

Blueprint Section Every Month

RADIO AGE

The Magazine of the Hour



*August
1926*

Blueprints of a Low Power
Transmitter **or** Life of an
Amateur **or** When Broad-
way came to Main Street

25¢

Complete Broadcast List and Log
In Each Issue

SM

The Why of S-M Audios



Facts

Frequency Response Characteristic

The curve of the S-M 220 is flatter than that of any other commercial transformer from 32 to 1,000 cycles. In the case of several S10 transformers, the percentage of distortion is several hundred percent greater than that of the S-M 220 over this range. Above 1,000 cycles the response falls off at a carefully pre-determined rate to compensate for the reverse effect in broadcast transmission and commercial loud speakers.

Frequency Range Covered

S-M 220's cover a range of from below 30 cycles to 8,000 cycles approximately. This allows reproduction of all common musical notes and their second harmonics—necessary for natural quality. Frequencies above 8,000 cycles are intentionally cut out thus eliminating hiss, background noise and high frequency oscillation. Practically no other available amplifying devices possess this new characteristic.

New Principle

S-M 220's are the first audio amplifying devices available to listeners in which the far-from-perfect quality of broadcast transmission and available loud speakers has been taken into account and compensated for. These two factors produce a signal weak on low frequencies and strong on high frequencies. S-M 220's do just the opposite. They possess a falling frequency characteristic—weak on high notes and strong on low notes. This compensates for everyday transmission and loud speaker characteristics of a reverse nature. The result is quality of unbelievable perfection—bass organ notes that shake a room, just as does the original organ itself. All notes, both high and low, are reproduced more faithfully to the ear than with any other available amplifying system.

Physical Characteristics

The weight of the 220 core, of highest grade Silicon steel, is over 2½ lbs. The total weight is 4 lbs. Compare this against an average weight of less than 2 lbs for five transformers supposedly in the class of the S-M 220 yet selling at from \$2.00 to \$4.00 apiece higher. The mean turn length on the 220 winding is twice as great as several of the transformers referred to. This takes wire—plenty of it. The core cross-section is 1¼ inches.

All this means but one thing—quality—for assuming good average engineering, the quality of an audio transformer is almost always approximately proportional to its size.

Handling Capacity

The 220's will handle sufficient input energy to obtain maximum power output from a UX171 tube—over six-tenths of a watt. Properly operated, with somewhat less amplification than shown in the accompanying curve, they will develop an output voltage of from twenty to thirty volts—with an even flatter characteristic than shown in the curve. The primary windings will handle 15 milliamperes continuously.

Output Transformer

S-M 221 output transformer is designed to deliver maximum power to standard cone speakers at 30 cycles, and decreasing power as the frequency increases. This effects aids in compensating for average speaker characteristics of a reverse nature. S-M 221's will handle the full power output of a UX171 or UX210 tube. They are guaranteed to improve low note reproduction and handling power on any standard receiver when merely connected between the set and loud speaker.

General Data

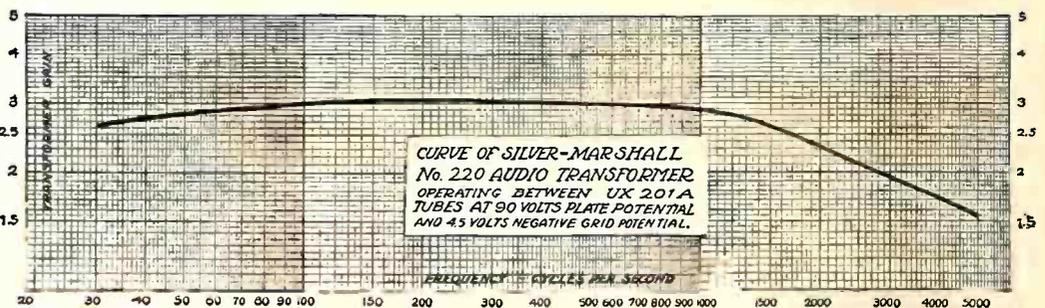
S-M 220's have a turn ratio of 3:1. Their primary inductance is approximately 100 henries. Their impedance ratio will fit any standard tube on the American market. The 220's and 221's are supplied in drawn steel cases, completely shielded. Guaranteed unconditionally against mechanical and electrical defects—and for absolute satisfaction.

S-M Audio Transformers were introduced with the guarantee that they would give the finest quality of reproduction obtainable. So far they have met with overwhelming success. Production has been steadily increased since the first samples brought back enthusiastic reports from editors, jobbers, dealers, and experimenters.

WHY?

There must be reasons—facts behind this landslide of approval of transformers introducing an entirely new thought in audio reproducing systems.

These facts, briefly, are presented at the left of this page. "The Secret of Quality" available at your dealer gives the substantiating details.



Plug-In B

The S-M type 650-B "Plug-In B" has an extremely high power output plus remarkable filtration. It will supply 300 volts with sufficient current to operate not only the UX-210 power amplifier but a whole receiver as well—"A," "B" and "C" power to an entire set including power amplifier stage. This is because of its generous design and the absolutely new Clough filter principle that leaves no trace of hum with the best of amplifiers. Completely assembled and wired, ready for operation \$39.50.

631 Stage Shield

The S-M type 631 stage shield is in an aluminum case 7½x5x3¼ inches pierced for a condenser, coil socket, tube socket, choke, bypass condenser and lead wires. It opens at the bottom allowing easy wiring, yet the top seals it tightly from outside interference. A unit that will allow you to keep in step with the latest engineering advances in individual circuit shielding. Price \$2.00.

"The Secret of Quality"

This booklet contains laboratory data never before available even to many manufacturers. It is the only authoritative treatise on all types of audio amplification written in non-technical language ever published. 10c is the price of this 96 page book. Ask your dealer for a copy.



Silver-Marshall, Inc.

850 West Jackson Boulevard

Chicago, U. S. A.

Power Supply Devices



WILL be thoroughly covered in the September issue of Radio Age—on the stands August 15.

In addition to the blueprint section showing one type of power supply there will be a number of other articles handling the subject fully and in detail.

Use of either the Raytheon or Rectron tube as a rectifier is shown in the articles, together with plentiful data on chokes, filament and plate supply transformers, high test bypass condensers, variable and fixed resistors, and all other units that go into the makeup of a successful and silent power supply device for your radio receiver.

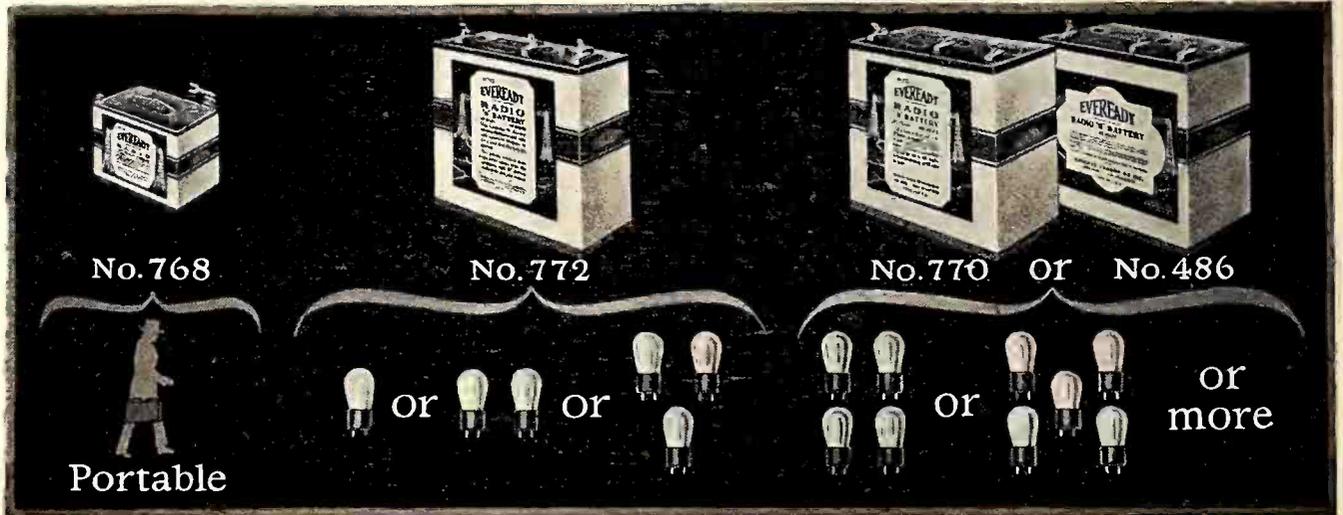
Be sure to order your September copy now. Better still, turn to page 60 and fill out the handy coupon—then you will be sure of getting the magazine every month.

RADIO AGE, Inc.

500 N. Dearborn St.

Chicago, Illinois

Perhaps you, too, can cut your "B" battery costs in half. Just follow the chart. It gives you the secret of "B" battery economy.



THOUSANDS of people have made the discovery that Eveready "B" Batteries, when used in the proper size, and on sets equipped with a "C" battery*, are a most economical, reliable and satisfactory source of radio current.

Here is the secret of "B" battery economy, reliability and satisfaction:

On all but single tube sets—Connect a "C" battery. The length of service given below is based on its use.*

On 1 to 3 tubes—Use Eveready No. 772. Listening in on the average of 2 hours daily, it will last a year or more.

On 4 or more tubes—

*NOTE: A "C" battery greatly increases the life of your "B" batteries and gives a quality of reception unobtainable without it. Radio sets may easily be changed by any competent radio service man to permit the use of a "C" battery.

Use the Heavy-Duty "B" Batteries, either No. 770 or the even longer-lived Eveready Layerbilt No. 486. Used on the average of 2 hours daily, these will last 8 months or longer.

These figures are based on the average use of receivers, which a country-wide survey has shown to be two hours daily throughout the year. If you listen longer, of course, your batteries will have a somewhat shorter life, and if you listen less, they will last longer.

Evereadys give you their remarkable service to the full only when they are correctly matched in capacity to the demands made upon them by your receiver. It is wasteful

to buy batteries that are too small. Follow the chart.

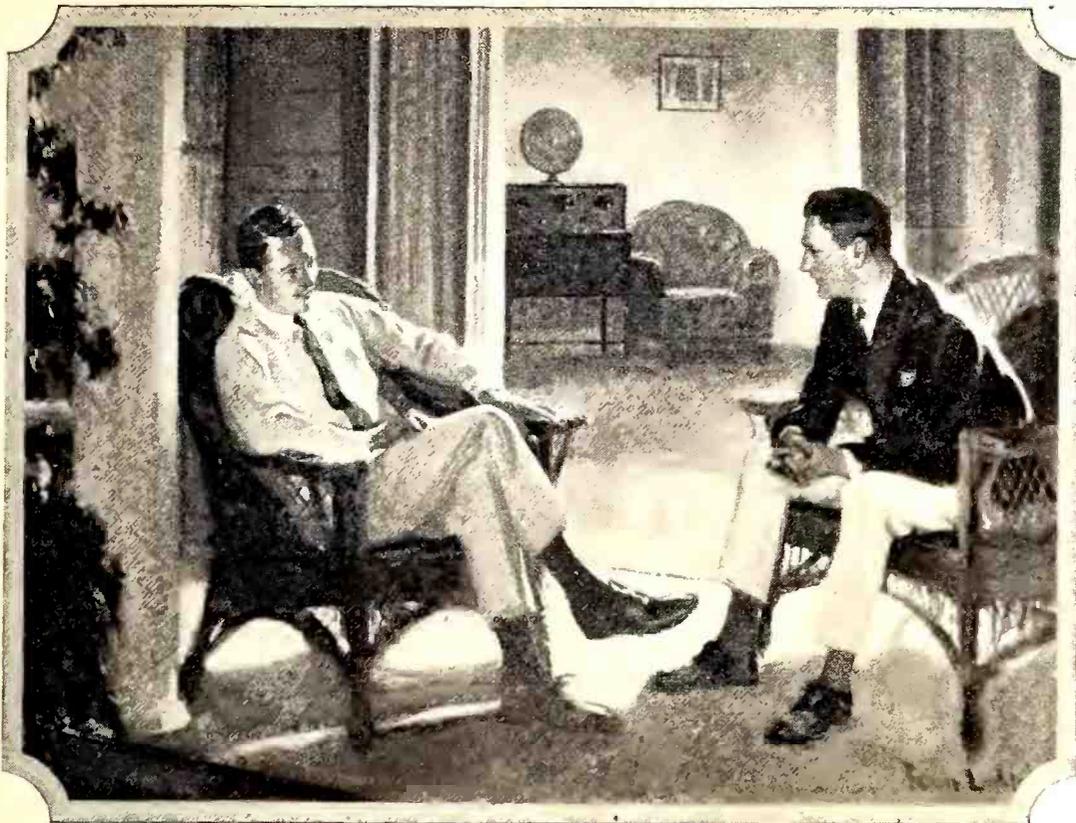
In addition to the batteries illustrated, which fit practically all the receivers in use, we also make a number of other types for special purposes. There is an Eveready Radio Battery for every radio use. To learn more about the entire Eveready line, write for the booklet, "Choosing and Using the Right Radio Batteries," which we will be glad to send you on request. There is an Eveready dealer nearby.

Manufactured and guaranteed by
NATIONAL CARBON CO., INC.
 New York San Francisco
 Canadian National Carbon Co., Limited
 Toronto, Ontario

Tuesday night means Eveready Hour—8 P. M., Eastern Standard Time, through the following stations:

WEAF—New York	WSAI—Cincinnati
WJAR—Providence	WTAM—Cleveland
WEFI—Boston	WJL—Detroit
WTAG—Worcester	WGN—Chicago
WFI—Philadelphia	WOC—Davenport
WGR—Buffalo	WCCO—Minneapolis
WCAE—Pittsburgh	WCCO—St. Paul
	KSD—St. Louis

EVEREADY
Radio Batteries
—they last longer



*“My wife insists on
getting a radio set exactly like yours.
Where did you get it?”*

“THE Radio Shop put it in for me, Jim. I’ve never had anything that was less trouble or expense, or that gave us all so much pleasure. We don’t see how we ever got along without it.”

“How about batteries? I’ve heard you have to give them a lot of attention.”

“Not if you get good ones, Jim. The service man from The Radio Shop who installed my set said that the Evereadys he was supplying were exactly the right size for the receiver and should last eight months or longer. I’ve had the set six months now, and as far as I can tell, the ‘B’ batteries are as good as new.”

That’s the experience of those who follow these simple rules in choosing the right “B” batteries for their receivers:

On all but single tube sets—connect a “C” battery. The length of service given here is based on its use.*

On 1 to 3 tubes—Use Eveready No. 772. Listening in on the average of 2 hours daily, it will last a year or more.

On 4 or more tubes — Use the Heavy-Duty “B” Batteries, either No. 770 or the even longer-lived Eveready Layerbilt No. 486. Used on the average of 2 hours daily, these will last 8 months or longer.

Follow these rules and you, too, will find that Eveready

Radio Batteries offer a most economical, reliable and satisfactory source of radio power. How long they last, of course, depends on usage; so if you listen less you can count on their lasting longer, and if you listen more, they will not last quite so long.

Send for booklet, “Choosing and Using the Right Radio Batteries,” sent free on request. There is an Eveready dealer nearby.

*NOTE: A “C” battery greatly increases the life of your “B” batteries and gives a quality of reception unobtainable without it. Radio sets may easily be changed by any competent radio service man to permit the use of a “C” battery.

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WTAG—Worcester	WGN—Chicago
WFL—Philadelphia	WOC—Davenport
WGR—Buffalo	WCCO { Minneapolis
WCAE—Pittsburgh	{ St. Paul
	KSD—St. Louis



LEFT—No. 486,
for 4, 5 or more
tubes, \$5.50.

RIGHT—Ever-
eady Dry Cell
Radio “A” Bat-
tery, 1½ volts.



EVEREADY

Radio Batteries

—they last longer

RADIO AGE

The Magazine of the Hour

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Chats With the Editor

RADIO school for farmers and others is something new in the way of carrying instruction to large numbers of people. It is to be inaugurated by the government beginning in October and the method by which it will be accomplished is described in this issue by Sam Pickard, recently appointed head of the radio section of the U. S. Department of Agriculture. Mr. Pickard writes the first announcement of the National Radio Farm School while other experts of the department will give our readers a series of articles covering the various activities of the school and cite instances where profitable advantage has been taken of the course.

Amateurs, (or hams as they are known to each other), will join us in congratulating Armstrong Perry on his exposition of the life of an amateur. There have been many stories written of the ham but we believe Mr. Perry's tops the list.

Naval maneuvers are always interesting to Americans, especially when it is the U. S. Naval maneuvers to which reference is made. The part that radio is playing in the present war tactics is portrayed by G. K. Spencer and liberally illustrated with photographs. You again have evidence of the fact America has led the field in its utilization of radio, this time for use as a military weapon.

Power amplification and power supply devices are now capturing the public attention to a degree never considered possible. A full line of power supply devices will be found in the blueprint section as well as other sections of next month's issue, written so even the inexperienced may read and build.

Frederick Smith

Editor of RADIO AGE.

RADIO AGE

The Magazine of the Hour

M. B. Smith
Business Manager

A Monthly Publication
Devoted to Practical
Radio

Frederick A. Smith
Editor

BE A HAM!

By ARMSTRONG PERRY

JUST why a radio amateur should be known by the same name as the hind leg of a hog is a mystery, but they are all "hams" and they glory in it.

There was a time, just after the public discovered radio, when the hams were accused of wanting to be the whole hog, but that was because broadcast listeners learned that there were amateur transmitting stations in most communities and assumed that these were responsible for every noise that interfered with the reception of broadcasts. If the term "amateur" originated in England, the abbreviated form naturally would be "ham," because the "h" does not belong there. The Englishman even calls Ohio "Ho-i-ho." Another possibility is that, as amateurs hammer out code messages with their transmitting keys, "ham" may be used as an abbreviation for hammerer. Anyhow, ham it is, and only he who is one can grasp the joy of it.

The ham has dominated the development of radio, at least until recently. Trace back the biography of an outstanding radio genius and you come to the time when his laboratory was in his home, and probably in his sleeping room. When a man becomes a ham he gives up sleep, so he does not need the bed room for that purpose. Money was no object, he spent on radio what he could pick up from available sources. Dubilier was so enthused over the hobby, after reading his first

radio book, that he climbed through a window into a lecture room where no boys were allowed, to hear his first radio lecture. The lecturer had to use him as an assistant in order to get rid of him. Armstrong,



Shore leave in foreign lands is one thing that lures hams into jobs as operators on ships. Albert Bombe, the one shown in this picture taken on the Island of Teneriffe, secured his first commercial position before he was seventeen, and learned Spanish in time to be prepared for this tete-a-tete

whose litigation against DeForest, before and after he received his million dollars for the patent on the regenerative circuit, made the public uncertain as to who really did invent the hook-up, had no idea of the commercial value of the circuit until years after he discovered how it increased the range of radio receivers. Weagant built

a storage battery and charged it with a hand generator before the days of radio, and his early radio experiences were just as innocent of any commercial motive.

Famous Hams

SUCH famous hams, and thousands still unknown to fame, were about all the radio experts there were available, when the broadcasting craze struck like a bolt from the blue. Their interest was in experimentation. The better a radio set worked, the less they enjoyed listening to it. Listening to broadcasts was the pet aversion even of professional radio operators. What the hams enjoyed was point-to-point communication for the purpose of seeing how far they could send their signals and how far they could hear the other fellows'. Yet, since there were few other experts available to help in the development of radio when the public began clamoring for it, the hams got the job.

The public wanted to buy radio sets as it bought phonographs, and get as good results. The hams wanted to build experimental sets and, as soon as one would work, tear that to pieces and build another. Politics itself never made stranger bedfellows than the ham and the broadcast listener.

The ham, of course, advised the radio public to build its own sets. This interested a lot of good ham material. It was a long time before the ladies,

more interested in applying coloring material to human visages than in applying solder to the ends of wires, and quite as likely to buy an article for its appearance as for its performance, caused the production of the beautiful pieces of furniture in which some radio sets now are housed.

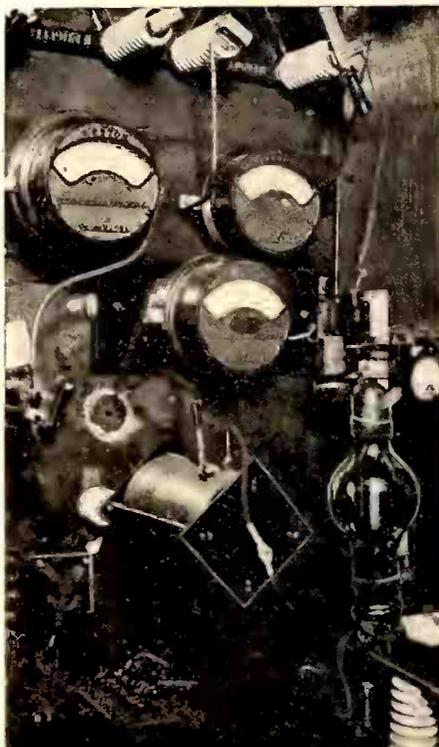
Good Advice

LOOKING at the matter from all angles, the ham's advice was good, especially for men. Many men have an urge for construction that their jobs fail to satisfy. A new piece of furniture pleases for a time, but men get more of a kick out of something that gives them work to do. Radio has proven to be an ideal pastime for the constructor. A few divorces have been reported, in cases where the head of the family permanently abandoned going to bed, so as to have more time for radio during the hours when the air was comparatively quiet, but on the other hand, husbands who never before enjoyed sitting up with sick children have become so angelic under the influence of radio that they have urged their better halves to take their rest while they administered the hourly doses. There is even a suspicion that fathers have increased the candy allowance at times, from ulterior and radio-ized motives, wanting an excuse to stay up at night.

Thousands of men have built radio receivers in the last few years. There is another step that they ought to take, namely, the building of radio transmitters. The Bible encourages it. Any man who remembers his Sunday School days will recall that passage which says "it is more blessed to give than to receive." Always being at the receiving end loses its punch sooner or later, even if you did build your own receiver. But sit down to a key, with the knowledge that you can make a million hear just by pressing it, and the sensation is like that of sitting in the seats of the mighty.

With no previous experience or knowledge of the subject, a man can follow directions, build

a radio transmitter, and, in fifteen minutes of easy work, interest all the neighbors, the city fire department, the National Board of Fire Underwriters, the radio listeners in a dozen states and the United States Department of Commerce. He will become so much in demand that he will have to limit his response to the demands made upon him. He will



Some ham stations are like the Mississippi River steamboat whose whistle was so large that the boat had to stop every time it was blown. This one seems to run to meters, but it has made some great records. It is 2FP Brooklyn

have to progress from the general to the specific. In other words, learn to call some one individual with whom he wishes to communicate instead of impressing his personality upon the world at large.

THE HAMS have an organization of their own. It is a unique body in which the members know each other by cryptic combinations of numbers and letters instead of using the Rotary Club method of "Bill," "Ed," and "Doc." One of them drops in on a stranger and says: "Hello, old man, aren't you 2BZ?" An expectant joyfulness spreads over the countenance of the one addressed. He sticks out a paw on which solder, stray

sparks and tools for the production of blisters have left their marks. "Sure!" he says, "and you are—?" "7LW." Then they are off, and all those things that a man leaves behind him when he dies, except radio, are forgotten until some neglected wife, patient or client butts in.

