outfit will receive radio messages over a range from 200 to 600 meters for a distance as great as any set having a detector and one stage of amplification. It is housed in a mahogany cabinet with hinged front and rear covers. Head telephones with plug attached are clamped on the inside of the front cover. Provision is made in the rear cover for batteries that can be easily exchanged.

The set is so designed as to make a neat appearance in the home. The front cover can be easily detached.

The outfit comprises a regenerative receiver with a vacuum tube detector and one stage of audio frequency amplification. The circuit is very efficient and will operate a loud speaker on signals received from nearby stations. With an additional amplifier, it can be used to obtain loud speaker signals from distant stations.

For portable use the filament current is supplied from two 3-cell, 4 1-2 volt flashlight batteries in parallel, and the plate or "B" battery current is supplied by two 22 1-2 volt batteries connected in series. For home use, when weight and portability are not essential, larger batteries both for filament and plate current can be used. For such use it is recommended that three 1 1-2 volt dry cells in series be used for the filament and two larger size 22 1-2 volt batteries in series be used for the plate voltage.

In Ireland

No definite policy has been announced by the Irish government up to April 1 regarding its position with respect to wireless broadcasting, or the operation of private receiving sets. There is a small market for this class of equipment, which, since the regulations of the British post office and the British Broadcasting Company do not apply in Ireland, is open to foreign manufacturers.

Foreign Languages

Schools in Sheffield, England, recently had the privilege of listening to French prose and poetry broadcast from a French radio station. The director general of the French radio service consented to cooperate with F. Lloyd, President of the Sheffield District Wireless Society, in an effort to provide for foreign language students the broadcasting of standard and classical foreign literature. It is hoped that this firsthand instruction can be extended to include the broadcasting of English, German, Italian and Spanish language lessons.

Every "Skipper" His Own Forecaster

Within a short time, skippers of ocean-going vessels equipped with radio, will be making their own forecasts and weather maps daily, according to Chief Forecaster Edward H. Bowie, of the United States Weather Bureau. This is due primarily to efficient and immediate radio service.

Since his return from a long trip on the Atlantic Ocean in the French ship, Jacques Cartier, Mr. Bowie is very enthusiastic over the prospects of forecasting at sea, and urges its practice on American vessels. With the vast amount of meterological information broadcast today from practically all large radio stations, and many ships, it is possible, he says, for the ship masters to make their own forecasts and even make a daily plot of weather conditions, just as is done in the weather bureau in Washington. The Naval Radio station at Arlington sends out a general report daily from North America and in return receives a similar report from Paris on European conditions.

Since most storms journey eastward, a skipper in the Atlantic generally knows what is coming and by keeping in touch with vessels west of him he can do his own forecasting. In turn, he keeps other ships posted as to conditions in his location, and by cooperation many floating weather bureaus eventually will benefit each other and the countries with which they are in touch.

Several new radio stations to transmit weather information from the north of this country now are planned, Mr. Bowie stated, one at Cape Farewell in Greenland, three in MacKenzie Valley, Canada, and one on Baffin Island.

"Radio has done wonderful things for meterology," Mr. Bowie said. "In the old days we issued statements, ran up storm warnings on the coasts and had to let that suffice, whereas today we broadcast everything and ships at sea are as well informed as shore stations."

Special Licenses

In an effort to encourage the scientific development of broadcasting and apparatus for that purpose, the Department of Commerce has created a new form of special license known as the "Broadcasting Development Class." Licenses in this class will be issued to station owners having transmitting and receiving sets of their own design and manufacture, provided in duplicate where failure is likely to occur. These stations are to be used for the improvement of broadcasting and many special requirements are demanded by the Commerce Department, which will furnish detailed information upon application.

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SERVICE DEPARTMENT FOR READERS

Please remember that Radio Age has one of the best radio instructors in the United States, who is ready to answer any technical question. This costs subscribers nothing.

Use of Rubber in Radio

(*Continued from page 17.*)

the set is responsible for a good share of the losses that occur in the receiver. At comparatively low frequencies chemically compounded materials are about on a par with hard rubber in this respect. But at radio frequencies these figures are not at all applicable, for a new phase of the insulator's structure becomes predominant. The leakage in the compounded insulators increases considerably, and the reason which has been advanced is that the structure consists of solid substance in which are microscopic pockets containing more highly conductive material. These pockets act as a series of tiny condensers that at high frequencies form a convenient leakage path."

Workability of Hard Rubber.

The workable qualities of hard rubber give it a distinct advantage over any other insulating sheet material used for panels. It may be machined, drilled, cut, threaded, engraved, stamped, sanded, and polished with ordinary tools without danger of chipping.

In large scale factory operations hard rubber is cut with power circular saws of special design. In panel making and similar work satisfactory results . are obtainable by using for cutting to dimensions an ordinary hack saw with blade having 24 teeth to the inch. For drilling holes use a straight fluted drill, feeding slowly without great pressure, otherwise the stock may heat excessively and the drill run the hole out of true.

Radio Parts from Sheet Stock.

Among the radio instrument parts that may be fashioned easily from hard rubber sheet may be mentioned condenser ends, slider blocks, spider web and honeycomb coil mountings, parts for phone plugs, detector bases, variocouplers, tube sockets, dials, knobs, and condenser boxes. Variometer tubes can be cut from stock hard rubber tubing, and various pieces and handles can be turned from hard rubber rods.