These combinations of symbols that hams use in place of names are assigned to them by the United States government, which keeps track of hams by a system similar to that used in recording inmates of federal penitentiaries. The first number indicates the district in which the ham and his radio station are located. The letters serve as serial numbers. It is necessary for a law-abiding ham to transmit his radio designation at the beginning of each message so that anyone who hears him may find his address in the radio call book in case he wants to do anything to him that cannot be done at that distance.

The name of this ham organization is the American Radio Relay League. Its headquarters are in Hartford, Connecticut. Its experience has been similar in some respects to that of the Oklahoma Indians who, after the politicians had shoved them off into a corner of the state where the land was supposed to be worthless, found that they were located over oil-bearing strata as rich as any in the world. Unlike the Indians, however, few of the hams have been murdered yet because of the lack of other quick means of depriving them of their rights.

Lo the Poor Ham!

Hams were shoved hither and yon in the ether as it began to fill up with radio traffic. In the early days they could work on any wavelength and with any power that their purse, or ingenuity in tapping power lines, could provide. As they began to outnumber and out-everything the government and commercial stations, the government began to limit them. Every time a waveband was assigned to them, they promptly demonstrated that it was the best



This Canadian ham, Leroy Fenderson of Jacquet River, New Brunswick, came home from the war with a heart so badly strained that he could not hold a job. He started building radio receivers for the neighbors and in a short time had an established business. He operates a ham broadcasting station for the benefit of his customers

waveband there was for long-distance, reliable communication. As soon as this was made plain, the government would take that waveband and give the hams one that was supposed to be NG. Then the hams would invent new apparatus and beat the old records and by-and-by that waveband would be swiped for government or commercial service.

Some time ago the hams went away down below one hundred meters, and soon found that a set of moderate power would transmit all the way from America to Australia, and that the daylight range of a transmitter working on ten to forty meters was more than equal to the night range of other sets although the night range on longer wavelengths averages about ten times the daylight range. One ham carried his ham set to the Arctic with the MacMillan Expedition, putting the standard Navy radio outfits off the ships three times but finally taking them along to keep the country out of war. Another ham, also using short-wave transmitter and receiver, kept the Expedition in touch with the world for twenty-two days when nobody else, ham or professional, could bring in its signals.

Hams have helped the railroads in moving trains when wires were down, supplied radio communication for relief work

when floods and fires disrupted other communication over wide areas, and established communication that is becoming world-wide and that can be used by anyone, without money and without price, who has a legitimate reason for asking for free service instead of using commercial service.

A man can initiate himself as a ham without great expense. A simple ham transmitter can be made from parts used in receivers, so it is possible to start with materials at hand and then gradually spend the price of the new car that you denied the wife and family, without attracting too much unfavorable attention.

In fact, a receiver can be made into a transmitter by inserting a microphone or key in the ground circuit. Bloopers transmit unconsciously. In fact they exhibit, like other lower animals, a lack of that consciousness that is the attribute of human beings only.

It is well to remember, without being reminded, that radio transmission is legal *only after both the ham and his station are licensed by the Government.* The Department of Commerce declines to license a ham until he has passed an examination proving that he has a working knowledge of the fundamentals of radio, and that he can send and receive at the rate of at least ten words, per minute, using the International Morse Code. The would-be ham's first mental reaction to this requirement is: "Why the heck should I have to learn code when I am going to transmit speech only until I learn the code?"

The answer is that human life is sacred. Radio is the only means of summoning aid to shipwrecked mariners. If a ham could not read SOS and QRT in continental code, thousands of lives might be lost because he kept right on talking after all other stations, even the big ones where minutes mean dollars, had become silent, so that the ships within reach of the one in distress could get her bearings



Here is an English ham, G. A. H. Wootton, who was given charge of the radio system of Scotland Yard, famous police headquarters of London. He invented the radio vans used by the Yard in directing Derby Day traffic and handling other big jobs

and send her the words of encouragement that men in extremity need. As for requiring some knowledge of radio, that is necessary because of the ease with which a ham can set fire to all the houses down the street, merely by placing his high-tension wires parallel with the house lighting wires without installing protective devices. Standard insurance policies state that the house insured is not insured if it harbors a radio transmitter, but special arrangements can be made to cover houses containing ham stations.

Code Not Hard

LEARNING the code is not such a bugbear as it seems to the uninitiated. It has been learned in half an hour so that the learner could both send and receive, at slow speed of course. Buzzer sets consisting of a key, a buzzer and a battery can be purchased at a low price and will give the beginner practice. If he begins without any strenuous effort to commit the code to memory, merely looking on a code card for each letter as he wishes to send it, he will be surprised to see how soon he will eliminate the glance at the card and send the letter from memory. There are machines, called omnigraphs, that will send automatically at any speed, for practice in receiving. There are stations that send at slow speed, so that a beginner, as soon as he can distinguish letters, can begin to catch messages from the air. In fact there are some amateur broadcasts sent so slowly that the dots and dashes can be written on paper as such, and translated into letters later.

After the license is secured, which should not take much more than the time required for building the transmitter, the way is easy and there is always a thrill just around the corner. There are plenty of hams in all stages of development. At first, exchanging messages with the brother ham in the next block has a kick. Then one in a neighboring town is picked up and worked. By this time the ham is beginning to use the abbrevi-

ated lingo that makes it possible to say more in less time, and save juice.

"GE OM QRK?" In seven letters like this the ham says good evening to the "old man" at the other station (who may have attained the ripe age of thirteen or fourteen) and has asked him how he is receiving the signals. QSA with a question mark is an inquiry as to whether the signals are strong at the receiving end, and QSA without a question mark is a statement to the effect that they are strong. As the two hams know without the question mark which is asking the question, it can be omitted. If the one who answers the question is one of those verbose, long-winded fellows, he may say: "U r QSA." There are 54 "Q signals" or abbreviations approved by the governments of the world and they are understood regardless of the native language of the operator. The development of abbreviated traffic by the hams is practically unlimited, and they use it even when conversing face to face.

The practical ham always can capitalize his hobby, though the earning of money is farthest from the thoughts of most of the fraternity. Radio service is far from its fullest development and every day a ham will learn something that will enable him to be of service to someone who uses radio but does not study it, or to someone who wants to install radio apparatus.

If ham stuff interests a man more than his regular job, the use of gray matter may solve the problem of finding a more agreeable vocation. Many men break down as early as the thirties from the effects of drudgery that is drudgery only because they drifted into the wrong job instead of finding the right one. Already there are reports that the field of radio is crowded. They come from men of the same types that report crowding in all lines of business and all professions, the men who fear competition because they lack the pep to keep ahead of the procession. There is a paying job in radio for every man who

can work at it with enthusiasm and efficiency. If no job is in sight, a man can make one if he is that kind of a man. Spare-time experimenters have financed their avocation indefinitely by selling the things they made and thus securing money for new purchases, and many of them have been approached with offers of steady employment before they realized that they were qualified for permanent positions in radio.

Summer Good

SUMMER time is as good as any time for ham activities. DX work is harder then, but the greater the difficulties the more fun there is in overcoming them. The very short waves cut through static better than longer ones. There are summers when many days are as favorable for radio as the average winter day. When the family is a way sweltering at a summer resort, the ham has the finest chance in the world to have the quiet house all to himself, with a bunch of apparatus and a pitcher of something on the old work bench and no one to call time on him.

The easy steps to Hamdom are: (1) Look through the files of this magazine for transmitter plans and select one that fits the purse. (2) Purchase a radio textbook that covers the elementary principles clearly and concisely. (3) Secure the parts and begin building. (4) Study code fifteen minutes a day, or for several short periods daily. There is no advantage in working at code after it begins to tire you. (5) Join the American Radio Relay League, attend all the meetings you can, and thus acquire the real ham spirit. (6) Secure a license as soon as qualified. (7) Work on schedule with some other ham, and take part in the tests conducted for amateurs. (8) Add to your equipment and power as opportunity permits. (9) Call up an Australian ham some day and, when he answers, realize that you have annihilated the circumference of the earth and that the nations of the world are at your door.

Interesting History of Tube Manufacture

Method of Securing Filament Material Is Described

By F. C. KELLEY*

DID you ever stop to think how this little product of research and scientific development, the vacuum tube, was evolved? Let us analyze this small bulb filled with metal parts and see how it is made.

The filament, which is the most important part in the tube, is made of tungsten, one of our rare metals. It is over 19 times as heavy as an equal volume of water, and melts higher than any other metal. The tungsten is obtained in powder form after reduction from its oxide by pure hydrogen. The pure powder, mixed with small percentages of thorium oxide and carbon, is first pressed under hydraulic pressure into bar form. If handled at this stage, the bar will break, so it is supported on a solid slab of tungsten and pushed into a hydrogen furnace where it is cinkered at a white heat. It is then refired at a temperature just below the melting point in an atmosphere of hydrogen by passing a very heavy current through the bar. During this operation the bar is held at one end between the jaws of a tungsten-faced, water-cooled, copper clamp forming one terminal, and at the other end by a similar clamp forming the other terminal. The latter clamp hangs in a bath of water-cooled mercury. The bar cinkers or shrinks both in length or cross section while the carbon reduces the thorium oxide to pure thorium metal. The destiny of the bar is now the same as pure tungsten which has been melted, and can be hammered hot by machines, called swaging machines into round rods, and then into small wire. The wire, after reaching a certain diameter, is drawn down cold through dia-

mond dies to filament size. This gives us the final filament material. When the tungsten is heated to a high temperature in the vacuum tube, the thorium diffuses to the surfaces covering it with a layer measured in atoms of thickness. The metal thorium is used to give increased current from the filament to the plate. There is a critical temperature where the tube operates with the greatest efficiency and the thorium diffuses to the surface just fast enough to keep it covered. If the filament temperature is too low the thorium does not give so much plate current, and if it is too high the thorium evaporates from the filament faster than it can diffuse to the surface. The former condition produces low efficiency, and the latter causes deactivation of the filament resulting in still lower efficiency, and lower current from the filament to the plate. There is still another change which occurs when the tungsten is heated to such a high temperature. It develops a crystalline structure, and upon the arrangement of these crystals in the filament, depends the life of the tube. This crystal structure is controlled by the treatment of the wire in the making so that, today we have tubes with long lives.

Platinum Expensive

AT one time all of the lead-in wires of our lamps and vacuum tubes were made of that rare, expensive metal, platinum. It was used because it was the only metal known that could be sealed into glass without cracking it, and still give a vacuum tight joint. Then, no other metal with like properties was known. The increased demand for lamps,

vacuum tubes, and the cost of platinum demanded a study of all the possible substitutes for this, valuable metal. After a long investigation, an alloy of nickel and iron was found, which had the same coefficient of expansion as glass. It was necessary to produce this alloy wire with a thin copper coating in order to obtain a vacuum tight joint between the glass and the wire. The comparatively cheap copper-covered, alloy wire, today, takes the place of the rare, expensive element, platinum, used in our early vacuum tubes. The alloy is used, then, only for the joint between the glass and the wire in that part of the tube known as the stem.

The stem consists of a small glass tube one end of which is flared so that it may be sealed into the bulb, and the other end contains the lead-in-wires to the filament, grid and plate about which the glass is fused. Small anchor wires are also sealed into the closed end of this stem and to them are welded nickel support wires for the filament, grid and plate. When completed, the stem carries the filament supported in the center of the plate with the grid correctly spaced between them.

The grid is made of fine tungsten wire wound around two nickel support wires in the form of a flattened spiral. Each point of contact between the spiral grid and support wires is welded.

The plate consists of a flattened cylinder of thin, sheet nickel, welded to nickel support wires.

After the stem is made and the parts mounted upon it, the bulb is placed down over it, and sealed to the flared end of the stem. The bulb is provided with

(Please turn to page 49)

* (Research Laboratory, General Electric Co.)

How Broadcasters Plan Your Summer Programs

By CHARLES B. POPENOE

Manager, Stations WJZ and WJY

THE PROGRAM, after all, is the foundation of the broadcasting structure. Were it not for the steady flow of increasingly good program features, radio would have but a limited appeal to the American public. Especially is this emphasized during the summer season, when radio must allow for the vastly increased diversions that come with the transition from an indoor to an outdoor life.

Broadcasters fully recognize this and radio program directors have prepared accordingly. This season, therefore, will witness a genuine radio summer in the matter of suitable radio programs quite as much as in ample transmitting power and improved reception.

The Sponsored Program.

HIGHLY significant, so far as this summer's programs are concerned, is the marked change that has taken place in broadcasting practice during the past few months. Gradually, broadcasting has progressed from a rather amateur and haphazard means of entertainment, to a professional and thoroughly established institution. Instead of a steady procession of amateur talent, with just an occasional sprinkling of professional performers, present-day programs consist virtually of all-star talent so far as the leading broadcasting stations are concerned. For the first time, through the medium of the sponsored program, the program director has the necessary means at his disposal to summon the best of professional talent. Today the program director, like the theatrical manager, plans his program and then selects and arranges his features with a view to providing max-

imum enjoyment and value to his invisible audience which, by its steadily increasing attendance, repays both the program director and the program sponsor for the effort and expense involved. And, under the new circumstances, the program director may plan his programs for the maximum summertime appeal. This choice makes for variety and correct balance. Thus the radio audience is assured the highest class of entertainment in summer as well as winter, borne on powerful radio waves capable of combating atmospheric disturbances, while the radio performers and their sponsors are assured a full house, in a manner of speaking.

Continuity of Radio

THIS new-day program makes for a continuity in radio that has heretofore been most difficult to maintain. Thus the same program features and the same radio personalities, which have come to the radio audience week after week through the fall, winter and spring, are, for the most part, to continue through the summer season. There is no reason whatever for breaking off one's radio acquaintances that have been formed during the cooler seasons. Even if the summertime takes the radio listener to the distant farm or remote camp, the long arm of the high-power broadcasting station assures friendly contact amid the new surroundings, whether the home receiver be brought along for the purpose or whether it be a portable receiver included in the vacation luggage.

Thus with very few exceptions, the established program features are to continue through the present season, for the program sponsors realize fully the

importance of continuity in maintaining the public good-will which they have been building up from to week.

While on the subject it might be well to say a word regarding the summertime musical features from the Radio Corporation of America's Station WJZ, which, because of its far-reaching voice, in company with the efforts of its associated stations, provides entertainment and news for radio listeners scattered over a vast area. The popular and consequently well-established programs are to continue, with but few exceptions, through the present summer months. Ample musical entertainment of the highest order, by way of orchestral and vocal selections, instrumental solos, dance music, vaudeville sketches, and the like is assured. There will also be travelogue trips to famous and storied vacation lands, and other popular features. In harmony with the season, program features in most instances will be of a light, even gay character, so as to have maximum summertime appeal.

Outdoor Features

PROGRAM features from the studio, as well as from the many points now reached through the elaborate and extensive pick-up systems of Station WJZ will provide the same high level of quality maintained during the indoor season of the year. In addition, many outdoor concerts will be broadcast during the present season, adding a touch of novelty to musical programs. We have arranged to pick up the United States Marine Band, the United States Army Band, and the United States Navy Band concerts, playing in the outdoors, as well as the New York Philharmonic Orchestra concerts.

Changing the Receiver to Single Control

By W. D. CRAFT

NO DOUBT a great many experimenters have tried changing a multi control receiver to a single control, and have experienced some difficulty. There are a great many factors that must be taken into consideration at such a change, not the least of which is the detuning effect of the antenna on the first radio frequency stage.

It is my intention to describe herein a method whereby the antenna may be coupled to a tuned radio frequency type of receiver without any detuning effect whatever. This method, while not original with me, I

was aware of it sometime before it was applied in a commercial receiver. As a consequence, I am prepared to give quite definite information for application and the results that may be expected. I am not prepared to give a theoretical explanation of the operation.

RF amplification in this tube. L^1 may be the primary winding ordinarily found on a R. F. transformer. Somewhat greater signal strength can be had if the factor of coupling between L^1 and L^2 is improved so L^1 should be wound right over top of L^2 with the turns distributed so as to cover the whole of L^2 . The number of turns is dependent on the type of tube used and the plate voltage. Between 20 and 30 turns is usually right. The value of capacity used at C^1 is not critical but will vary under different conditions from .0001 mfd to 1mfd. When the ground is con-

ical results as the 201A with slightly less than $\frac{1}{4}$ the filament current consumption. When 201 A's are used in the rest of the set and a "199" is to be used in the antenna coupler, a resistance sufficient to cause a drop of 3 volts should be put in series with one of the filament leads.

There isn't any justification for using this method on a receiver that all three circuits are not to be tuned simultaneously. However, in the case of an extremely long antenna, it may be added and will facilitate tuning below 300 meters (1000 KC). In the case of a regenerative receiver of the ordinary type radiation will be minimized by the addition. The constants and procedure given above should be followed.

FROM the curves taken, the detuning affect of the antenna was noted. My particular antenna had the effect of loading the first stage at waves from 1420 KC to 1150 KC and at somewhat lower frequencies, the affect was opposite. These curves were not exaggerated in any particular, but were a composite of curves run on 3 manufactured receivers the Silver Six (Freed Eisemann NR 7, Atwater model 20, Fada 125 A). It is apparent that my antenna

(Please turn to page 49)

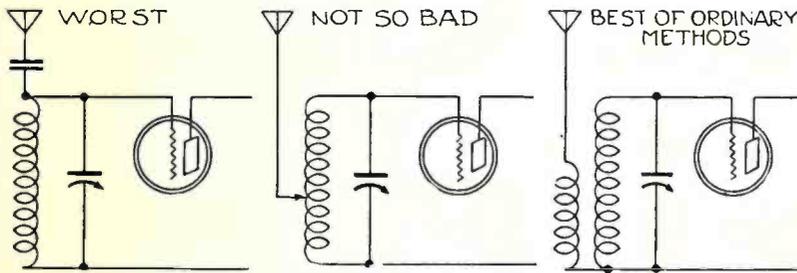


Fig. 1 Various forms of coupling the first R F tube

needed to the positive filament, this condenser may be left out, but a great deal better operation will be had with the negative filament grounded and the condenser in place. The type tube to be used may be either a "199" or a "201 A."

A "199" will produce ident-

In Fig. 1 are shown the various methods that have been used heretofore with some notes relative to performance with a single control receiver. In Fig. 2 is shown the improved method mentioned above and the circuit of an ordinary tuned radio frequency receiver. The part left of the dotted line is the part we are concerned with here. As may be seen, an extra tube is used. No gain in single strength can be expected because it is hardly possible that there is any

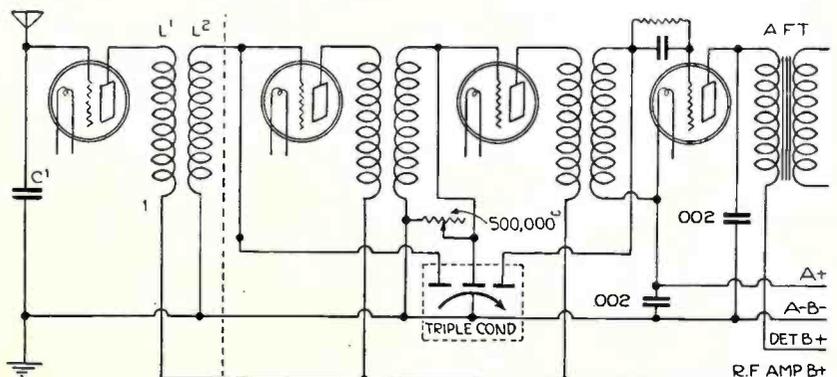


Fig. 2 Schematic of circuit suggested by author of this article

Truly This is a Radio Summer

*Broadcasters, Engineers and
Manufacturers Collaborate*

By DR. ALFRED N. GOLDSMITH*

THIS, the fourth summer of broadcasting, at last finds conditions pretty much suited to a genuine radio summer. Indeed, it is not stretching the notoriously abused radio truth to say that broadcasting has finally evolved from a seasonal amusement to an all-year-round service that brings entertainment, enlightenment and education day in and day out to the American public at large.

Psychologically, sociologically and technically, summertime radio makes its long proclaimed debut this summer. Psychologically considered, the radio devotee, during the long indoor season has grown to know the radio personalities that have come week after week into the home to entertain, enlighten, and to educate. The sponsored programs, ensuring the periodic appearance of certain radio features, have taken firm grip on the radio audience. The friendly contacts thus established are not to be broken off even though summertime may usher in a new order of things. Considered, sociologically, or passing from the individual to the radio audience at large, it is evident that radio has become a very necessary feature of everyday American life. The public must have its radio program just as it must have its daily newspapers, in summer as well as in winter. Technically considered, it is fortunate that means have been provided whereby radio service can be assured in summer as well as in winter. There has been a vast increase in broadcasting power. Marked improvements have been scored in radio receiving sets, making for better selectivity, greater sensitivity, and vastly improved tonal qualities.

Summer Programs

THE foundation of the broadcasting structure is, after all, the radio program. Hence any discussion of summertime radio must begin with a consideration of what broadcasters have to offer for those who listen-in during these warm months of the year.

A survey of the entire broadcasting situation discloses a continuation of the high level maintained during the past months in the selection of broadcasting material. In the passed season sponsored programs, with paid talent, have come into prominence, in marked contrast to the sustaining programs of the past with their voluntary talent. And the sponsored program, more than any one other feature, ensures the best of professional talent, a well-balanced program, and a continuity of effort from the beginning to the end of the year.

These program features so well known to the radio audience in all parts of the country, will, for the most part, continue on the usual schedule basis. The sponsors of the leading program features have not been slow to appreciate the necessity for this continuity, lest they jeopardize the efforts that have gone before. So we are assured a solid and worthy background of musical entertainment for the summer's broadcasting. Certain it is that there will be no decline in the high quality that marks present-day broadcasting from the better stations.

Outdoor Activities

SUMMERTIME not only means outdoor time for the radio audience but also for the studio staff. Program directors are keen to take advantage of all possible outdoor events,

sending their microphones and pick-up wires far and wide in search of band music, musical societies, outdoor orchestras and so on. Then, too, the radio reporters will be kept busy all this summer, carrying their microphones to the important sporting events, special ceremonies, national affairs and other outdoor happenings, furnishing up-to-the-minute news and word pictures to the radio audience.

Program directors promise us seasonal talks, aimed to interest and to aid the summertime audience. There will be just enough of these talks to add variety and solid value to the programs.

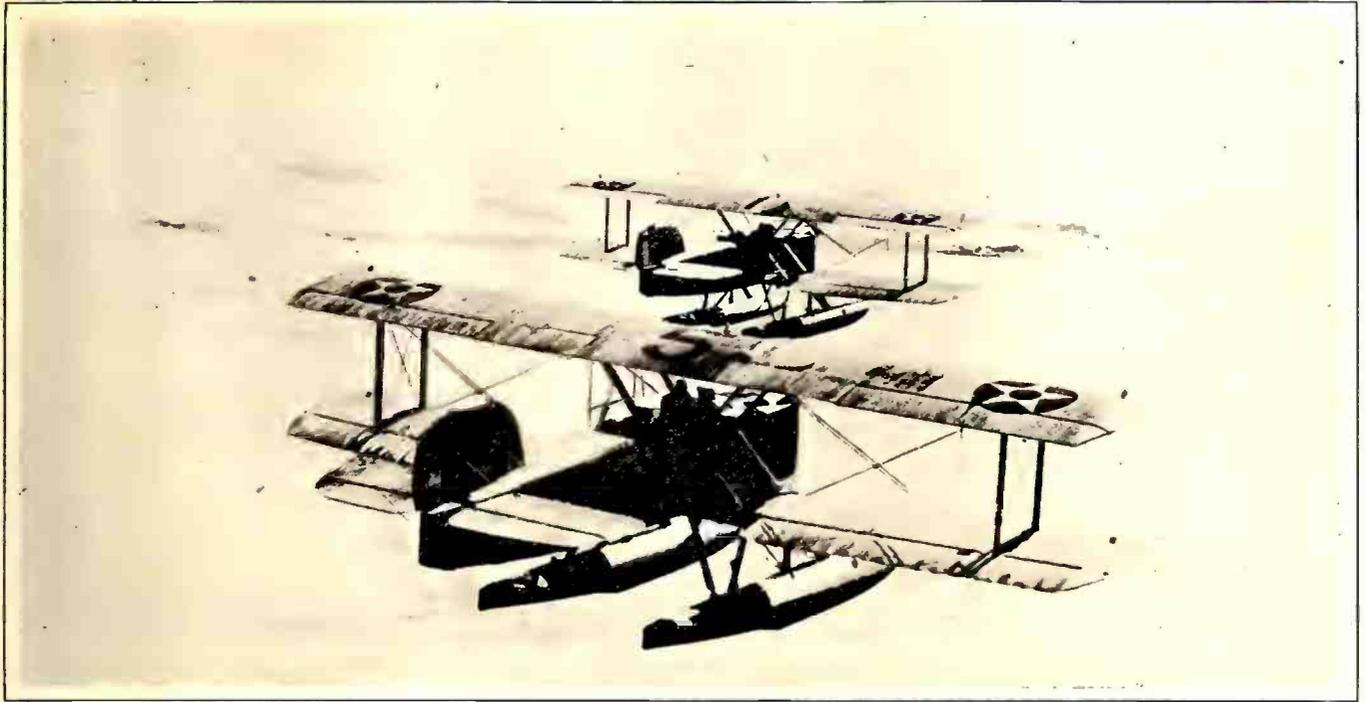
There will be news bulletins, too. In fact some broadcasters plan more news and more frequent news bulletins, bearing in mind that radio, in many instances, may supplement and extend the usefulness of the newspaper for those vacationists buried deep in the remote camp or the rural farm.

The keynote of summertime programs will be maximum entertainment, in keeping with summertime thoughts and moods. Most broadcasters promise more dance programs, to provide plenty of gaiety for those who take their radio along with them to vacation land.

Powerful Signals

FULLY awake to the necessity of meeting the occasional atmospheric interference of summer, the broadcasters, in their aim to provide all-year service, have increased the power of their broadcasting voices. It is most interesting to note that this summer there is 200 kilowatts more of broadcasting energy than there was last summer!

*Chief Broadcast Engineer, Radio Corporation of America.



Douglas torpedo planes operating as scouts and using radio for communication with their base

Naval Maneuvers Show Many Uses of Radio

*All Means Known Converted
Into Military Weapons*

By G. K. SPENCER

ALREADY at the portals, and even now entering into the gates of the web of the future, which looked so mysterious a few years ago, the United States fleets today have laid the cornerstone of their future war at sea on the art of radio. A radio, however, which begins to assume staggering proportions in the immensity of its scope. Already linking the fighting fleets, radio, during the maneuvers of 1926, one half of which are completed and the other half to be staged during the autumn months, has entered the province of actual combat.

A paralyzing warfare, a rushing rapidity of movement, deciding battles in the confines of min-

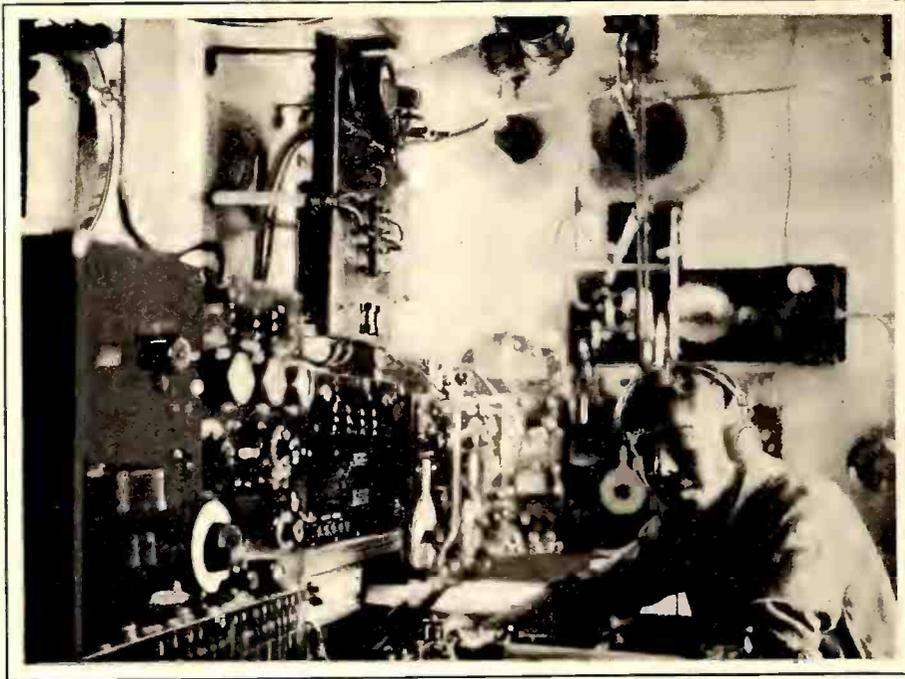
utes, has come upon us, and none realize this more than the officers and radio personnel of the Navy of the United States.

Plans which call for the construction of at least two full squadrons of radio-controlled "torpedoes," are now completed by the fleet staff—but these "torpedoes," are merely that in name—in reality, they are radio-controlled airplanes, loaded to the limit of their carrying capacity with explosives of the most intense power known to the military.

Amphibian Tanks

BUT, and this time we are not talking of simply plans, but of the real thing, the Navy of the

United States has placed in the water a fleet of amphibious tanks, every one of which is capable of communicating with the vessels of the fighting fleet, even while they move shoreward under their own power, and then up the beach to the assault of enemy works. By their radio, they keep the fleet's gunners informed of their location, so the fleet may stand off at sea and bombard enemy shore works, without danger of firing on the amphibious tanks sent ashore to destroy exposed enemy positions and receive the surrenders of enemy forces ready to yield to the fleet's guns—also to prevent the enemy retreating with safety. If the enemy attempts to leave his shelter, the



Typical scene in a U. S. Naval destroyer radio room. Receivers for all wave bands are shown as well as spark and tube transmitters

amphibians promptly machine gun him.

Another recent naval development with radio, has been the application of automatic recording of radio messages to the navy's aircraft. Eventually it is intended to do away entirely with skilled radio operators in the navy's fighting aircraft, evolving a general system for naval pilots and plane personnel to read their commands directly from an automatic radio instrument, likewise they will transmit automatic messages to the flags under which they operate. This principle has already been successfully demonstrated as practicable during the naval operations of this year, and its extension is simply a matter of time.

Profound Effect

WITH these new radio aids to war at sea, the United States fleet entered upon its summer schedule, and already within the scope of comparatively few months, it is discerned that they are to exercise a profound effect on naval tactics. Tactics which have changed but little since the days of Nelson, except for the increased celerity of movement granted by the introduction of steam are now feeling the impres-

sion of radio. The second great change of course in naval tactics, in the history of the world, is now in process of denouement.

Radio has enabled the ordnance experts of the navy to develop "indirect fire" to its extreme degree, and with the opening of the general maneuvers off Panama in the spring, we found

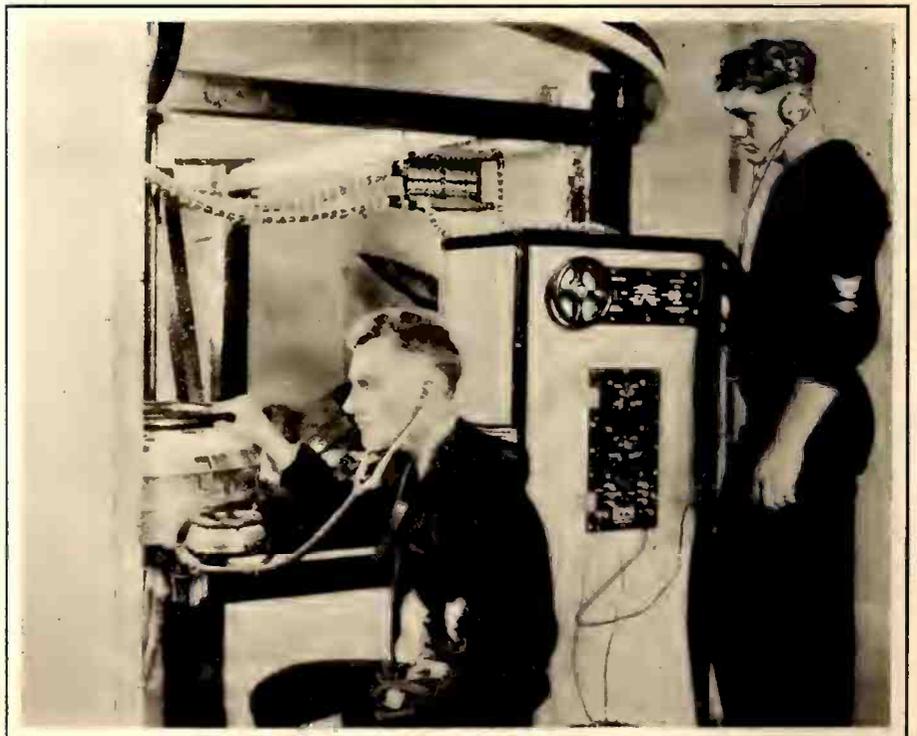
the entire fleet opening battle, and deliberately blinding itself to the enemy by the use of smoke blankets. Immediately with the sounding of the "enemy contact" alarms, thin wisps of smoke began to appear to port and starboard, and soon clouded the entire horizons, ringing the fleet in a vast amphitheatre of murk. To this was added a ceiling of chemical smoke when the air forces added the final touch to the scene.

From this moment onward, the mighty smoke blanket which moved hither and to upon the surface of the waters was merely a blind instrument of death, directed by only two sources, and both of these sources are radio sources.

From above, the ever-driving aircraft observed the enemy movements and fought enemy aircraft in order to secure information as to enemy strength. This entire intelligence reached the fleet traveling beneath the great surface cloud, by radio. Every shell fired was fired on a radio order.

Underwater Signals

THE other source of intelligence at the disposal of Ad-



U. S. Naval direction finder personnel on post. Great improvements have been made in radio compass work

miral S. S. Robinson, was from the submarine scouts, each submarine of which ferreted out the enemy on the surface and beneath the surface, radioing by means of microphonic messages, the information necessary to the admiral in command.

The net result was that an admiral in his cabin, with dimly burning electric lights about him and his staff, directed a first class naval battle without ever leaving the room, even to go on the bridge. The only utility the picturesque "long glass" or binoculars have today at sea is during the time between battles, or in peace-time cruising.

To this admiral in his cabin, with his staff, a constant stream of radio information sifted from the ship's radiomen, and even the gunnery officer accepted his ranges and trajectories from the radios of the over-flying aircraft.

In the air, of course, a furious battle waged, for the opponent, aware that the tide of battle was to be decided in the air, was endeavoring to achieve a preponderancy which would successfully prevent the transmission of radio

information to that great dark mass of moving vapor on the surface. The commanding admirals on the surface, in their cabins, would not know of the result of this aerial action until suddenly adequate aerial reports failed, or silence resulted from the nervous calls of the surface radiomen for information from the air.

Radio Eyes of Fleet

THEN, with his eyes effectually put out, the admiral in command might order a cessation of smoke-making so that he might have a fighting chance—though it could but be a forlorn hope—by fighting in stark nudity on the surface of the sea, exposed to the enemy's entire air and surface forces, themselves protected from definite gunnery by their own smoke and chemical fogs.

Radio, combined with air, has brought this situation about, and were it not for radio, neither air nor any other auxiliary of the fleet could function. There would be no fleet—in the modern sense!

Now, let us proceed to the general work of peace, or the routine of the fleets prior to battle.

When the fleets proceed to sea for a major cruise, direct radio from the mainland to the forces ceases. Thenceforward, until the forces either return to a United States port, or arrive at a colonial port, navy radio from the high powered stations, simply transmits general schedules between mainland and colonial ports, the fleet intercepting all messages which carry certain confidential and secret code words attached, with the understanding that such messages are for action by the fleet. A United States fleet moving in the South Pacific ocean, may be receiving its communications from a schedule being sent from San Francisco and addressed to Hawaii or even to an Alaskan station. Conversely, a northern moving fleet may receive communications through a schedule being sent from San Francisco or San Diego to Dairen, Canal Zone. This is done to prevent an enemy obtaining any indication of the probable position or destination of naval forces operating at sea.

Within the fleet, itself, a constant interchange of messages



All these aircraft are radio equipped and can take off at a moments notice. Orders are received by radio and reports made by the same method. Each plane has a man on radio watch



Radio compass housing mounted on upper deck. Radioman shown before the housing

progresses on low-powered instruments, until it is deemed unsafe, whereupon even low-powered transmission is stopped, until battle opens, when a veritable inferno of radio begins to fill the air.

Perhaps, the most recent achievement of the sea forces in radio communications, has been the transmission on 72 meters, with five watts input, of messages between aircraft operating on the Pacific coast and the Navy Department at Washington.

Short Wave Work

OPERATION on short wave-lengths has become a real practicality in the navy, and a recent naval dispatch was transmitted from Annapolis, Maryland, a naval high-powered station, to Admiral Mark Bristol, American Commissioner at Constantinople, aboard his Flagship, the U. S. S. Scorpion, lying in Constantinople roads, off the Sublime Porte.

So advanced has short-wave transmission become that the Naval Alaskan Flight Expedition, operating this summer in Alaskan territory, in conjunction with the

Department of the Interior, is making use of the short wave skip-wave method of communicating with the battle fleet flagship, which though it will be many hundreds of miles to the South—in Californian waters—will have command of the flight expedition in Alaska, under Naval Lieutenant B. H. Wyatt.

The aircraft in Alaskan duty will use standard Navy tube transmitters, with a transmission range of 1,500 miles, in the routine communications to the supply and flag vessels on the Alaskan coast, but the longer distance communications will be by skip-wave, thus for the first time utilizing the principle in a standard work.

In order to obviate ruses by spies in war-time, the Navy has definitely adopted the principle of transmission of pictures by radio, and signatures will undoubtedly be radioed to important orders in the future, as well as plans of enemy bases and shore works, as well as enemy new ships, which may be produced after the fleet has put to sea, but which would prove of value to the units moving into battle.



Naval radio direction finder with model submarine on test run

Beginner May Make 200 Mile Crystal Receiver

Consistent Nightly DX Reception if Set Properly Made

By M. L. HARTMAN†

and

JOHN R. MEAGHER‡

MANY readers will be surprised to learn a simple crystal set has given a fairly consistent nightly range of more than 200 miles. Yet this is not unusual; it is just the average performance of a well designed crystal set and has been done repeatedly this and the latter part of last winter.

From our location in Niagara Falls, New York, with an aerial and location no better than the usual, we have regularly listened to Pittsburgh, 200 miles away, to Springfield, 325 miles, to Schenectady, 250 miles and to Chicago, 450 miles.

This record may seem out of the ordinary and indeed we ourselves were surprised at first. But the manner in which the first set and others of the same type, used on our own and other people's aeriels operates, has convinced us that the feat may be duplicated at will.

Of course, there is a reason for this efficiency. It is owing almost entirely to the design of the circuit which incorporates the best 'low loss' ideas. (Incidentally the low loss plan, because of the absence of resistance-nullifying regeneration, is of far greater benefit in crystal than tube sets.)

The splendid range of this circuit and the admittedly fine reproducing qualities of crystal detectors makes this set desirable considering its extreme simplicity and low cost. As far as distinctness and clearness of tone is concerned, this, and in fact any well planned crystal set, is far superior to vacuum tube outfits.

Design of this set is far from being the result of a lucky accident; rather it is the

product of considerable research and experimentation. For in the early part of this year, in order to find the particular circuit and arrangement of parts for a crystal set giving the very best results, we spent considerable time comparing the relative merits of various forms of circuits, of different coils, of combinations of coils and condensers and of numerous variometers. The arrangement finally evolved is as efficient as can be made. It does not sacrifice volume for selectivity nor selectivity for volume, but combines and pleasingly retains the best features of both.

Briefly, the circuit is of the adjustable auto-coupled or conductive type. The inductance is fixed and tuning is accomplished with a variable capacity. Tests have shown this circuit to be fully as selective as any and far

more sensitive than the majority.

The connections are shown in Figure 1. The fixed value inductance—it has no "dead end" turns—is very easily made, consisting of fifty turns of annunciator wire wound in a single layer, turns side by side, on a cardboard, rubber or bakelite form 4" in diameter and 5" long. An empty oatmeal container makes as good a form as any. One foot leads should be left at each end of the coil for connections to the circuit. Annunciator wire (number 18 double cotton covered, paraffine coated, copper) may be bought in any radio or electrical supply store; it is admirably suited for the purpose and should be used. There is nothing mysterious about this coil and while it is not as imposing as spider-web and basket wound inductances, out tests have shown it to be better.

Tap the Coil

TAPS are made to the coil at every tenth turn. One of the best and easiest methods of do-

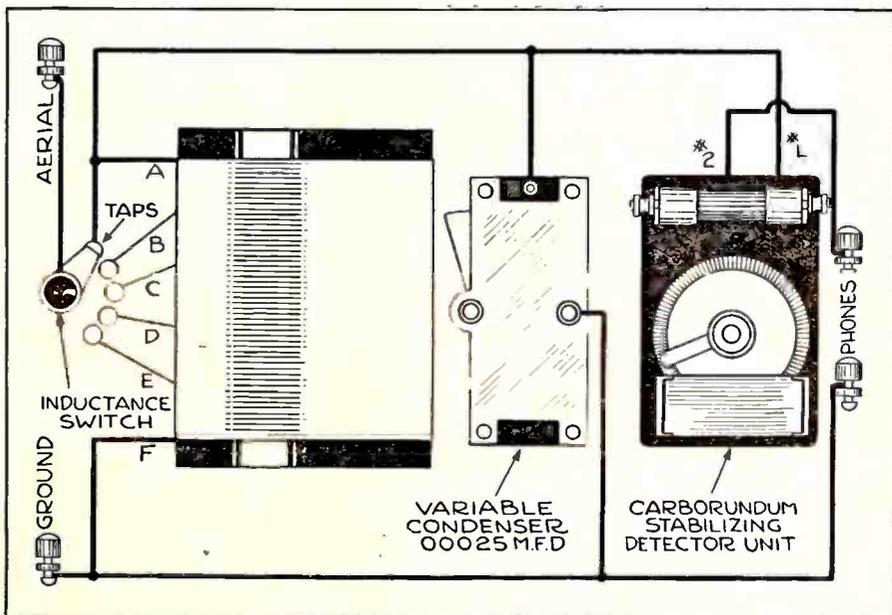


Fig. 1. Sketch of a simple and well designed crystal circuit. The coil consists of 50 turns of bell wire

† Research Director, Carborundum Co., Niagara Falls, N. Y.
‡ Radio Research Engineer, same company.

ing this is to insert a blunt point under a spot on each turn that is to be tapped and raising this spot slightly above neighboring turns. The raised portion may then readily be scraped of its insulation and the lead soldered to the exposed wire. There are six leads in all from the coil, one at each end and the four taps at the 10th, 20th, 30th and 40th turns respectively.

If the wire is wound tightly there will be no necessity for coating with some binding substance. However, if the turns are loose it is well to apply a coat of collodion, a few ounces of which may be purchased in any drug store. This should be done after the leads are soldered in place.

The variable condenser should be approximately .00025 mfd. maximum capacity. This value is generally found in the 11 and 13 plate types. If purchasing this item, it would be well to specify a straight line frequency (S. L. F.) type merely to keep abreast of the general popular trend. Actually any other style may be used with equally good results. The condenser should be well made mechanically and electrically. Price is not always a reliable indication of condenser worth. We have seen and used perfectly good S. L. F. "low loss" condensers costing one dollar.

The detector may be of any

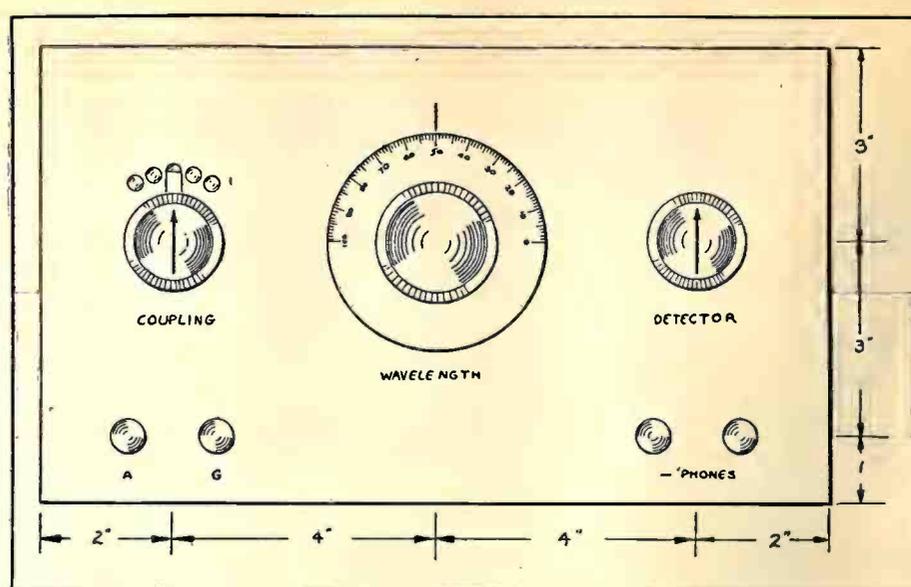


Fig. 2. Simple panel layout for the crystal set

type, though for best results its impedance or internal character should suit the impedance of the particular headset being used. It should also bear a certain relation (rather difficult of exact specification) to the input impedance. These conditions can best be met through use of electrically controlled Carborundum permanent detector (Carborundum Stabilizing Detector Unit). With this detector the impedance may be regulated to match any conditions. Being electrical the control is positive and the design affords smooth adjustment accurate to less than one thousandth of a volt. This is accomplished

in the unit with a high resistance neutral-point potentiometer having a positive and negative voltage range. A mica insulated shunting condenser is built in the base of the unit which, as can be noted from the drawings, is a single control, single hole mounting device.

Selectivity Range

ANOTHER Point in favor of the electrically controlled detector is that the damping effect of the detector on the tuned circuit may be regulated through a wide range—resulting in an equally wide selectivity range. This works out in such a way that stations spreading, say, ten degrees over the tuning dial with an ordinary detector, may be restricted to two or three degrees through proper adjustment of the electrically controlled Carborundum detector unit. This is a particularly valuable feature in crowded radio districts.

The coil, the condenser and the detector unit are the main items. They, together with the panel, bus wire, binding posts and inductance switch should be collected before starting actual assembly.