Hard rubber is no doubt at once the cheapest and best radio panel material and meets with favor because of these points and the facility with which it can be machined. Where volume production in molded pieces is concerned the advantage of cheapness lies with the various hard molded plastic compositions. It is safe to say that when special parts are needed or highest quality desired hard rubber alone should be used.

Molded Hard Rubber Parts.

Hard rubber can be molded into any form in iron or steel molds under hydraulic pressure or in soft metal molds made from a steel matrix. Iron and steel molds are preferable as the molds are more permanent and retain their shape, producing a more uniform article. It is easily worked into special designs either by molding or machining and takes an excellent finish.

A hard rubber molded part of widely extended utility is the case and cap of the telephone receiver. In this application hard rubber is particularly valuable owing to the accuracy with which it can be machined and also to its remarkable sonorescent quality.

Other hard rubber molded pieces used in radio instrument construction are variometer tubes, and frames, condenser bases and tops, slider blocks, spider-web and honey-comb coil mountings, parts for pone plugs,detector and induction coil bases, and a variety of other irregular shapes of specialdesign.

The variometer case is molded in two pieces. These are accurately formed to fit together closely without machinery other than boring bolt holes. The variometer rotor is molded in one piece of suitable size to revolve within the two-piece case. Variometer tubing is made of one-ply hard rubber calendered sheet formed around a mandrel, the edges of the raw stock being united by knitting together the skived edges. Hard rubber tubes and rods are packed in soapstone for curing in open steam. Vacuum tube sockets are made in a multi-cavity steel mold, as are also the B battery box and its perforated cover pieces, also the condenser case or small single piece box with end flanges designed to contain the parts of a fixed condenser.

Condenser ends are made by sawing thin hard rubber sheet into suitable size and dimensions. Dial knobs with graduated dial are molded from steel molds hobbed or engraved to show the dial graduation cut into the finished surface of the dial. The graduation and figures are given distinctness by filling them with white lead paste.

Several of the molded parts named are shown in the illustration. Among those represented the panel and variometer tube are not molded but are made from calendered sheet stock.

Standard Panels.

Hard rubber panels are sawed from vulcanized sheet, the standard size of which is 20 by 48 inches made in bright-tin finish, which is secured by vulcanization between planished sheets of tin. Panels for radio receiving sets should be true, square cut, and edges ground true.

Following are the usual stock sizes of 3-16 inch hard rubber panels for the amateur builder of receiving sets.

7 x 10	7 x 24
7 x 14	10 x 12
7 x 18	12 x 14
7 x 20	12 x 18

Simple Tests for Hard Rubber Quality.

Hard rubber is made in many grades and the quality can be easily judged by the toughness of the shaving and by the facility with which it cuts and machines. The easier it machines the better the quality and the more readily it takes a black high polish.

As interest grows in radio reception from far distant stations, and the application of the theory of radio frequency becomes correspondingly more general, the importance of protecting all apparatus against slight leaks and losses, due to ineffective insulation, is more and more appreciated. This condition will gradually bring about the use of panels, dials, and other parts having smooth polished surfaces free from small pits and furrows, and having unusual freedom from inherent and surface moisture.

Use of Kilocycles

The Second National Radio Conference, which met with Secretary Hoover in March, introduced a method of designating radio waves which is somewhat new to the radio public. This is the use of frequency in kilocycles (abbreviated kc) instead of wave length in meters. The advantages of this practice have been familiar to radio engineers for some time, and it is probable that it will eventually replace the use of wave length in meters. As a matter of fact, wave length is a somewhat artificial conception in the handling of radio apparatus and is one of the difficult things for the beginner to understand. The frequency of the radio wave is the same as the frequency of the alternating current which flows in the radio transmitting or receiving set.

As often happens in technical matters, the idea of "kilocycles" is simpler than the forbidding aspect of the word suggests. "Kilo" means a thousand, and "cycle" means one complete alternation. The number of kilocycles indicates the number of thousands of times that the rapidly alternating current repeats its flow in either direction in the antenna in one second. The smaller the wave length in meters, the larger is the frequency in kilocycles.

The reason that kilocycles are coming into use and displacing meters is that the necessary separation of the frequency of transmitting stations to prevent interference is the same, no matter what the frequency may be. This neccssary separation is variable and quite misleading when expressed in meters. Thus the number of radio messages that can be transmitted simultaneously without interference can be correctly judged from the kilocycles but not from the meters. For example, the amateurs will in the future work in a band of wave lengths from 150 to 200 meters, but this is a frequency band from 2000 to 1500 kilocycles. This is an enormously wider band when considered from the viewpoint of kilocycles than, for example, the band having the same width in meters from 1000 to 1050 meters, which is 300 to 286 kilocycles. While it is possible to carry on fifty simultaneous radio telephone communications between 150 and 200 meters, only one could be carried on between 1000 and 1050 meters.

In accordance with the recommendation of the Second National Radio Conference the Department of Commerce and other Government departments will hereafter follow the practice of specifying in even values of kilocycles rather than meters. The Conference recommended the practice of expressing wave frequency in kilocycles per second with wave length in meters in parentheses thereafter. The relation between the two is very simple. To obtain kilocycles, divide 300,000 by the number of meters; to obtain meters, divide 300,000 by the number of kilocycles. For example, 100 meters = approximately 3000 kilocycles, 300 meters = 1000 kilocycles, 1000 meters = 300 kilocycles, 3000 meters = 100 kilocycles.

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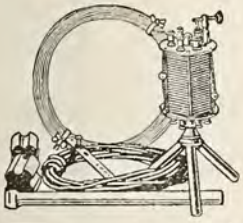

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