The parts may be mounted on a 7"x15" radio panel or they may be fastened to a plain shellaced wood base in laboratory fashion. The switch points should be placed close to the coil in order that the tap leads may be as

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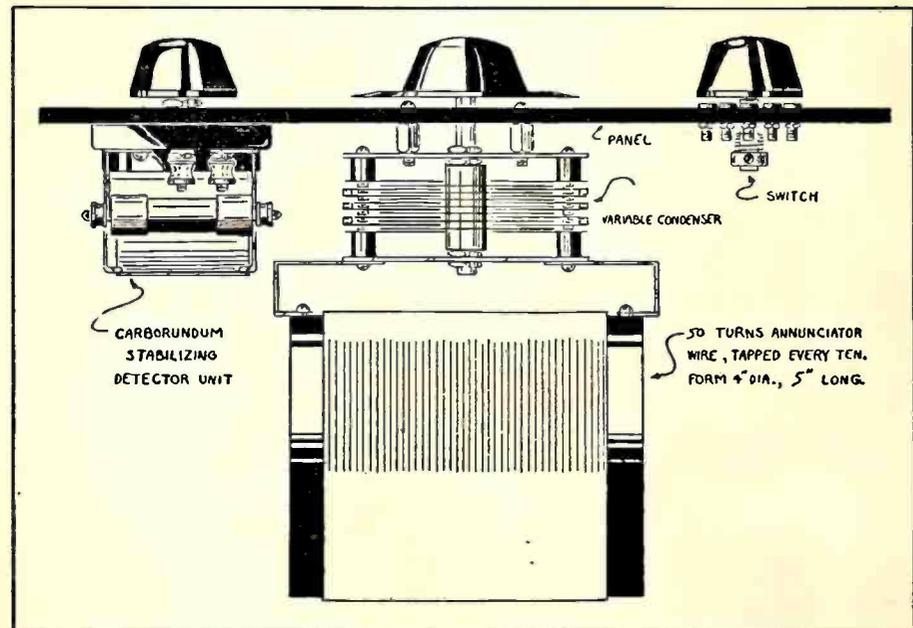


Fig. 3. Behind the panel; Showing the principal parts; variable condenser, coil and detector unit

National Radio Farm School

By

SAM PICKARD*



"Uncle Bert," the garden expert, who will use radio to help gardeners

ACHIEVEMENT of almost instantaneous dissemination of pertinent information to the operators of America's fundamental industry, agriculture, is one of the most effective accomplishments of the modern century. Yet only the fringe of the real possibility of flashing information to the American farmers has been touched. Numerous factors in the past have made it inadvisable for radio stations to devote more than a few moments each day to the broadcasting of market prices, etc.; the chief of these was the fact that radio sets were first purchased by city residents, who were interested only in programs of entertainment. With the rapid increase in the number of receiving sets throughout the country, this situation has been entirely changed.

Today about sixty per cent of the nation's population is on farms and in towns of less than 5,000 population. This group,

*Chief of Radio Service, U. S. Dept. of Agriculture.

while primarily interested in radio programs of entertainment, has expressed its eagerness for information which will be helpful in manning the industry of agriculture. Radio stations could well afford to devote at least ten per cent of their programs to broadcasting important farm information; but how many stations in America are doing this today?

Warm Response

DURING the past few years several colleges have flashed lectures, brief items of farm news, market quotations, and other features to the farmers of their respective states. Those stations have received a warm-hearted response from the farmers.

The first organized effort on the part of the United States Department of Agriculture to reach, by radio, every corner of this vast country with pertinent general farming information,

was made on February 15, 1926, when a few experimental features were sent to numerous broadcasting stations. This effort was so successful that the Department of Agriculture is now launching the most comprehensive and valuable program for all persons interested in agriculture that has ever been known in history. Scientists and economists are taking posts as teachers and advisers, not in colleges where the enrollments are necessarily restricted, but in the national college of the air, where millions of people may receive the benefit of their efforts.

The possibility of revolutionizing farm methods and placing America's basic industry on a sounder economic basis is enormous. The national farm school can accomplish in a short time, what educators have hoped to do over a period of many years. The farmers are now able to sit in their homes, receive assign-

ments from scientists, and then go to their laboratories—the farms—and carry out the experiments.

The Organized Plan

IT is not the intention of the Department of Agriculture to send its radio material out in a hit-or-miss fashion. Definite plans for making direct contacts with the farmers have already been made. The farmers are enrolling for the air college courses indicating their preference of stations for broadcasting the programs. This step is essential in order that the farmers may get the best possible reception at all times, as the preferred station is the one whose energy reaches the receiver with the greatest clearness. The national air college programs will then be allotted to the radio stations as requested by the farmers.

The service from the Department of Agriculture comprises a dozen different features—all diversified as to subject matter and method of presentation. All of it will be popularized and some of it dramatized. A brief resume of the program, which will begin on the first Monday of October, 1926, gives a general idea of the vast quantity of valuable information to be made available.

Weekly Letter of Dad

Son at college writes an interesting letter home each week telling the folks some of the high spots in his studies of agri-

This article is a preliminary one covering the scope of the National Radio Farm School which will be inaugurated by the United States Department of Agriculture.

Beginning with the September issue of Radio Age we will have an article each month by Milton S. Eisenhower, of the Department of Agriculture at Washington, who will keep our readers in touch with "Radio on the Farm".

Be sure to get your September copy for it will be a treat.

Editor.

culture which he believes might well be put into practice on the old home place. These letters, which sparkle with human interest, carry important farming messages. Those who follow

Jim's enthusiastic correspondence with dad will have a treat to look forward to each week.

Infamous Bugs and Rodents

Ten-minute talks about "pests that are bothering now," as told by the insects and rodents themselves. A lesson in the control and eradication of those pests which cause tremendous loss in money and lives will be told as a fascinating and humorous story with the object of captivating the attention of both youngsters and grown-ups.

Chats With Weather Man

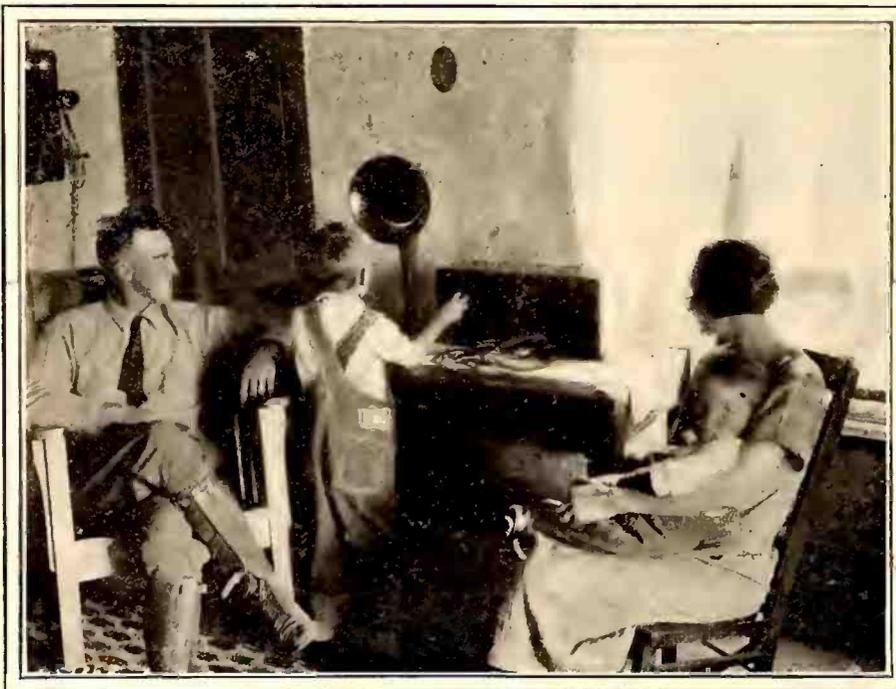
A five-minute discussion each week on the ever interesting subject—weather. These talks are popular discussions of weather facts and phenomena, which play an important part in the daily life of the nation, timed with reference to giving the information practical application.

Primer For Town Farmers

This ten-minute weekly feature should be one of the most popular offered by the Department of Agriculture. Those subjects of particular interest to urban dwellers, such as "Care of Golf Greens," "Lawns," "Cut Flowers Culture," "Pruning Shrubs and Trees," "The City Garden," "Porch Boxes," etc.

U. S. Radio Farm School

In the U. S. Department of Agriculture Farm School of the Air, the farm will be the students' laboratory. Concise, timely lessons, which dovetail with the daily farm work, will be presented in an attractive style by foremost agricultural authorities. Laboratory assignments will necessitate putting into practice the subject matter taught. Each radio short course will be supplemented with printed copies of radio talks and a file of bulletins. Students, who regularly enroll and follow a lecture course through an eight weeks' period and report on one or more of the laboratory assignments, will receive official recognition of their work in the form of a certificate issued by the Secretary of Agriculture and chiefs of the bureaus sponsoring the courses.



Perry Brown, Sherman county, Kansas, his wife, and two sons listening to their set—Photo by U. S. Dept. of Agriculture



The Peterson family and their neighbors listening to radio. (Morris County, Kansas)
Photograph by courtesy U. S. Dept. of Agriculture

The national college of the air will deal with all phases of livestock, poultry and dairy problems. Twenty-four short courses, of eight lessons each will be offered. The only entrance requisites are ambition and a radio set. A million enrollment blanks will be distributed to farmers during the summer and fall. Prospective students will be asked to designate stations from which they wish to hear the livestock lessons.

Housekeepers' Chat

An informal daily 15-minute program featuring: (1) Questions Women Are Asking; (2) What Shall I Have for Dinner?; (3) Backyard Gossip. Answers to all pertinent questions of general interest to housewives; a suggestion in response to that old problem, what to cook expressed in terms of menus for the food requirements of an average family; and last, a little personal consultation on those important household subjects such as nutrition, clothing, health, decorations, etc.

Fifty Farm Flashes

Each flash includes a timely, practical farmer's question, answered concisely, clearly, and completely. Approximately twenty minutes are required for broadcasting the questions and

answers. A different subject is treated on each of the five broadcasting days of the week, in order that farmers may listen in for the program dealing with the subjects in which they are most interested. The farm-flash program is: Monday, livestock; Tuesday, crops and soils; Wednesday, poultry; Thursday, fruits and vegetables; Friday, dairying. The question and answer method

of presenting important timely information is probably the most successful that has as yet been used in radio broadcasting.

The services described are furnished free of charge to the broadcasting stations chosen by the farmers and the Department of Agriculture for flashing the information. While the scientific facts are not distorted in any way, experienced editors in the Department adapt material to that exacting form necessary for effective radio presentation.

Direct Contacts

THOUSANDS of direct contacts will be made with the farmers through the U. S. Department of Agriculture Farm School of the Air. In many instances radio stations will cooperate with state agricultural colleges, thus supplementing material contributed by the Department of Agriculture.

More than one hundred broadcasting stations have already utilized one or more services from the Department of Agriculture. Practically every section of the country has been benefited by these utility programs. The Department is now working in cooperation with various agencies with the object of stimulating a widespread increase in the number of receiving sets on farms.



Sam Pickard, newly appointed Chief of Radio Service of the U. S. Department of Agriculture, and an idea of the mail received asking agricultural advice, which will be given by radio

Radio is Now Utilized As Mine Gas Detector

PITTSBURGH, PA.—An important use for radio in safety work has been developed. It is now being applied in its simplest form to the safeguarding of miners in coal fields against the destructive and deadly effects of gas accumulation. The presence of gas in dangerous quantities is indicated by this radio device. It has a sensitive relay apparatus which actuates warning alarms that will permit the clearing of the affected areas or the entire mine of the operating personnel if the ventilating system cannot relieve the dangerous congestion that is likely to result in explosions and fire at any moment.

Chief Causes

THE two principal contributory causes of mine disasters are the explosions of methane gas and the ignition of fine coal dust which saturates the air. The latter is particularly high after a number of shots have been fired baring new faces of coal in the numerous galleries of the operation. This freshly mined coal dust when ignited explodes with incredible violence, wrecking everything in its path and spreads with unbelievable rapidity from shaft to shaft until the entire mine is a total wreck. The devastating effects and loss of life are only too well recorded in news accounts to need repetition here, and while the records show that fatalities from this source represent only a small percentage of death from accident in mines the toll is one that scientists believe can be eliminated, reducing the miner's risk to a minimum. With the acts of nature under which heading mine explosions are generally considered removed, the miner's own carelessness will be practically the only element against which he has to guard—which, incidentally, is responsible for the greater part of mine deaths. Based upon the principle of the electrical conductivity of various gases this radio adaptation brings into use the sim-

plest of radio circuits consisting of nothing more than an air condenser, a vacuum tube, a sensitive relay and alarm bells. The principle on which the condenser works makes this possible. The plates are charged with electric energy that is discharged only when the current stored is of sufficient strength to break down the dielectric properties of the medium separating these plates, or when the dielectric itself changes to one of greater conductivity, permitting the condenser to discharge its stored energy. It is on the latter principle, the change of the dielectric medium, that the mine gas detector works. The air condenser in this instrument is inserted in a small duct through which air is pumped or drawn from various parts of the mine, each particular gallery having its own separate gas detector unit. These units will be located on the surface of the earth as part of the fan and ventilating control equipment.

While the air passing through the condenser is clear of gas the circuit remains open, but when the air comes through carrying coal dust in finely divided particles the ionization of the atmosphere between the plates of the charged condenser becomes more perfect depending upon the amount of dust suspended in the air, until the condenser discharges. The frequency of the discharge depends entirely upon the amount of dust in suspension. Each discharge of the condenser is accompanied by a closing of the relay circuit that rings the bell. The rate at which the bell rings gives a reliable check on the change of conditions below so that the operator in charge of the control board can regulate the ventilating system to relieve the condition before it becomes a menace by either drawing out the air or forcing a fresh draft to dissipate it.

With the large, high-speed

fans now used in mines it is possible to change between 300,000 and 400,000 cubic feet of air a minute. They work in either direction equally well and either force the air down or draw it out of the mines to suit the exigencies of the occasion.

Other Problems

THE separation of the plates of the condenser is dictated by physicists, chemists and mining engineers, who have determined when the percentage of dust and gas assumes dangerous proportions. The problem of detecting various amounts of percentages of dust nearing the danger point was comparatively simple. The gases that are lighter than air present other problems that are now the subject of research, and it is hoped by mining engineers that their detection will be as positive and reliable as that of the dust hazard. In the lighter than air class comes the carburetted hydrogen group, better known as marsh gas, the result of decaying vegetation.

Once the constants of the various gases have been satisfactorily established, engineers are of the belief that one of the mine's greatest hazards will be removed and leave only the very visible signs of impending disaster for miners to contend with, such as falling roofs, which are usually preceded by cracks and flaking off of small pieces as well as bulging timbers and other signs that miners understand.

In the not far distant future radio will find more uses in the industrial world as we scratch deeper the surface of the subject which today is just growing out of the novelty stage. This latter statement will undoubtedly raise objections from many who think radio a perfect science in its present stage. The potentialities of radio are unlimited, as it goes back to the fundamentals and deals with electrons, the little particles that make possible discharge of energy across the gap of the gas detector, an action that is positive and unailing.

When Broadway Came to Main St.

Listeners Outlook Broadened Through Medium of Loudspeaker

By

DOROTHY BRISTER STAFFORD

"Oh, East is East and West is West, and never the twain shall meet,

*.....
But there is neither East nor West, Border nor Breed nor Birth,—"*

SINCE the dawning of radio broadcasting—if one has the temerity to take liberties with the oft-quoted poet, who was writing about something entirely different back in 1902. But the lines do seem so perfectly adapted to radio. Distance is swept away, the East is brought West, the South goes in all directions, one class is learning about another class, rooted prejudices are swept away over night; the urban and the bucolic, the ridiculous and the

sublime, the best and the worst are all churned up together in this modern maelstrom, which, for want of a better name, we call radio broadcasting.

No wonder the new listener is befuddled, bewildered and oftentimes discouraged before he gets the maze charted and is able to steer an understanding course through the turbulent sea that engulfs him the first time he experiments with his radio set. It has grown so rapidly—this baby wonder—and the keen, young minds that are ever on the alert to provide provender for every possible taste represented in their huge audience have functioned so lavishly that the result is beyond the wildest dreams of the early broadcasters.

But to us it is not alone the features that are designed primarily as educational that count, it is the unconscious absorption by the radio listener of modes and customs of which he has heretofore lived in ignorance, that is so interesting. He is picking up things about life as it is lived, through his radio set, which, while they may not give him a greater mental or moral stimulus, certainly are broadening his outlook upon existence to an extent he could not possibly achieve in any other way than by the reading of books.

What Public Wants

AND one has but to stop and blink for a minute at the overwhelming display of lurid magazines that sprouts forth on every corner cigar-stand, that blocks one's entrance to every



Milton J. Cross, chief announcer of WJZ

drug store, and even overflows into the shoe shining shops, to realize that the American today is not a reader of books. He seems to demand in his literature—if such it can be called—a portrayal of a hectic, neurotic life such as never was lived on land or sea, and something as far removed from his normal existence as the imagination of the fictioneers can produce. Anything within the bounds of reason bores him to distraction, and he refuses to read it. Even the yellowest members of the press are now passed up for the omnipresent tabloid, with its distorted, perverted pictorial handling of the news. So where is a citizen of this great commonwealth to get an idea of the life of his neighbors if not from his radio set? If he hears good music and instructive talks he must know that somewhere there are people who appreciate that sort of thing, and if he has a brain at all, he may be moved to find out what it is all about. On the other hand, if he is a severe, hide-bound, solemn fellow, and his radio set brings him an inkling of the lighter things of life, something is accomplished there, for he will have a broader, more tolerant view of his fellow man, and particularly a better understanding of the younger minds about him. We have all noted cases like that of the old-fashioned, careful mother, who feared the radio was going to cor-



Norman E. Brokenshire, announcer at WJZ, who has broadcast some of the most important features put on by that station

rupt the minds of her children, and who now, almost any night at ten o'clock, can be found rolling up the rugs to dance to the strains of some popular orchestra.

And one of the most singular things about the situation is that listeners of a certain class are not wildly enthusiastic over the broadcasts that are planned especially for them. They are looking—as in their fiction—for a kind of life they are unfamiliar with. The city dweller, surrounded as he is by the best entertainment the country can produce, is likely to angle for the remote station, in the hope of running across something different, and vice versa.

Uncle Perks Up

IT was one of the first really bright spring days, and we had driven out to the farm to see how Uncle John's rheumatism had survived the winter. He greeted us with a great deal of satisfaction, and said:

"Now you can tell us what a supper-club is."

"Why, Uncle John, when did you get a radio set?" we asked. His blue eyes twinkled, "And how did you know we had one?"

"Where else would an old innocent like you hear about supper-clubs?" And then in the sitting-room, enthroned upon the wide window-seat, looking out across Uncle John's broad acres, we found what he called his "humdinger." And it surely was. No two-tube mail order set for Uncle John. With high-powered cars in the barn, the latest gadgets in farm and dairy machinery, all modern kitchen improvements for Aunt Hetty—when he started out to buy a radio set, he got one. He proudly displayed all its shiny insides, its power tubes and up to the minute condensers, and produced a sheet of butcher's paper with what looked like the radio call book transferred in his neat writing, which he proudly informed us was his log. He had heard stations we didn't know existed, and sitting cozily in the midst of his own wide domain he knew nothing of the interference from steel buildings, electric power and neighboring sets that exists for all us city-bound listeners.

"It's changed our whole way of living," said Aunt Hetty. "All winter Pa has been taking a nap as soon as the men bring up the evening's milk, and then we sit up till scandalous hours. But, my, we've had lots of nice evenings. I don't know what we ever did before we got it."

Then we took up the business of supper-clubs. We found that Uncle John, by one of those strange perversities of which the human mind is capable, instead of being attracted by the sort of music with which he could re-



George Olsen, leader of the Hotel Pennsylvania Grill Room Orchestra, who broadcast through WJZ

sonably be expected to be familiar, had become fascinated by the type associated with the wild night life of great cities, and had spent most of his winter listening to it. He knew every jazz hit of 1925, and had formed opinions and prejudices regarding the performers that seemed wholly out of accord with the normal workings of the mind of a Presbyterian deacon who had never visited a really large city in his life.

"After he gets the market report and listens to all the speaking about politics, he won't listen to anything but New York City," said Aunt Hetty, "and while some of it's nice I'd rather hear the old-fashioned tunes oftener."

Listen to Jazz

RECALLING how many "old-fashioned tunes" we had heard from the city the past win-

ter, and the many programs designed by ambitious directors with her type of listener in mind, we wondered just where Aunt Hetty had been dialing. And while we endeavored to clear up some of Uncle John's erroneous ideas in regard to supper clubs, we couldn't think of anything more incongruous than the picture of those nights that presented itself.

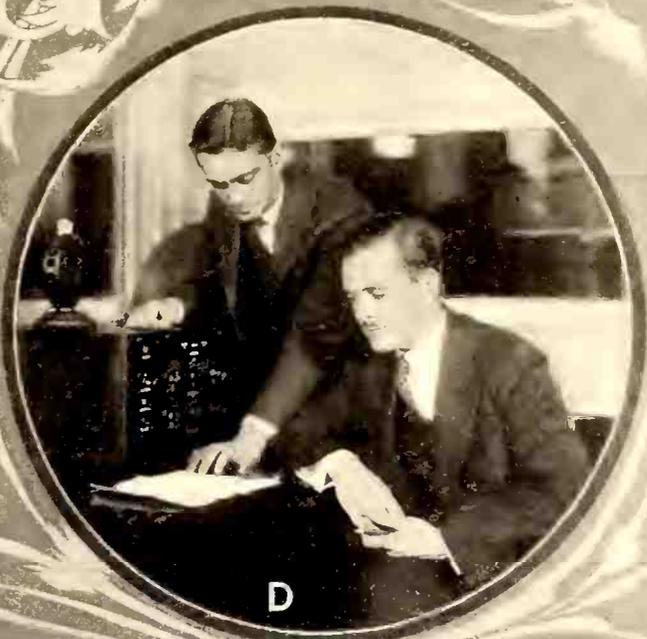
The quiet, peaceful farmhouse—Uncle John, with his pipe on one side of the base-burner, with old Sport, dreaming of rabbits at his feet; Aunt Hetty on the other, the cat purring cozily in her lap, and her fingers busy with the everlasting pillowcase lace she has been knitting ever since we could remember, listening to—what? To the wailing of clarinets and the twang of banjos in the hands of eight or ten dapper young men, with heads shining like trained seals, with the best tied ties north of Times Square and weekly incomes from their nimble fingers and flexible lips equal to the returns from Uncle John's wheat yield for the entire year. And the surroundings of the entertainers, as they thumped and tooted and jazzed and rhythmized,—was there any way of picturing the scene to the couple listening far off in the middle west? The gleam of white shoulders, the flash of golden hosiery, the wild abandon of the Charleston—the whole milling mass glimpsed dimly through the smoke,—the combined odors of quelques fleurs, Russian cigarettes, French cigarettes, home-grown cigarettes, gin—what was the use? The quiet farmer who had spent his days in peaceful fields among gentle-eyed cattle could never see it.

"Well, by cracky, I'd like to go to one of those places," was Uncle John's comment, "though I don't see how they get people to pay for just sittin' down at a table. Joe Reynold's girl sent him a picture of the Pennsylvania Hotel, but I told him I heard their band playin' every night or so right here at home."

Uncle John, of course, could have lived and died very happily in ignorance that a life so entirely

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Baltimore's New Station



- A—Here we have the WBAL Trio which has recently become a regular musical feature at Baltimore's super-power station. Reading from left to right are: Celia Brace, violinist, Florence Walden Otey, pianist and Helene Broemer, 'cellist. These artists may be heard every Friday night from 9 to 10 p. m.
- B—H. J. Peterman, leader of the U. S. Naval Academy Band. This band broadcasts from WBAL on Tuesday nights from 9 to 10 p. m.
- C—Program supervisors are not usually artists themselves, but in this case we note an exception. Gustav Klemm in addition to supervising the WBAL programs is conductor of that station's concert orchestra.
- D—Two of the staff announcers of the Baltimore station are shown above. Seated is Stanley W. Barnett and James Wilkinson is standing. The former is also the studio manager of WBAL.

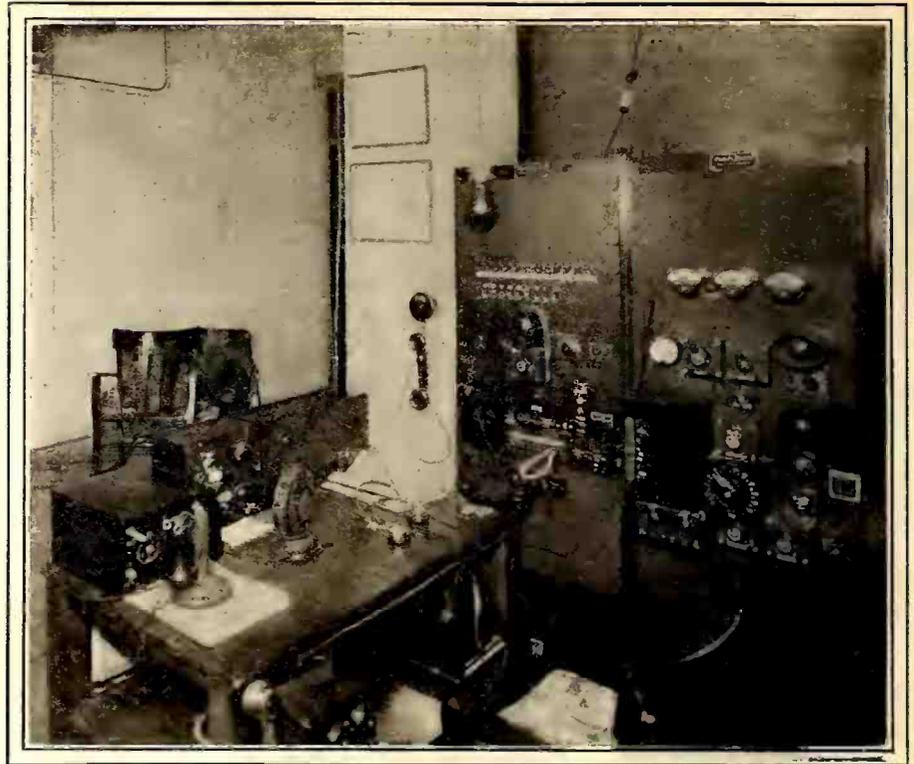
San Diego Now Has Broadcasting Station

By EDNA DEXTER

IT was a tense dramatic moment. Radio fans gathered eagerly about their sets. Watches were consulted every few minutes. Then, with a throb of excitement, a sound broke the stillness. The great moment had come. San Diego was on the air!

All this took place on March 27, the opening day of San Diego's first broadcasting station. For weeks the public was kept informed of the expected event, and the program that marked the first entertainment was something that local radio fans will long remember.

The celebrated "Uncle John" of



Operating Room of Station KFSD

KHJ Los Angeles was the guest announcer. There were speeches by the mayor; Admiral H. Robertson of the 11th Naval District; the president of the Chamber of Commerce; and prominent men

from various organizations. The entertainers represented the best talent of the city, and the numbers lasted till past midnight.

Station KFSD is operated by the Airfan Radio Corporation, and is located on the roof of the luxurious Grant Hotel. A specially designed studio, each room of which is padded with noise-proof celotex, and further protected by heavy velvet hangings and tapestries, houses the \$30,000 enterprise.

The enthusiasm with which the public-spirited citizens greeted the news of a high powered radio broadcasting station can easily be understood. It will now be possible to tell millions of radio fans about San Diego, the Silver Gate City. A new avenue of publicity has been opened, which will indirectly benefit every activity throughout the county. The establishing of a broadcasting station also insures the many advantages resulting from a new industry.

Benefits San Diego

COMMENTING on this, Hal C. Rogers, president and general manager of the Airfan Radio Corporation says:

"San Diego is deriving more

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Studio of Station KFSD

Stories *the* Studio Microphone Relates

*Coolidge Cool; Grange-Modest,
Bugs Baer Sad and Duke Wild*

By GWEN WAGNER

IT'S barely possible, of course, that you don't care what goes on on the other side of the microphone. It's barely possible that you wouldn't give a hoot to know whether your favorite movie actor was paralyzed with fright the first time he faced the microphone or whether he walked in and confronted the instrument with as much aplomb as he ever did the camera.

I say it's barely possible, but hardly probable. Breathes there a radio fan with soul so dead that to himself he hath not said, "Wonder what that guy's like anyway? What makes his voice sound like



Red Grange

that? Is he scared or is that the way he talks all the time?"

For your easier identification, this story will concern itself with references to the great and the near great. How they conduct themselves before the microphone. What their studio manners are.

You've probably been told, time

and again, that everybody who faces the microphone for the first time is scared to death. That isn't true. Maybe most people are scared to death but a few of them aren't.

Cal Is Cool

FOR example, there's Calvin Coolidge, president of the United States. I'm told he was as cool as the well-known, though slightly indigestible cucumber at his first appearance before the microphone. He hemmed not, neither did he haw. He delivered his address in an even, steady voice that went over the air with every vowel and consonant intact. Indeed, I am told that his radio talks are far more impressive than those he makes in person before an audience.

Senator Walsh, of Montana, is another cool one at the microphone and a gentleman whose voice has broadcasting qualities surpassed by none.

Buck Jones, movie star, was pronounced a "swell fellow" in the studio from which he first broadcast. True, he arrived at the studio laden down with diamonds of every size, shape and description but even their dazzle couldn't put Buck's undeniable manliness in the shade.

Somebody or other (maybe Buck himself or maybe his press



Crown Prince Paul of Greece

agent), had provided notes for the occasion. Buck, of course, was merely to read them off in front of the microphone. Buck started out all right but he hadn't been on the air sixty seconds until he became so enthusiastic he threw his notes away and never looked at them again. He delivered one of the most interesting talks ever reported by this particular station.

The Unexpected

“**B**UGS” BAER, famous newspaper writer and humorist, let loose a veritable tornado of wise cracks before his turn at the microphone. He laughed and jested and did everything anybody would want, and expect, a humorist to do. He even displayed his prowess as a wrestler before an admiring, if amazed studio crowd.

And then Mr. Baer took his place before the microphone. The whole studio held its breath, waiting to hear the wisest of wise cracks fall from the lips of Mr. Baer. And did Mr. Baer choose to be funny before the microphone? He did not. Mr. Baer went in for something rather vaguely and mournfully entitled “A Pauper’s Will,” a piece so blatantly sad that by the time he was finished everybody was ready to break right down and bawl.

The Crown Prince Paul of Greece arrived with a full staff of attendants, some eight or ten in number. He was early and while he waited, his majesty must have a cigarette. But ah! He had no match. He made this fact known with a quiet and inconspicuous request for one. Immediately the whole staff of attendants rose. They scrambled over each other trying to get to the prince with a match. At last someone did and the prince puffed contentedly while he awaited his turn.

It might be interesting to know that the prince was consumed with curiosity about the radio broadcasting set and its manipulation. He went around and touched it speculatively with his finger, exactly as a small boy might. He must have been profoundly in awe of the microphone because he faced the mirror and adjusted his monocle before he went on. Permission had been

given him to speak a few words in his own tongue to his countrymen but he became so excited and nervous before the microphone that he forgot it entirely.

M. S. Szymczak is a professor of philosophy in the De Paul University, Chicago, and while, in line with his duties, he often instructs students in public speaking, etc., he himself does some very unnecessary things before the microphone. For example, he gestures dramatically throughout his talks. For that matter, a great many speakers do.

Talks Her Way Out

STATUESQUE and beautiful Ethel Barrymore was scared in the studio but she kept her head. She talked herself out of the place. She said she was pleased with this and she was pleased with that and before anyone could recover from this overflow of compliments, Miss Barrymore had pleased to vanish from the studio.

The Duke de Travise, a French nobleman, handed one bright young radio announcer a good hard jolt. The duke went through his little piece before the microphone all right but when it was over he charged out of the studio into the next room wherein a radio receiving set was turned

on. Some music was being broadcast. The duke listened attentively and then turned and addressed the young announcer who had followed him to discover the reason for the duke’s haste.

“Very nice,” volunteered the duke anent the music which was coming over the air.

The announcer admitted it. Still the duke listened with, perhaps, a more profound attention than was absolutely necessary. In fact, his air was that of one listening to one thing and waiting for something else. At last, in apparent desperation he turned to the young announcer.

“When,” he demanded in no uncertain syllables, “does my speech go on?”

Modest Red

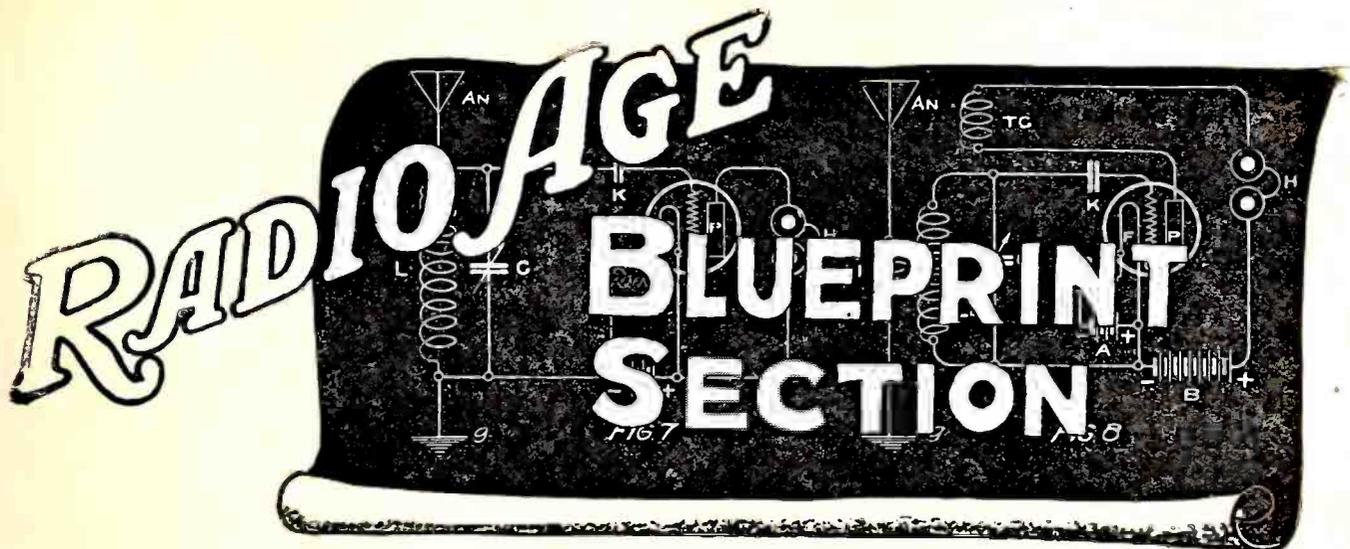
WHEN Red Grange made his first appearance before the microphone he brought his gang with him. His manager was there. Some of his team mates were there. Some of his admirers were there. And not a few of those who always and eternally bask in the reflected glory of some personage without, apparently, having any reason for doing so.

Grange, however, appeared the least important of the entire

(Please turn to page 48)



Bugs Baer



Receiver, Transmitter and Wavemeter for the Short Wavelengths

*Low Power Telegraph Set
Designed For Wet or Dry
B Battery Operation*

SHORT waves, on the order of 20 to 80 meters and even lower, which were five years ago considered impractical for transmission purposes, have now by research on the part of the amateurs and the communication interests become so well known for their distance propensities, that anyone with a limited amount of apparatus and a little outlay of money can build a short wave transmitter.

Telegraphically the man in the country need no longer be isolated from his fellow fan in the city. Likewise the city fan need not worry about an extensive antenna system, since antenna systems for the extremely short waves are very inconsequential things compared to the larger and more complex antennas used in years gone by on the 200 meter band.

Power sources are no longer an obstacle to the fan who would like a short wave transmitter. Heretofore a generator or a messy electrolytic rectifier was generally necessary, but today on the shorter waves there are thousands of B battery operated sets which are regularly covering sub-

By F. A. HILL

Associate Editor

(Copyright 1926)

stantial distances with a small B battery input. The National Carbon Co., the Burgess Battery Co., and other varied interests, have been doing good work on little transmitters that two and

mitter consisted of simply a Western Electric J tube (the old Navy receiving tube) with 180 volts on the plate, with which even then on 200 meters, he was successful in bridging distances of from 300 to 500 miles. For greater distances and more reliability it was necessary to go to higher power and larger tubes, but that is a different story.

We are now concerned with the operation of a short wave transmitter especially for the 40 meter band, with possibility of slipping down into the 20 meter band if it is found results are better there. Towards this end we are determined to keep the apparatus itself at a minimum both as to quantity and cost and with a most careful regard for simplicity. The question of losses enters into a project of this type and consequently we will decide upon material which will keep those losses down to a minimum.

Some of the material on hand in discarded regenerative sets might be utilized in the construction of a short wave set for low power operation, such as a socket or two, an audio transformer (for the receiver) and other

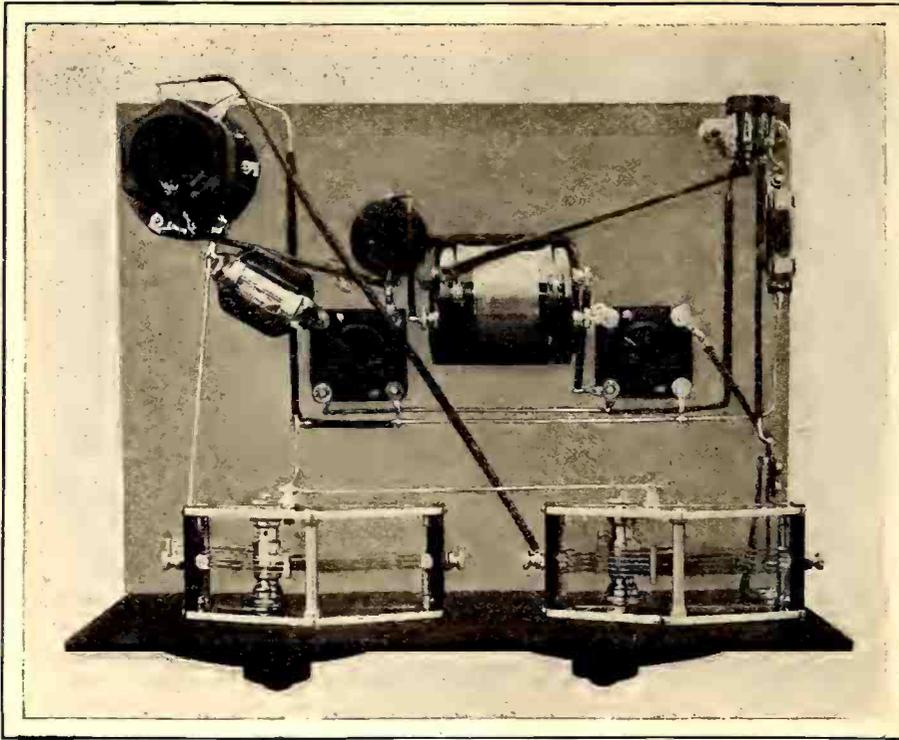
Wavemeter Parts

- 1 0-1 d. c. milliammeter, Weston.
- 1 .00035 Cardwell, taper plates.
- 1 Carborundum detector unit.
- 1 Silver-Marshall coil socket.
- 1 7 by 13 by 3-16 hard rubber or bakelite.
- 1 Silver-Marshall coil form (blank).
- 1 National type B dual range vernier dial.

three years ago would have been scoffed at.

Pioneer Days

PIONEERING as 4GL in the early days of continuous waves, the writer's first trans-



The Short Wave Receiver

minor items. In the use of condensers, leaks, and inductances it is best to have something that will stand a little more punishment than the usual receiver takes.

Schematically the transmitter is shown in Figure 1 of the blueprints. Essentially it consists of a coupling coil, L1, which is in series with the antenna, counterpoise and a variable condenser, C1. The coupling coil (unless it is desired to "load" the antenna circuit by increasing the wavelength of a normally short antenna) is made up of an arbitrary number of turns, say five, which serve to pick up oscillatory energy from the closed circuit and pass it out into the antenna. The closed, or oscillatory circuit, consists of an inductance L2, with wide spaced turns of bare wire, on a form about 3 inches in diameter; the tuning condenser C2, which spans the grid and plate leads; a grid capacity, C3, either spanned by a variable gridleak of 1,000 to 10,000 ohms or with the leak from filament to grid; a capacity C4, known as the plate blocking condenser; an r. f. choke L3 in series with the plate and the positive of the high voltage B battery; a resistance R2 in series with the positive filament

terminal to give the transmitting tube the proper voltage from a 6 volt source, and a telegraph key of the same type as used in Western Union and Postal offices. This key in the diagram is shown as shunted by a capacity, C5, of .002 mfd. to swallow any sparking from the key contacts. In small powers this is not necessary.

Inductance Wire

The inductance may be wound on a cardboard form with fairly stiff wire, No. 12 or No. 10, bare, all turns being run tightly together; the form removed and the coil mounted on a small strip of board, the turns being properly spaced before clamping them onto the strip of board or bakelite. Another form and the one we used in building the small power set at the RADIO AGE laboratory was to take two Proudfoot coils, strip them of windings, butt them together end to end and bolt them fast; then space wind about 16 to 18 turns of the No. 10 or 12 wire on the forms. The form of the winding may be seen by looking closely at the photograph showing the wavemeter, transmitter and receiver on the table in the laboratory. It projects above the

level of the transmitter, which is the second set from the left in the picture, the first being the wavemeter, the second the transmitter, and the third, the receiver which is on the right of the table.

L1, L2 and L3 are the only things which have to be made up. L1, which fits inside of the larger inductance, L2, consists of five turns of No. 10, rubber covered wire, spaced widely inside the larger inductance and without any support save friction against the sides of the form. This coil is never varied and may remain in its location indefinitely. L3, which is the r. f. choke may be made up on a cardboard tube about one and a half inches in diameter, and wound with 100 or more turns of No. 26 DCC wire. It should be located in such a manner that its field will not conflict with the field of the inductance, L1.

The Old Weagant

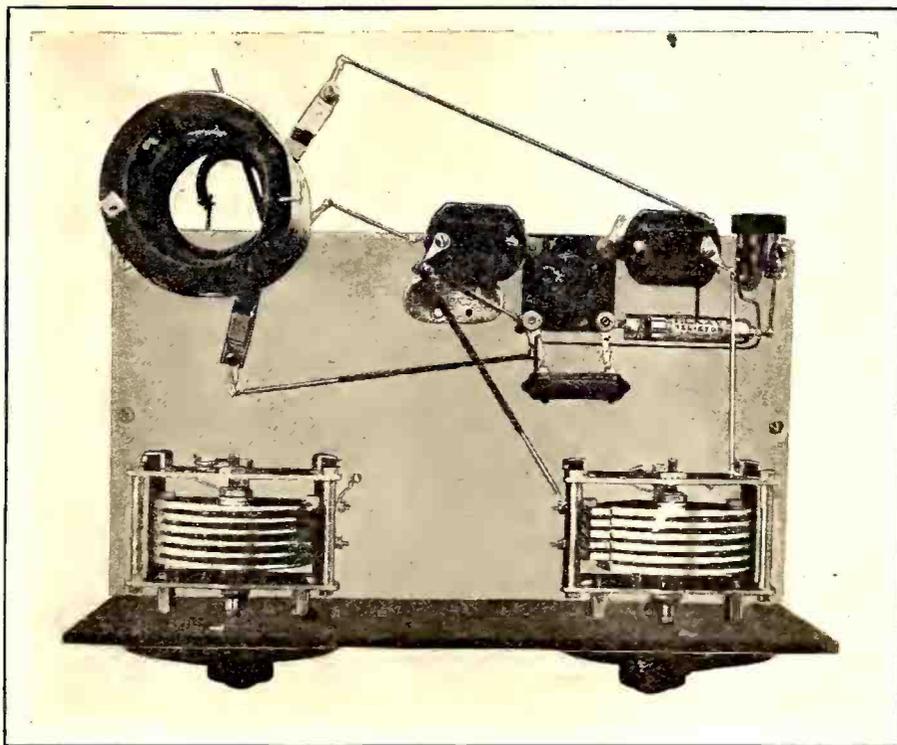
FOR short wave reception a condenser controlled regenerative set (Weagant) is used, and is shown schematically in Figure 2 of the blueprints. It consists of two variable condensers, one audio transformer, two sockets, one r. f. choke, one Jones base

Receiver Parts

- 1 7 by 13 by 3-16 hard rubber or bakelite panel.
- 1 Karas .00014 mfd slf condenser.
- 1 Karas .00025 mfd slf condenser.
- 2 Benjamin cushion universal sockets.
- 1 Sangamo .00025 mfd grid condenser and clips.
- 1 Nonoise variable grid leak, Radio Foundation, Inc.
- 1 Silver-Marshall coil socket 6 contact.
- 1 Silver-Marshall coil form, blank.
- 1 Jones base mounting plug and cord.
- 1 Karas audio transformer.
- 1 Yaxley phone jack.
- 1 Centralab modulator plug.
- 1 Daven .5 ampere filament resistor and mounting.
- 1 Apex r. f. choke coil.
- 2 National type B dual range vernier dials.

mounting, a fixed filament resistor in its clip, a jack, grid leak and condenser; coil socket and the necessary coil for the particular waveband to be spanned. Simple wiring is used and the photograph of the receiver shows the manner in which the parts are disposed about the panel and baseboard. The wiring is done by means of the schematic, as is customary, for electrical accuracy since photographs do not always show clearly the manner in which the wiring is done.

For calibration purposes and to determine the manner in which a set oscillates, and on what wavelength, a wavemeter is absolutely necessary. It also must be highly accurate for on that lower band a slight error in capacity will throw one entirely out of that band into an adjacent one occupied by other interests. It is very important that the wave remain on the band for which it is licensed by the government—in this case—the band from 8,000 to 7,000 kilocycles. The wavemeter is shown schematically in Figure 3 of the blueprint section with a few of the details which may



The Completed Short Wave Set

Transmitter Parts

- 2 Cardwell taper plate condensers .00035 or .0005.
- 2 Sangamo .00025 mfd fixed condensers.
- 2 Sangamo .002 mfd fixed condensers.
- 1 Allen-Bradley variable resistance 1,000 to 10,000 ohms.
- 1 Elkay fixed filament resistor for .5 ampere with mounting.
- 1 Jones base mounting plug and cord.
- 4 45 volt sections of World B batteries.
- 2 National type B dual range vernier dials.
- 1 Telegraph key, J. H. Bunnell Co.
- 1 Benjamin cushion socket, universal type.
- 2 Benjamin brackets for sub-panel.
- 2 Pieces of 7 by 13 by 3-16 hard rubber or bakelite.
- 1 0-100 d. c. milliammeter, Jewell.
- 1 1-1.5 ampere r. f. ammeter, Jewell.

be helpful in constructing it. It has two inductances, L1, for the wavelength determinations, which is spanned by a capacity C1, and the other an inductance, L2, which is a pickup winding for the carborundum detector and zero to one milliammeter. The wavemeter works on the resonance principle; when the emitted wave falls within the band covered by the coil L1, the energy is rectified by the carborundum crystal and passed through the milliammeter, giving a deflection on the scale. The point at which the meter hand peaks is the wavelength of the transmitter. By proper calibration one can determine the wavelength of each degree on the scale and thus tell at what point of the wavelength range his transmitter is oscillating. In Figure 3-A is shown a simple loop and flashlight by means of which you can determine if the set is oscillating. Put the loop over the top of the transmitting inductance. If the set is oscillating the little flashlight bulb will glow. Use a small 2 volt flashlight bulb for this purpose.

The above description about completes the amount of apparatus necessary in making up the three items: the transmitter,

receiver and the wavemeter. Now we will go into a detailed description of the individual parts of the set; getting the antenna up, what it shall consist of, likewise the counterpoise, and finally getting the transmitter on the air. While the set may be utilized for short wave phone work we do not believe in spoiling a perfectly good transmitter (telegraph) which will cover distances of good order, for a phone transmitter which will give poor results over a distance not to exceed fifty or a hundred miles, and under only very favorable conditions at that. So learn the code, if you don't know it, and get busy talking to your fellow fans scattered over the globe.

Antenna Scheme

FOR the general scheme of your antenna, see the insert 4-A, shown in Figure 4. The antenna and counterpoise consist of two six wire cages, the cages about 5 inches in diameter. Ends of the cages are made of a circular ring of bakelite cut from a discarded panel, and six holes bored near the outer edge of each end piece. These holes are spaced equidistant around the perimeter of the circle. Two end pieces are used for the antenna

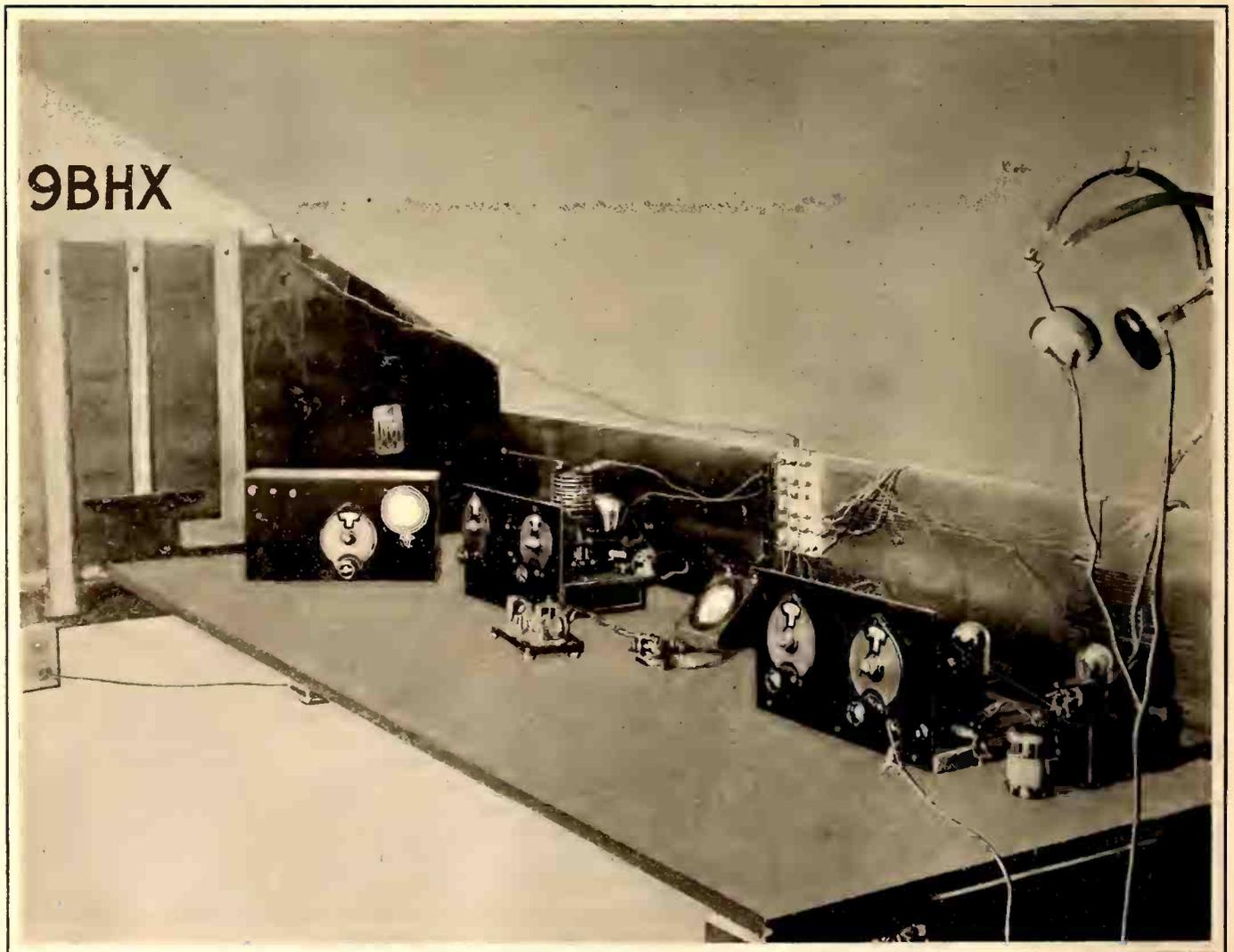
and two for the counterpoise. If you have some stout brass rings of approximately the same size you may use them instead. The separators are the same size as the end pieces and may be rings of micarta, bakelite, or other insulating material. They are used to keep the six wires spread properly and spaced to prevent shorting or changing of capacity in the antenna. The antenna and the counterpoise are each 24 feet long; the antenna being erected so the six wire cage will take advantage of all the vertical height possible, while the counterpoise may take all the horizontal height possible. The arrangement is shown in the sketch and should serve as a guide in the method of erecting the aerial and counterpoise, which terminate in two pyrex bowl lead-ins, made in the fashion shown in the small sketch at the left of Figure 4 in the blueprint form.

Pyrex custard cups, or small bowls of the same material, readily obtainable at a hardware, or crockery store, will serve admirably for lead-in insulators, a quarter inch hole being bored in the center of the bowls (Use a three cornered file in a brace and bit; sharpen the edge to form a chisel edge, and use turpentine as a cutting agent. Drill slowly, allow head of brace to describe a rotary motion while drilling; do not rush the job and do not place much pressure on the bottom of the cup with the file, and eventually you will have a nice hole through the pyrex.) For those able to afford it, bowl lead-ins are made up in pyrex by the Cardwell people and are excellent for this purpose. After the bowls have been drilled, run a quarter inch threaded brass rod through and place one bowl on the outside of the house and the other on the

with the brass rod and nuts. Allow about an inch around the rod away from the roof or wall. This is in case you can cut a hole through the wall of the house or the roof. If you cannot, or do not want to, do this; then put a board under the window the same width as the window; bring the window down to meet the board, and bore holes in the board itself for the lead-in insulators, the bowls being attached in the same manner as if you were going through the wall or the roof.

Having put up the antenna and counterpoise, the former's mast to be guyed on account of its 40 foot height, and the lead-in wires arranged, you are now in position to go ahead with the construction of the transmitter.

Before doing so refer to the schematic, Figure 1, and the photograph of the transmitter for an idea as to placement of parts. The left hand condenser,



Radio Station 9BHX in the Radio Age Laboratory, construction of which is detailed in this article

a Cardwell .00035 mfd., is in series with the coupling coil; the condenser on the right is the oscillator tuning condenser, the same size as the one above, and spans the grid and plate leads to the inductance. The socket is one of the new Benjamin cushion type for all types of tubes; the grid condenser is a Sangamo .00025 mounted by means of a piece of spring brass direct to the grid terminal on the socket. The gridleak is an Allen-Bradley variable resistor, range 1,000 to 10,000 ohms. It spans the negative filament and the grid and is located on the panel with the knob underneath the subpanel. Another .002 Sangamo is directly across the filament circuit for a bypass of r. f. while the plate blocking, or isolation condenser, is another Sangamo .00025 (although a .002 may be used if desired). In series with the positive filament connection, (the right hand one) is an Elkay filament resistor for two UV-201-A tubes on 6 volts. This takes care of the half ampere draw of the UX-112 amplifier tube being used as a transmitter. The Jones base mounting plug is arranged at the right hand rear corner of the subpanel and takes care of the filament wiring. On account of keeping the r. f. choke coil away from the rest of the set, the positive wire from the 180 volt B battery is not run to the Jones base but goes through the r. f. choke and direct to the plate terminal on the socket, which in the photograph is designated by the soldering lug attached. The plate terminal also supports a piece of spring brass onto which the Sangamo .00025 plate blocking condenser is affixed. Two Benjamin brackets are used for holding the subpanel. The piece of bakelite used was a 7 by 26 by 3/16 of an inch, and it was cut in two pieces, both 13 inches long. One formed the panel and the other the shelf which is mounted on the Benjamin brackets. The inductance is mounted on the baseboard and made fast by means of one or two brass bolts and nuts. The grid terminal of the transmitter goes to the bottom of the inductance; the filament tap is variable and has a

clip on the end of the wire from the filament; the plate connection is likewise variable and it too has a clip on the wire from the plate isolation condenser. Otherwise three variable taps would be required, but it was found in practice the grid could be left stationary at the bottom end of the transmitting inductance and the filament and plate taps made variable.

Wavemeter Next

AFTER all connections have been made in accordance with the schematic diagram in Figure 1, you are ready to test the transmitter. Before doing so, we will describe the wavemeter so after it is finished and calibrated you will be in position to actually put the transmitter into operation without guessing as to your emitted wave. It will also save you a great deal of time and energy in having the wavemeter ready to check your wavelength and also the value of current in the antenna (relative) in the event you are not using a radiation ammeter or a flashlight bulb in the antenna circuit. For best results in determining your antenna current a zero to one and a half ampere meter (rf) such as that made by Jewell or Weston will be fine. If you cannot afford it, then a flashlight bulb will do for the time being, but arrangements should be made to short out the bulb when the set is being used. We are more inclined to use the wavemeter and its zero to one Weston milliammeter to determine the relative value of output current since this meter is capable of peaking very nicely. (The r. f. ammeter would do that too.)

Figure 3 of the blueprint section shows the schematic of the wavemeter; a detail of the coil mounting; the layout of the parts on the panel; a detail of the plug in coils (Silver-Marshall) and other details of interest to the builder. The inductance is composed of 14 turns of No. 18 annunciator wire (L1) while the rotor inside of L1 carries 4 to 8 turns of No. 26 or 28 wire as a pickup coil for the carborundum detector and the milliammeter

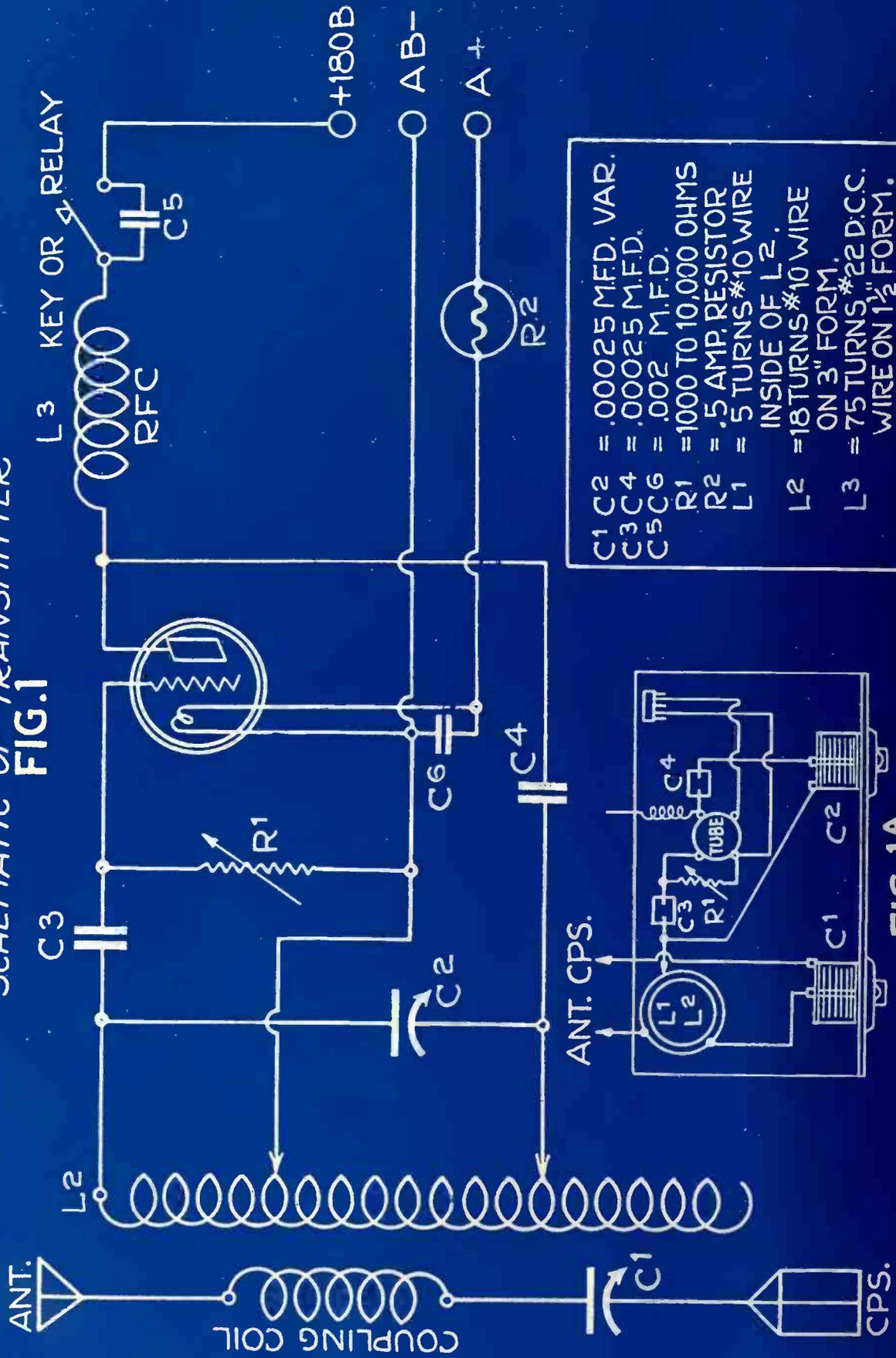
arranged in series with it. For the detector we picked the carborundum crystal unit made by the Carborundum Co. of America since that unit is a fixed crystal with a potentiometer for varying the sensitivity of the crystal. In the wavemeter it is very handy and relieves you of the difficulty of telling whether your crystal is in good adjustment or not. You know it is. For the condenser a Cardwell .00035 having the new taper plates to give a s. l. f. characteristic was used and we were quite surprised with the ruggedness—a feature that is highly essential in any wavemeter. The indicating device was a Weston zero to one milliamper meter; all these devices being shown in the schematic and other figures, also the drawings of the front and rear views of the wavemeter. Dials used on all the sets were of the National type B, with the new dual range scales and having a variable ratio of operation. For the wavemeter we run the governor to the right for slowest motion. The different drawings, pictures and schematic circuit will give anyone an idea of the manner in which the various units are put together. The coil and socket for the wavemeter is placed inside the panel to be out of the way of harm. Only four of the six contacts are used; the pickup coil being on 1 and 2, the wave coil on 3 and 4, with 5 and 6 left blank.

Wavemeter Range

USING the value of turns shown in the schematic Figure 3, the wavelength range of the wavemeter will be from about 25 meters to 100 meters. After the wavemeter is built it should be calibrated. This work is done at the Bureau of Standards for a nominal fee. Communicate with that Bureau at Washington before sending the meter to them.

If you prefer to calibrate the meter yourself (although you are not likely to make such a precision job of it) you can select a number of the short wave high-power telegraphic stations, ascertain their kilocyclage, and then use your wavemeter against the receiver to "siphon" the

**SCHEMATIC OF TRANSMITTER
FIG.1**



- C1 C2 = .00025 M.F.D. VAR.
- C3 C4 = .00025 M.F.D.
- C5 C6 = .002 M.F.D.
- R1 = 1000 TO 10,000 OHMS
- R2 = .5 AMP. RESISTOR
- L1 = 5 TURNS #10 WIRE
INSIDE OF L2.
- L2 = 18 TURNS #10 WIRE
ON 3" FORM.
- L3 = 75 TURNS #22 D.C.C.
WIRE ON 1½" FORM.

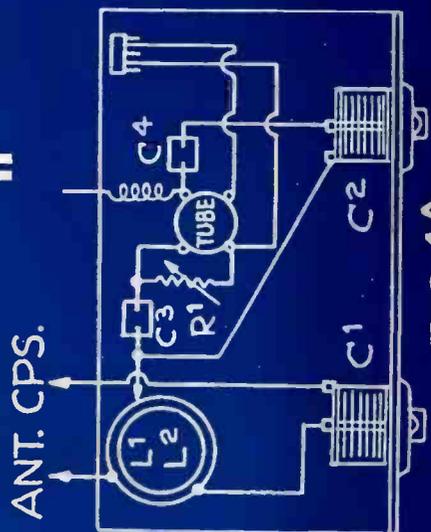


FIG.1A

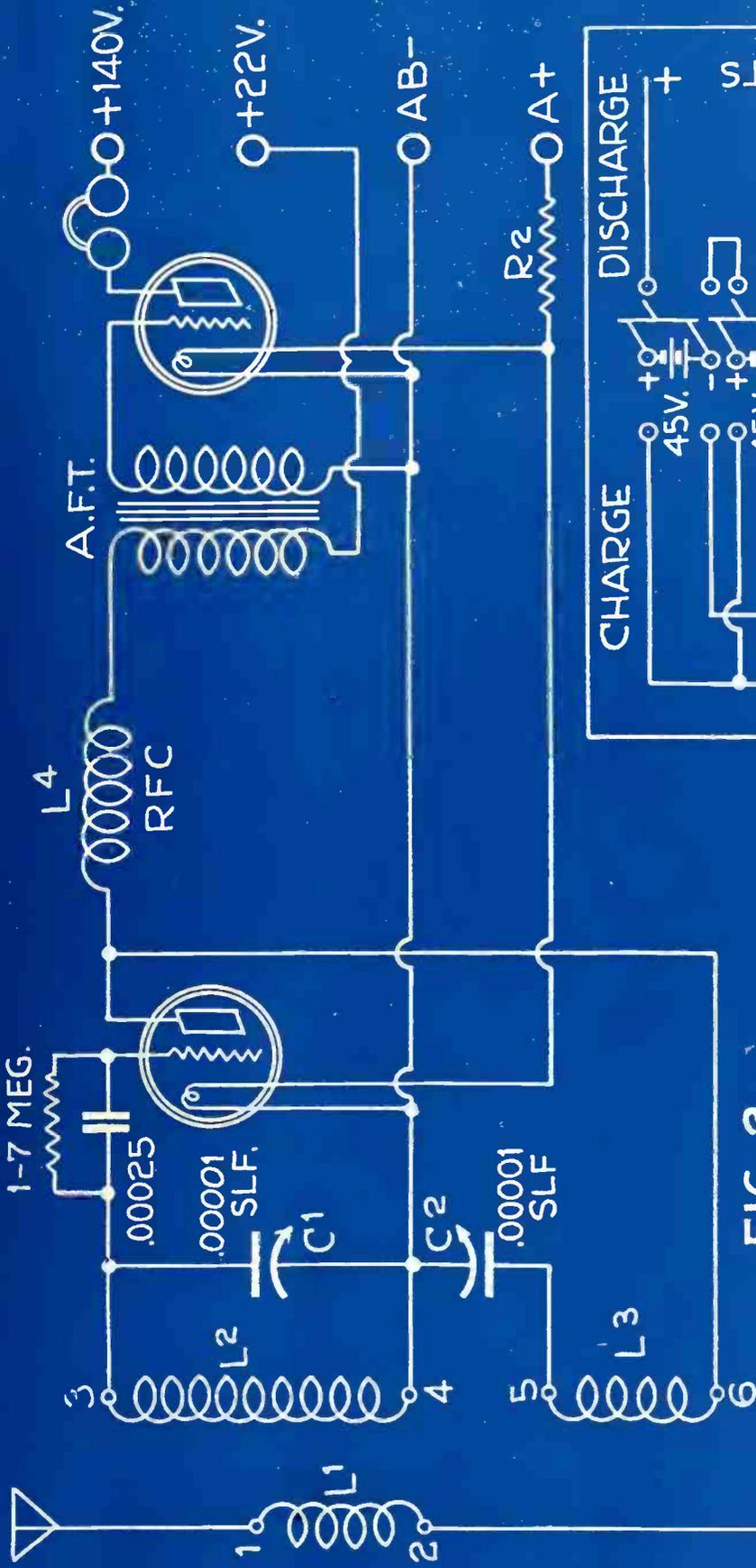


FIG. 2

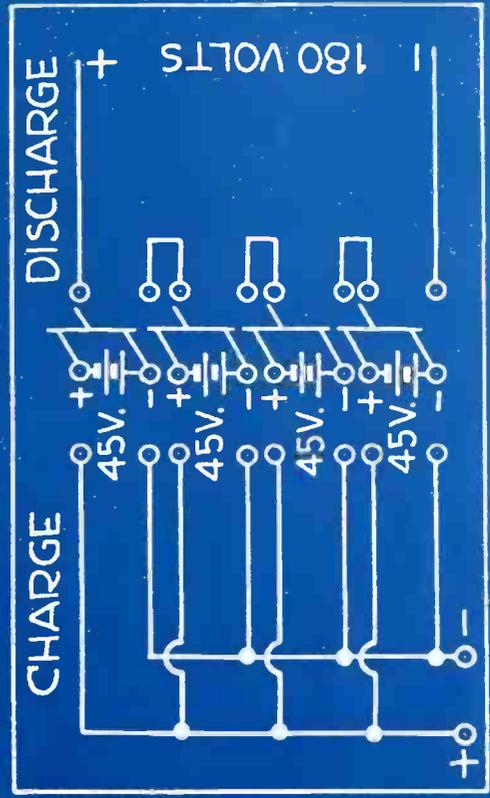


FIG. 2 A

signals out of the receiver. The process is as follows:—place the receiver in oscillation, picking up a predetermined transmitting station. Place the wavemeter so its coil is near the inductance of the receiver. Swing the condenser dial on the wavemeter back and forth until the receiver stops oscillating. There will be a blank spot from a degree to three or four degrees wide at the point where the wavemeter circuit and that of the receiver are in resonance. Midway between the two extremes, or edges of the non-oscillatory condition of your receiver, is the point at which your wavemeter is tuned. By use of graph paper and a little care you can work out the calibration of the meter, but for extreme accuracy we believe it would be better to have the meter properly calibrated at the Bureau of Standards.

Assuming you have the meter calibrated you are now ready to start putting the transmitter into operation. You have already wired it in accordance with the schematic in Figure 1. Take the grid tap as the bottom one on the inductance. Count five turns up the inductance from the grid tap, the grid tap being the first; at this point locate your clip for the filament tap. Then count up seven to eight turns from the filament tap, and locate the tap for the plate lead. Set the condenser C2 at zero; light the filament of the UX-112 and press the key. Twirl the condenser dial on C2 from zero to fifty or sixty degrees and watch the milliammeter. If there is no change in the reading at any setting of the condenser, the set is probably not oscillating. The set when going into oscillation will give indications of it in the milliammeter by a drop in milliamperes when the best oscillatory condition has been reached. If no change can be found under these conditions in the plate current meter, then come down one turn on the filament tap and one turn on the plate tap. This should permit the condenser to cover and control the oscillating condition of the tube. By means of the loop of wire and small

flashlight bulb you will also be able to determine if the set is oscillating.

Set in Resonance

WITH the closed circuit, that is, plate and grid circuits, in resonance for oscillation, vary condenser C1 in the antenna circuit (in series with which can be placed a flashlight bulb to indicate radiation and partial resonance). Altering the capacity of the capacity C1 should change the brilliancy of the flashlight bulb in the antenna circuit and this circuit can then be balanced capacitatively until the bulb glows at a maximum. These are rather rough approximations but will serve to get you on a wave somewhere near the one on which you are to operate. Then you can take the wavemeter, set its dial on a degree of the scale corresponding to the wavelength you want to use; put the transmitter in oscillation and vary capacity C2 until the needle on the 0-1 milliammeter rises. By careful tuning you can peak the needle at its highest point. In this process you will also have to change the value of C1 until you get maximum current induced from the closed circuit into the antenna. If the needle on the milliammeter of the wavemeter just barely moves, you can move the wavemeter closer to transmitter. If it threatens to go off the scale of the meter then move the wavemeter further away. Above all be very careful because such a meter is very delicate and excessive current will burn out the shunt inside. The knob on the crystal unit is a potentiometer and is used to vary the current passing through the carborundum and thus govern its sensitivity. You can alter somewhat the reading of the milliammeter by changing the value of current in the detector circuit.

Capacity Effects

IN THE event you are bothered with capacity effects in tuning the transmitter and wavemeter (that is, the set goes off oscillation when the hand is placed near the panel) we suggest you take off the vernier knobs (they are held on with a

set screw) and slot then with a hack saw. Then cut an inch wooden rod about thirty inches in length, sharpen one end like a screwdriver, and use it to turn the knobs of the vernier dials. This will permit tuning the set without troublesome body capacity effects.

For small powers perhaps a radiation ammeter is not essential but we believe it would be worth while to get one anyway, since it will always indicate radiation and help in determining resonance of the circuits. Get a Jewell or Weston zero to one and a half ampere r. f. ammeter.

In arranging your battery switch, and antenna switch, which is a six pole double throw affair, be sure it is hooked up so that on changing to the left the transmitter is on; on changing to the right the receiver is on. It would be a good precautionary measure to insert a fuse which will blow at a tenth ampere because the resistance of the batteries is so low that if anything goes wrong with the transmitter you will have the full amperage of the batteries to contend with and that might be an excessive and disastrous value. It pays to be careful in this respect. This fuse can be inserted in series with the negative lead of the B battery where it joins with the negative of the A battery.

Have all wires coming to the switch. Do not have any voltage applied to the receiver while the transmitter is on since by using a common battery in that matter detuning effects result in the transmitter. Also you can arrange so the common negative B and negative A are grounded to a cold water pipe. This will help in stabilizing your receiver and will ground the closed circuit of the transmitter.

Storage B Batteries

STORAGE batteries used in this transmitter now in use at RADIO AGE laboratory are World batteries of the conventional type for receiving sets, and the voltage is 180, there being four sections of 45 volts. The batteries are generally shipped dry; you fill with 1250

gravity sulphuric acid and place on charge, limiting the charge to .25 ampere. In our case we merely arranged an eight pole double throw switch, each switch carrying a 45 volt section, and connected so all four units, or any one singly, could be charged with the Tungar. We found that the Tungar would not do well on anything in excess of 72 volts, so we used the 45 volt sections all in parallel.

There are both disadvantages as well as advantages to the use of dry cells or wet cells for a transmitter. The note emitted is pure direct current and is very sharp. In that respect it is a disadvantage, but judging from the number of wobbly notes in the air on short waves, we believe d. c. notes are best after all since their pitch may be varied by the receiving operator to any frequency desirable, whereas this is not so easily done with imperfectly rectified alternating current. Probably a man owning a d. c. set would have to call longer than his brother who is equipped with rectified a. c. and perhaps the a. c. set could have higher voltages, but for the low power sets we believe the best bet is the direct current from storage B batteries or dry cells.

For those who have Delco lighting, or other types, on their places, it is suggested the 180 volts be made up in sections of 24 volts (12 cells) so these may be charged from the Delco 32 volt system. If you have a. c. in your home you may rig up a chemical rectifier for charging the B battery, in which case you put two forty-five volt sections in series and then parallel so the 110 volts after rectification in the chemical rectifier, will charge your B batteries.

Can Also Use AC.

IN THE event you have a. c. and can rectify and choke it well so it is not full of objectionable ripples, you can rearrange this same transmitter to handle a. c. rectified. The tube can be increased from a UX-112 to a UX-210 which will handle about 7.5 watts with 350 volts on the plate. From then on

you can go to two of the latter tubes in parallel and increase your voltage still further. After all, the same arrangement is carried out in increasing the size of your transmitter, only in the ones utilizing high voltage you have to allow better insulation factors than you do in the low power sets, and a center tap for the grid return on a. c.

Refer back to the April and May (1926) issues of RADIO AGE for data on a receiver and a transmitter. Also read Mr. Earle's story in the May issue on how to secure your government license, in the event you have not taken out one already.

The transmitter thus built is now operating under the call 9BHX and the operators will be glad to work any of our readers, as well as others, who care to communicate with us. The set is tuned for a wavelength just a trifle above FW, the St. Assise, France, station working on a wavelength of 42 meters, or 7139 kilocycles.

Will Answer Questions

WE SHALL be glad to answer questions of readers who run into difficulties with getting started. If the foregoing is closely adhered to will probably have no trouble in getting onto the air. If you do, write us and we will do our best to straighten you out.

Several suggestions about your transmission. Do not call a chap forty-nine times and sign your call eighty-seven times. Make it the three times three proposition, thus: 4BY 4BY 4BY u 9BHX 9BHX 9BHX; then go over it again. There is nothing so appalling as to listen in during the evenings or early in the morning and hear some chap calling his life out, ad infinitum, and signing his own call in the same manner. It is all right to be persistent and wish to get your man, but do not do it by endless calling in a lazy, sloppy manner. Many of the fellows who call for ever and ever do not get replies because they antagonize their listeners. Also do not try to develop into a speed demon the first week you have your set. Send clean cut stuff

and you will never worry for lack of fellows to work. Cultivate a sloppy swing and the only ones that will work you will be persons of the same type.

Building the Receiver

FOR THE receiver the construction is simple and the circuit is the old, old Weagant. The primary can be 5 turns of No. 28 or 26 on the rotor inside the Silver-Marshall coil form. The secondary, in our case, we made of 13 turns of No. 18 bell wire, and the tickler of 9 turns of the same sized wire. This gave us a range from around 30 meters up to 50 meters. The parts for the receiver are shown in the accompanying list of parts and the receiver can be duplicated without any trouble by comparison with the schematic in Figure 2 and the photographs.

The numbers appearing on the inductances in Figure 2 are the same as shown on the coil form and should be used in wiring up the receiver. One and two are the antenna and ground; three the grid terminal, four the filament, five the filament and six the connection to the plate of the receiver.

It is not necessary to calibrate your receiver unless you desire to do so. However by noting the various naval stations in the short wave band you can readily find the range of your own set.

Wavemeter Calibration

On account of the length of time it generally takes the Bureau of Standards to celebrate meters, and also the fact at times this work cannot be done on account of the press of other work; readers may find it convenient to have their wavemeter calibrated by Harper and Marco, consulting radio engineers, 5514 Broadway, Chicago, Ill. As in the case of the Bureau the reader should write in first so as to get details regarding packing, etc.

Symbols and Diagrams

Figure 1 of the blueprint shows the schematic by which the set should be wired. The coupling coil may be reversed

(Please turn to page 40)

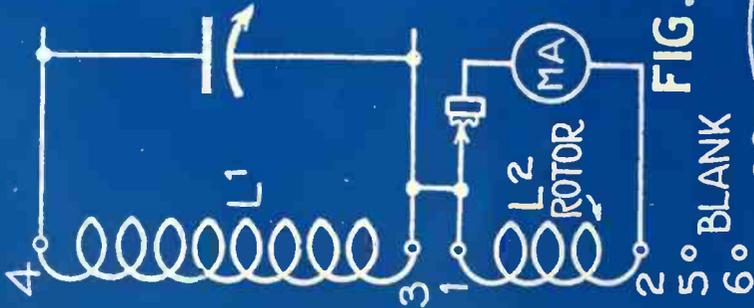


FIG. 3

5° BLANK
6°

$L_1 = 14$ TURNS #18 ANNUNCIATOR WIRE
 $L_2 = 4$ TO 8 TURNS #26 OR #28

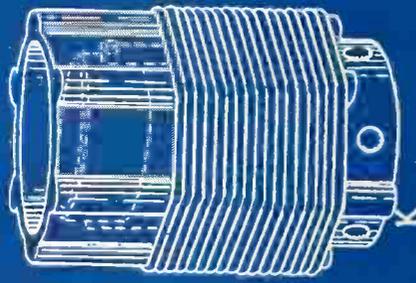


FIG. 3 E



FIG. 3 A

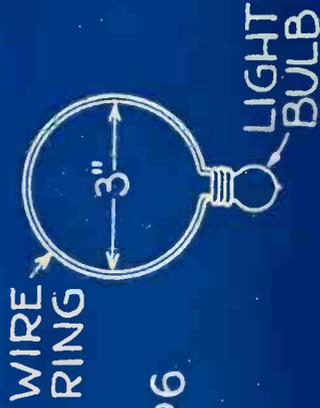


FIG. 3 B

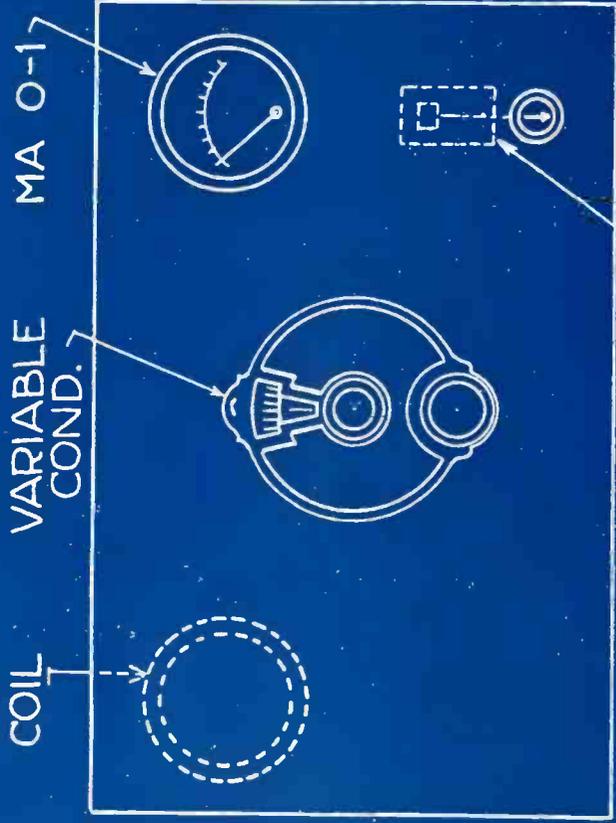


FIG. 3 D CRYSTAL

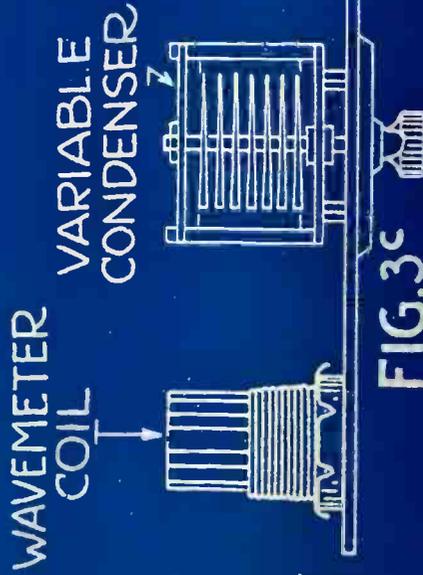


FIG. 3 C

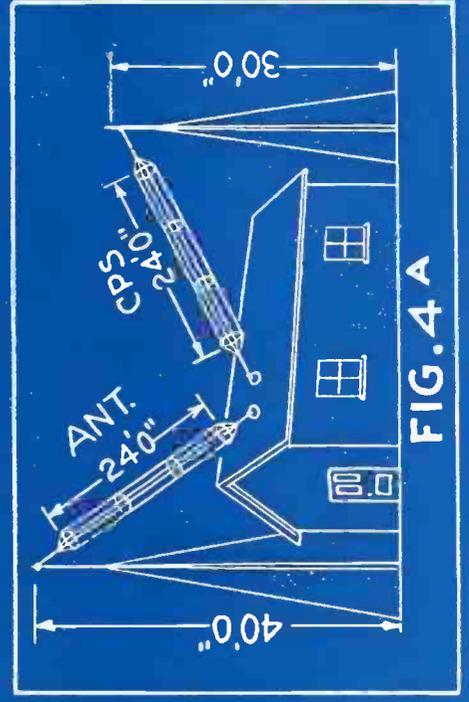
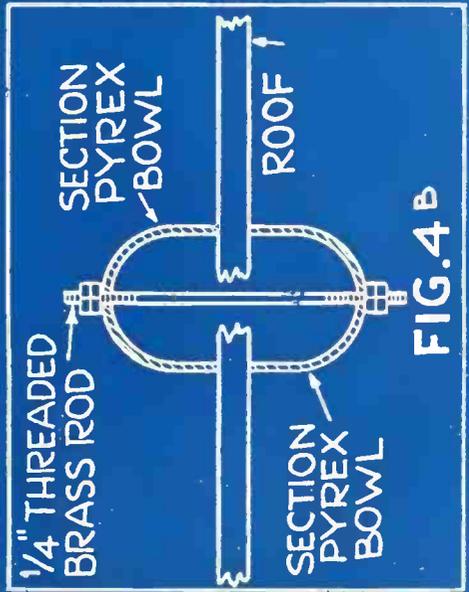
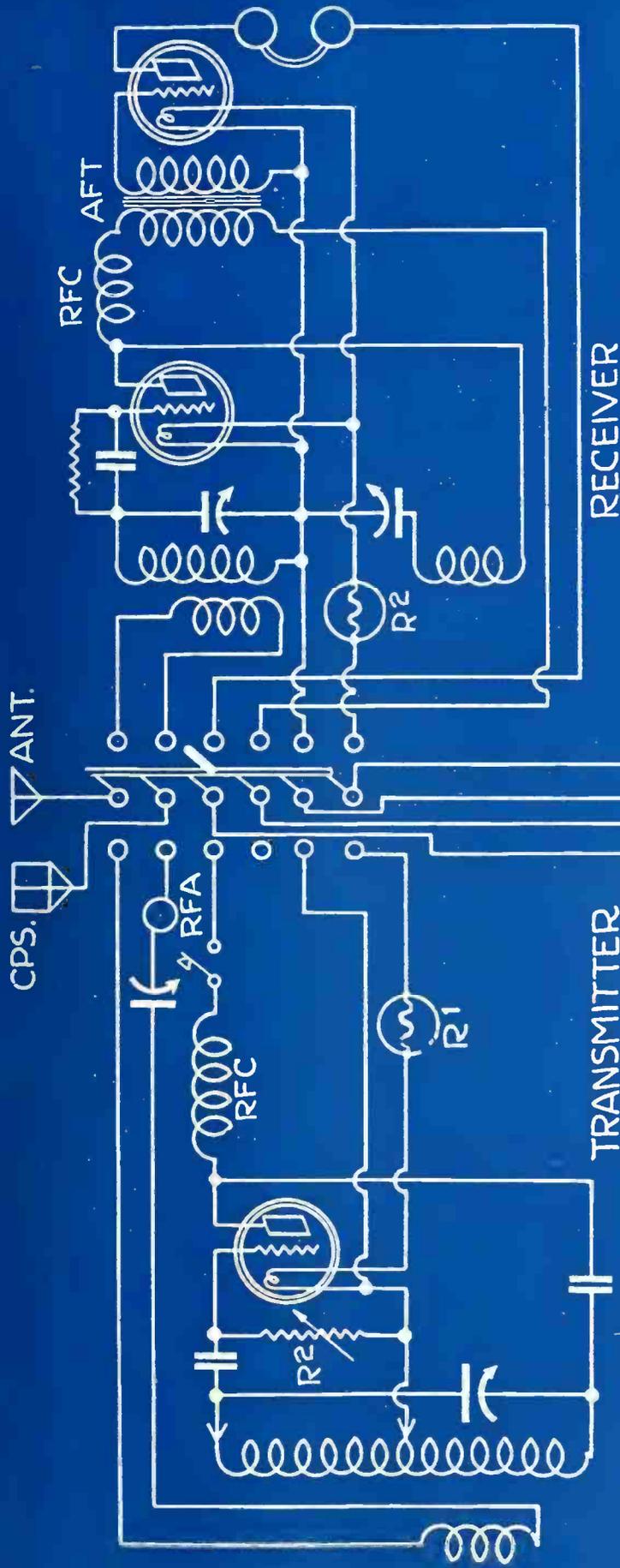


FIG. 4 A

FIG. 4

FIG. 4 B

to find the best results. In one direction it is opposite to the winding of the inductance L 2 and on trial we found better results when the two coils were wound in the same direction; the antenna going to the top of L1 (the coupling coil) and the grid going to the top of L2. The radiation ammeter, not shown in Fig. 1, may be placed in the antenna circuit, although in Fig. 4 it is shown as RFA and is located in the counterpoise lead. Fig. 1A shows the manner in which the parts are laid on the panel and baseboard, with the list of parts to the right.

Figure 2 shows the receiver, which is explained in the text. Figure 2-A shows the charge-discharge switch for charging the B batteries. There are four 45-volt sections charged in parallel and discharged in series giving a total of 180 volts.

Figure 3 is the schematic of the wavemeter; Fig. 3-A the detail of the coil socket; Fig. 3-B the detail of the flashlight bulb and wire ring for determining if the set is oscillating; Fig. 3-C the panel layout of the wavemeter; Fig. 3-D the front panel layout of the wavemeter and Fig. 3-E the detail of the wavemeter coil.

Figure 4 is the complete schematic of the send-receive switch. The negative B lead is fused for a tenth of an ampere so if anything happens in the transmitter the fuse will blow and not permit disastrous consequences. Fig. 4-B shows the detail of the pyrex lead-in bowls described in the text. Figure 4-A shows the antenna and counterpoise detail. On account of cramped space it was not possible to get more than 24 feet of antenna and 24 feet of counterpoise. For best work on the 40 meter band the length should be about 30 to 32 apiece. If you do not care for a cage, a single wire antenna and the same for the counterpoise will do just as well.

In operation it is best to make the length of antenna and counterpoise as much as possible so as to permit finding resonance on 40 meters with about 10 to

20 degrees of the variable condenser in the counterpoise. The coupling coil may be from 2 to 6 turns and will depend somewhat on the length of the antenna and counterpoise circuits.

Alternatives

ALTERNATIVES for filament plate supply can be considered as follows: For a. c. operation of the filament of the transmitter use a Thordarson T-120 filament transformer, which will deliver 8½ volts across terminals, with center tap. A rheostat may be used to bring this value down to the desired amount for the transmitting tube. To get best d. c. note use a potentiometer across the terminals of the filament transformer secondary and make your grid return to the sliding arm. By changing the position of the slider you can find the electrical center of the a. c. filament circuit and eliminate a good deal of the a. c. hum in the transmitter. Put a one mfd. bypass condenser from the center tap on the potentiometer to each side of the filament secondary. You can use a Yaxley, General Radio or some other good make of potentiometer. The bypasses for the filament circuit may be Dubilier, Electrad, Kellogg or other good makes.

For plate supply, if you desire to use rectified a. c. get Thordarson's T-125 which delivers 350 and 550 volts from each side of a center tap, or a total of 700 or 1100 volts. This can be applied to an electrolytic rectifier and the output filtered. We understand the old S tubes will no longer be manufactured so this method of rectification will not be possible much longer. The use of a Raytheon tube is limited by the voltage which can be applied to it, so it is not available for anything except very low power and low voltage work.

Motor generators for amateur transmission may be had from the Esco organization (Electric Specialty Co.) and may be secured in a variety of sizes with different combinations for operation. For example you can use a dynamotor operating from a storage battery and delivering 500 volts d. c.; you can get a gen-

erator operating from 32 volt d. c. source (Delco, etc.) or you can get the motor for the generator with either a. c. or d. c. 110 volt winding. The generator is the same always, the motor differing in accordance with your primary power supply type.

Get Fuse Right

THROUGH error in Figure 4 the fuse is placed in the negative filament line when as a matter of fact it should be placed in series with the milliammeter. The line carrying the fuse in Fig. 4 should be a solid line and the fuse inserted between the negative B battery and the milliammeter.

Further helpful information on low power battery operation may be secured from reading Engineering Pamphlets 9 and 10 issued by the Burgess Battery Co., at Madison, Wis., in which the split Colpitts circuit as developed at their laboratories is fully described.

In using a. c. filament or plate supply it is always best to have filters placed across the supply lines to drain those lines of any r. f. pickup from the transmitter and prevent such energy from going out over the supply lines to neighbors. Take two one mfd condensers and place them in series. At the center of the two put the ground connection. Then each end of a condenser goes to line. Thus one side of one condenser goes to one side of the line and the other side of the second condenser goes to the free side of the 110 volt line.

In a forthcoming issue of the blueprint section Radio Age will detail the steps necessary in the construction of a crystal controlled transmitter, since this type of set is the highest form available and particularly noted for its bell-like note and almost absolute permanence of frequency.

For the antenna and ground connections on the transmitter the XL pushposts are very handy since the top of the binding post may be pushed down and the wire inserted. The clamping action is positive and tight and makes for simplicity in assembly.



Pick-ups and Hook-ups by our Readers



Conducted by F. A. Hill

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

AUGUST may not be the best month in the year for radio reception but it is certainly classified as a building month. Perhaps eighty per cent of the correspondence in this department shows the DT fraternity are either rebuilding their old sets or making an entirely new one, and they all seem to pick the month of August for that work. Maybe because they will have ample time to get the set fixed in time for the good weather that follows shortly thereafter.

H. JOHNSON SMITH, at Digby, Nova Scotia, writes as follows: "I have been taking your excellent magazine for the last three months and enjoy it very much. Have at some time or other subscribed to most American and British magazines on radio and to date yours is the best I have struck. Am in Nova Scotia spending a vacation. I live in British Guiana, South America, and have a fairly good ham station down there. Have brought with me a short wave set. Want to enroll as a 'Twister of Dials'—I've twisted them since 1916 and will go on twisting 'em as long as I can."

Welcome om! A ham is always known by the receiver he carries and you never see a real amateur without a receiver. Reception on the short waves is certainly a revelation both on phone and code, as compared to work on the higher wavelengths.

EDWARD JONES, 1428 Amsterdam Ave. (Apt. 14),

DIAL TWISTERS

H. Johnson Smith,
Edward Jones,
Edward Schrepper,

Royal Bank of Canada,
1428 Amsterdam Ave.,
161 Newton St.

Digby, N. S.
New York, N. Y.
Brooklyn, N. Y.

DIAL TWISTER



New York, N. Y., makes good use of the log-a-wave chart on page 64 as a means of showing the list of stations he has received. Such a method saves time and energy in the compilation of a DX list.

APPARENTLY our friend in Merrie England, the *Wireless World*, does not have much admiration for our broadcasting scheme in this country. Recently the *World*, in commenting on the fact Portugal may inaugurate a broadcast system based upon the United States plan, remarked: "Problem—find the plan."

ACCORDING to our correspondent a radio expert in Great Britain has designed a fool proof receiver that is automatic. All the fan does is to turn it on and off. When installed and wired in place, the dials are set and clamped in place. The operator simply plugs in the loudspeaker when he wishes entertainment, and pulls it out when through.

All DT's who would be satisfied with that kind of a radio set, please arise!

ON THIS page we are printing a picture of Edward Schrepper, 161 Newton St., Brooklyn, N. Y., who with his family, is enrolled in the DT fraternity. The set is a three tuber made a long time ago from diagrams in this magazine, and still perking to this day. The picture frame atop the receiver contains a verification letter from KFI. Edward, who is 14, is the champion dial twister of the family, and delights in bringing in the DX while the New York locals are blasting away. This time Edward will have an emblem.

CHICAGO still heads the list of cities having the largest number of broadcasters per city, followed by New York, San Francisco and Los Angeles. Among states Illinois and California are tied for first place

with 24 broadcasting cities each, while New York follows with 20 and Pennsylvania with 18. This data is being placed on a large map of the United States which is on exhibition at the Sesqui Centennial exposition at Philadelphia.

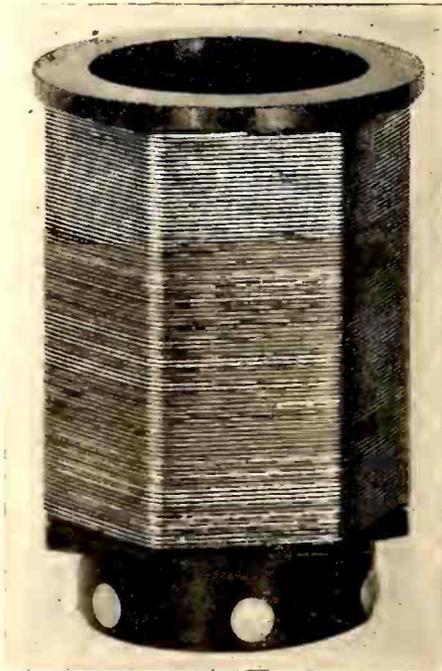
IT IS reported that amateurs in Cairo, Egypt, are proposing to put a transmitter on the top of the pyramid of Chepren, a height of 472 feet. The transmitter itself will actually be installed in the Rameses tomb with probably an RF feeder to the antenna itself. This is not the first time the pyramids have been used for this purpose for during the war many antennas were strung up for listening in to enemy messages.

ASSISTED by approximately a dozen picked amateur stations in the Eastern and Central part of the United States, the Naval Experimental station NKF, located at Bellevue, D. C., is now engaged in conducting observations on the transmission of a variety of short waves from the battleship *Memphis*, now on its way from New London, Conn., to St. Nazaire, France. The operation of the short-wave sets on the *Memphis*, working under the call NISS, is in the hands of Dr. A. Hoyt Taylor, in charge of radio at the Bellevue laboratory, and much valuable information on the behavior of short waves at various distances is expected as a result of the experiments. On arrival at St. Nazaire, the apparatus will be transferred to the U. S. S. *Pittsburgh*, call NOT, and additional tests will be run from this ship on the return trip to the United States.

GEORGE HAAS, JR., formerly 405 Adelyn Drive, S., San Gabriel, Calif., but now of 408 Hatch St., St. Paul, Minn., read the recent article by Armstrong Perry and H. M. Bishop, the former on tube rejuvenation and the latter on tube paralysis, both of which appeared in the July issue; then dug out his WD-11's and put them in his present

AMATEURS will be glad to know that amateur radio station 9EK, operated by the Burgess Radio Laboratories at Madison, Wis., has been selected as a central Naval-Amateur station, and assigned the significant call letters "NRRL," meaning Naval Radio Relay League. The transmitter only employs this call, however, when used by Naval Reserve operators for communicating with amateurs who have joined the Naval Reserve for instruction purposes.

Improved Form



Improvement has been noted in the winding of the Silver-Marshall interchangeable plug-in coils. Instead of the winding being of silk covered wire wound close together (for the longer waves) the forms are now supplied with threaded supporting columns on the coil and the winding is done with enamel wire, each turn fitting into its groove. Thus the capacity effect between adjacent turns is reduced. The coils are available from 18 to 550 meters and fit the S-M universal coil socket.

set. To his surprise some of his old tubes (which he had laid away as poor performers) functioned better than some of his new ones.

We have tried the same trick with some of our old tubes but have had no luck, so made good use of them during the Fourth of July celebration in place of firecrackers—by throwing them against a stone wall.

Unidirectional Antenna Best
THE only practical method thus far discovered of reducing atmospheric disturbances or static in radiotelegraphy or telephony in any marked degree, at a given frequency, is that of unidirectional reception; that is, by using some form of antenna or antenna system which receives more strongly from one direction than from another, says Dr. L. W. Austin, Bureau of Standards, Department of Commerce. Well-known forms of such systems are the Beverage or wave antenna used extensively by the Radio Corporation of America for transoceanic reception, and the older but more convenient, though somewhat less effective, combination of aerial and coil antenna (loop).

Unidirectional reception is useful whenever the static does not come from too nearly the same direction as the station being received. By such means, the ratio of signal can often be made from ten to twenty times better than on a simple antenna.

In choosing the site of a receiving station it is of great importance therefore to discover the prevailing static direction and its changes during different seasons of the year.

9 B H X TRANSMISSION

Operators at 9BHX, located in the Radio Age laboratory, report having worked with our short wave transmitter the following amateurs during the month of June:-

1AAL	2MK
8PL	3AGC
2UP	2BBB
4BY	1BLF
2GP	8BHM
4BK	1BCA
4AJ	3ZO
8ALR	9MO
6OR	9AYP

4NI



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Write for full description.

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COMPANY

STATE AND 64TH STREETS
CHICAGO, U. S. A.

Makers of Burns Loud Speakers

Hints For Removing Battery Acid Stain

“WHAT to do if radio battery acid is spilled on fabric floor coverings or clothing,” was the subject of a recent microphone chat by Paul H. Bonham of the National Association of Dyers and Cleaners, appearing over Station KOA, Denver, in a bi-monthly series of home economics programs.

He warned that liquid in a storage battery is diluted sulphuric acid and will burn a hole in fabrics if not washed out immediately.

“Do not carry a storage battery across rugs or carpets,” he urged, “nor should it be permitted to touch curtains and draperies.”

“Mix household ammonia with cold water in equal parts. Place white blotter under spot where liquid soiled the garment, if it is clothing. Use medicine dropper to saturate portion covered with battery acid. The blotter beneath the spot will attract ammonia water through the fabric, washing out the acid. Tamp the spot with cheesecloth to absorb liquid from cloth. Continue until certain the threads have been thoroughly washed clean of acid. Blot as dry as possible then hold before an electric fan until completely dry.

Ruins Cloth

“Battery acid is treacherous in its damage to fabric. A heavy acid stain may go unnoticed until the garment is laundered or dry cleaned and ready for pressing. When heat of the iron or moisture from steam in pressing, penetrates the cloth, a corrosive action causes immediate destruction of the fibers. If this happens, it is too late for laundering or dry cleaning—the cloth is ruined.

“Where color of the rug, carpet or garment may be black or blue, don't conclude that a stain will not show because the shade is dark. Stains from battery acid will change blue or black to red.

FREE!

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12-Cell — 24-Volt Storage 'B' Battery

Positively given free with each purchase of a **WORLD Storage Battery**. You must send this ad with your order. **WORLD Batteries** are famous for their guaranteed quality and service. Backed by years of successful manufacture and thousands of satisfied users. Equipped with **Solid Rubber Cases**, an insurance against acid and leakage. You save 50 per cent and get a **2-Year Guarantee**

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6-Volt, 140-Amperes	15.00

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6-Volt, 13-Plate	13.25
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Send No Money Just state battery wanted and we will ship day order is received, by Express C. O. D., subject to your examination on arrival. **FREE "B" Battery** included. Extra Offer: 5 per cent discount for cash in full with order. Buy now and a guaranteed battery at 50 per cent saving to you.

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WITH THE MANUFACTURERS



New Socket by the Insulating Company

A SOCKET designed by A. G. Heller, President and engineering head of the Insulating Company of America, Inc., 59 Warren St., New York, presents a number of features.

This device represents a new principle in the method of holding the tube. The contacts are eyeletted to the sub-panel at the four points corresponding with the tube prongs. As they swivel freely at these points the outer or terminal ends can be swung in any direction for convenience in wiring. This movement also allows the position of the wiring to be determined after the contacts are installed. Sockets are designed for soldered, eyeletted or screwed wiring.

The appearance of the new socket is unusual, inasmuch as no mounting devices appear on the top of the panel. Only four white insulated eyelets, through which the tube prongs pass, are visible. This results in a very attractive sub-base unmarred by unsightly eyelets, etc., scattered over the surface.

Cleveland Radio Show

CLEVELAND'S second annual radio exposition, which is to be held in the big municipal auditorium Sept. 20 to 26, promises to be one of the biggest, most important and most productive radio shows of the year.

A program of greater magnitude and greater effectiveness than attempted last year has been outlined by G. B. Bodenhoff who is managing the show here again.

Many exhibitors in the 1925 Cleveland show have declared that exposition was the most productive of any of the year and they are returning to show again.

Succeeds Mallory

F. E. ELDRIDGE has been appointed commercial manager of the Radio Department of the Westinghouse Electric & Manufacturing Company, succeeding to the position recently made vacant by the promotion of E. B. Mallory.

Mr. Eldredge holds the degree of Master of Science from Syracuse University. He enlisted in the Signal Corps of the United States Army in 1917, and when the war ended was serving as an officer, in charge of the inspection of all radio material manufactured in the Department of the East. He continued in the service and after being made a first lieutenant in the Signal Corps of the Regular Army in 1920 was transferred to the Signal Corps Depot, Fourth Corps Area, Georgia, where he remained until 1922. Then he was sent to the Panama Canal Zone, as commanding officer of the 10th Signal Company in the Panama Division.

Mr. Eldredge in 1924 entered the service of the Westinghouse Company, in charge of the government section of the radio department and held that position until his latest promotion.

Radio Age is planning further visits to major organizations in the radio industry. These descriptive articles will be presented from time to time in this magazine. Watch for them.

Globe and Technolian Are Merged

THE Globe Phone Mfg. Company of Boston, and Reading, Mass., and the Technolian Corporation of Boston have combined. The merged companies will be known as the Globe Technolian Corporation with factory and executive offices at Reading, Mass.

The Globe Phone Mfg. Company have for nearly twenty years been experts in Acoustics, developing and building sensitive sound producing and receiving instruments for the deaf. The Globe Company entered the Radio field in 1922 and are makers of the well-known Globe Radio Headset and Loud Speaker.

The Technolian Corporation is an outgrowth of the Irving W. Kimball Laboratory of Boston and brings to the Globe Company a line of reproducing speakers and the Technolian combination radio-phonograph with special in-built speaker.

Radio Exposition Set for Sept. 27

USING the Hotel Sherman as headquarters the Allied Radio Congress combined with the National Radio Exposition will hold an exhibition from September 27 to October 2 at Chicago.

The Exhibition Hall of the Sherman will be arranged for the exposition which will be under the management of the International Trade Exposition Co., with Milo E. Westbrooke as manager.

Moves to Cambridge

THE Tobe Deutschmann Company, manufacturers of the TOBE line of Bi-Pass, Filter and High Voltage Condensers, has just moved to greatly enlarged quarters in Cambridge, Massachusetts.

Cannot Forecast Radio Reception Signals

DISCUSSING the relationship between radio reception and weather conditions, J. M. Sherier, Denver's government weather forecaster, has released the following statement to KOA.

"The weather bureau has received many requests that it undertake to forecast conditions favorable or unfavorable for radio reception. To attempt to do this, however, is considered unwise because enough is not yet known about the factors involved to make it reasonably certain that reliable forecasts can be made.

"Tho many persons have studied the weather maps in relation to signal strength and static, as determined by individual opinion while listening in, and some precise measurements have been made by physicists and radio specialists, there is a difference of opinion as to the extent to which the character of weather affects radio signals. The general view of those most competent to judge seems to be that there are strong influences other than weather involved.

"It is believed that the problem must be attacked in a systematic way if conclusive results are to be obtained. This would require apparatus of precision for measuring signal strength and character from stations of known output.

"Such apparatus should be located at many places over the country and be operated by trained men. The weather bureau could not take up such a problem without authorization and funds."

During a recent appearance over the General Electric broadcasting station, Mr. Sherier pointed out that weather forecasts cost less than a two-cent postage stamp for every man, woman and child in the country.

"Official forecasts receive an average weather verification of approximately 90 per cent," he declared. "To most people, this appears surprisingly high; in fact, there is a tendency on the part

of the average individual to remember all forecast failures and to forget the successes."

Radio Audience Visits "Q" Train

IT CERTAINLY is a radio age! On June 16, at the Union Station, in Chicago, Mayor Dever stepped before the microphone, to make a dedication speech for the Burlington's beautiful new Vacation Flyer, running between Chicago and Denver. The train—the last word in artistic decoration—was on exhibit all day, and a goodly throng was expected, for the ceremonies were of great interest. Miss Caroline McIlvaine of the Chicago Historical Society spoke on the historical significance of such an event, and Miss Bessie Bennett, of the Art Institute, and Mrs. John Alden Carpenter, well known authorities on Interior Decoration, talked of the advance made in utilitarian art. Moreover the rumor had got about that refreshments were to be served from the fountain in the train's Pompeian Lounge! But who would have expected over 6000 people! That radio audience simply couldn't stand just to hear

about a party and not come to it, and they started to join the line less than an hour after their invitation to do so was broadcast.

Separate Divisions

OWING to a demand for their apparatus the Cardwell organization has divided their sales into three divisions, the manufacturers, retail and amateurs.

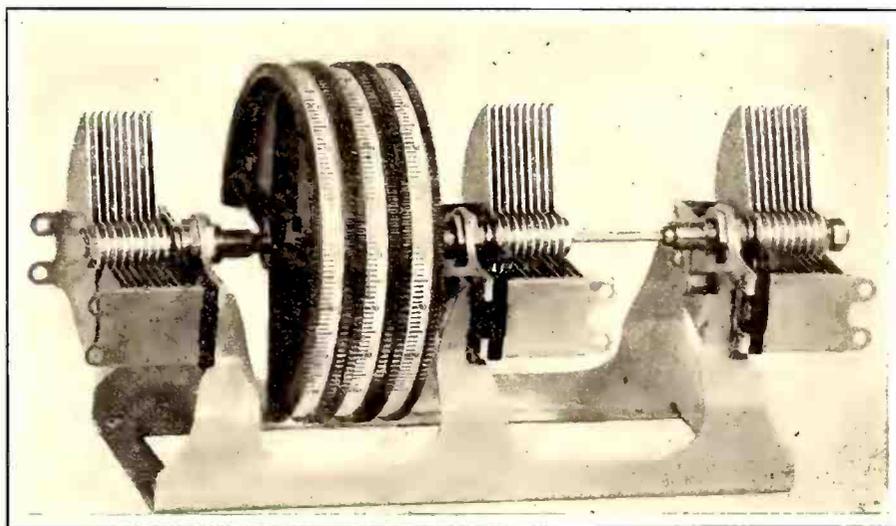
Manufacturers will be handled direct from the office of the company at Brooklyn; broadcast equipment for retailers will be handled through exclusive jobbers, while the amateur trade will be handled in part by the jobbers, but mainly direct from the factory to the amateur.

Booklet on Tuning

"**S**OLVING the tuning problem" is the title of an interesting booklet recently issued by the General Instrument Corporation.

Although referring to their new Metalign SLT condenser, the booklet also covers the tuning condenser field generally and gives the reader a good idea of how the condenser should be made for mechanical as well as electrical efficiency.

LOCALIZED CONTROL UNIT



Above is shown the new localized control unit manufactured by the Alden Mfg. Co., intended for use in tuned r. f. sets or any other type of receivers in which three condensers are required for tuning. The chassis is arranged so it may be incorporated in a receiver bodily. Three drums control the three variables (in this case .00035 mfd. each). The condensers may be varied simultaneously by movement of the drum as a whole, or each condenser individually may be altered by means of its respective drum section. Such a unit has been tested in the Radio Age Laboratory and found highly satisfactory for group tuning work. It is ruggedly built and well machined.

When Broadway Came to Main Street

(Continued from page 24)

foreign to his existed, but so long as he was getting as much enjoyment out of it as from a troupe of performing monkeys—and no doubt his matter of fact mind would place a night club crowd in the same category—who shall say his radio set wasn't worth the price? It had brought him New York, something heretofore as remote and unthought of as China, and now he was attempting to visualize something of its vastness, its millions and its many wonders.

"I will say," he commented, "that's a right smart-lookin' young fellow they've got for a mayor down there. I saw his picture in the Tribune one day."

"Yes, and he used to write popular songs, Uncle John," we told him. "Just the kind of things you've been listening to." Upon looking back we fear we left our old, country friend with a sort of a "Manhattan Transfer" impression of New York, where Jimmy Walker might be found most any night leading an orchestra in a supper club, but we did our best.

WJZ'S Super Power

IT IS to WJZ's successful experiments with super-power the past winter that the Uncle Johns of a thousand miles or more distant, owe their introduction to many features of metropolitan broadcasting. Though a number of them have been listening to WEA F for a couple of years through the Detroit, Cincinnati, Chicago, Davenport and Minneapolis hook-ups, this winter has been their first opportunity of hearing the metropolis direct and programs not planned especially for far away listeners.

It seems to us that this success of WJZ's is the one outstanding broadcasting achievement of the unsatisfactory winter of 1925, with its epidemics of sun spots, auroras, and various manifestations of nature, that have combined with man-made interference to render things unpleasant for the radio listener. For they have been able to encompass incredible distance with tremendous volume. True, it has seemed

that invariably on the nights reserved for the Victor concerts, the busy little electrons decided that a migration was in order, or the moon had to get full, or some other interference crop up to bear out the theory that the only satisfactory way to hear radio from a point five hundred miles distant is over a telephone wire, but on the whole the performance of this station has been very satisfactory.

And while we are speaking of Victor concerts—if there was one single carping, anti-radio critic extant, the final concert of this group surely left him without a leg to stand on. The combination of Jeritza's magnificent cadenzas, de Gogorza's velvety baritone and the reluctant Zimbalist's expert bowing, made it an evening long to be remembered by those who love the very best in music. And it is programs of the character of these and the splendid Atwater-Kent presentations through WEA F that make it so necessary for us to hear New York with satisfaction. It is all very well for Mr. Babbit out in the Middle West to exclaim, with fine scorn, "What do we need to hear New York for? We've got just as good talent right here in Gopher Prairie." We know perfectly well we haven't. If they were so good, they wouldn't stay in Gopher Prairie. For today the talent of both the old and new world gravitates to the great city of opportunity as surely as once all roads led to Rome.

Stagnate at Home

WE recall a day when we were negotiating the traffic mess in Forty-second street in company with a young painter, who had achieved a notable success after ten years' struggle in the city. We had dodged seventeen taxicabs, a score of trucks, and were edified by the spectacle of a woman being extricated from under the wheels of a surface car.

"George," we said, with a good deal of irritation, "why don't you go home to paint? How can anyone do any creative work in such a bedlam as this? Now that you have arrived, you don't have to stay here."

"I stay because I can't work anywhere else," was his reply. "I

don't know a dozen people in the city, outside my own group, but it is the crowds in the streets, the bedlam as you call it, the bigness of it all, that gives the inspiration. And then it is the contacts. Everyone who is doing anything in art is here, or comes here at some time. I'd stagnate back home."

Which, while it has nothing to do with radio, probably explains the lure of Manhattan, and why we are dependent upon the greatest city for the best in radio entertainment as well as the more established arts of the theatre and the concert stage.

The great orchestras, such as the Philharmonic, come to us through WJZ; the Army, Navy and Marine Bands, rebroadcast from Washington; concert and dance orchestras from the great metropolitan hotels, important speeches and broadcasts of banquets to great personages, occasional appearances of some distinguished man or woman who happens to be in the city, together with studio programs always of a character in keeping with the high standard of the station.

With the wealth and prestige of the Radio Corporation of America back of it, its wonderful mechanical equipment, and the high standard of its studio personnel, it would be singular indeed, if WJZ were not a great station. Aside from the high spots of the Victor concerts, Godfrey Ludlow's studio recitals on Sunday nights have had the largest following of music lovers. And then there is Henry Hadley's Philharmonic Orchestra, the Royal Salon Orchestra, the Baldwin Hour and many others that it is a joy to welcome into our homes.

And for the oldsters like Uncle John, with suppressed cafe complexes, and the exiles from the Great White Way, there is a dance program from a different hotel or club every night, which brings the tang of Broadway, (purely symbolic, for there are so few of them on Broadway any more,) to far distant sections.

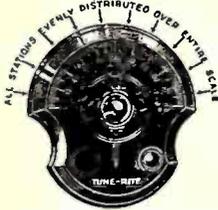
TUNE-RITE

The Straight Line Frequency Dial

Separates Low Wave Stations

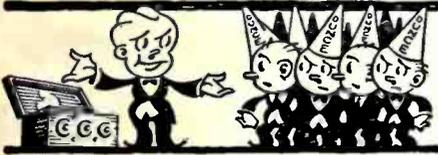
Converts any set into a SLF set without expensive or bulky SLF condensers

Instantly attached



No drilling to attach.

Price \$3.50



Fool Proof

AMPERITE—the perfect filament control. Takes the guess out of tube control. No knobs to turn. Makes tubes last longer. Makes any novice a master operator. Specified in all popular construction sets. \$1.10.

Radiall Company

Dept. R. A.—8 50 Franklin Street, New York City

Write for FREE Hook-ups



The "SELF-ADJUSTING" Rheostat

A&B Battery Charger ONLY \$2

SATISFACTION GUARANTEED



Charges any type of storage A or B battery, using a few cents worth of ordinary house current, either alternating or direct. Cannot injure battery. Complete directions enclosed. Anyone can operate. No expensive "extras" to buy. Why pay

\$10.00 to \$15.00 for a charger when you can get this splendid GUARANTEED R. B. Charger by mailing us two dollars (bills, money-order, check or stamps) plus ten cents in stamps or coin to pay mailing costs. Charger will be sent postpaid. If you are not satisfied, return within five days and we will refund your money. Order at once—TODAY.

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Dept. A-40, 308 East Third St., Cincinnati, Ohio

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FAKE BOOK Z. H. POLACHEK PATENT ATTORNEY CONSULTING ENGINEER 70 WALL ST. NEW YORK

NAME _____ ADDRESS _____ MAIL TODAY

Amateur Message to China

AN outstanding example of the amazing strides that the radio amateur has made in the last few years is furnished by the record of a recent message that originated in the Hawaiian Islands for delivery in China. Although ordinarily such messages are sent either direct to the destination, or by means of one or two intermediate relays, the communication in question traveled a distance of nearly twice the circumference of the earth before it reached the party for whom it was intended.

The message was started from amateur station 6DBL, at Honolulu, and from there went to 2NZ, E. S. Strout, Jr., of New York City, no direct communication to China being possible. 2NZ gave it a fresh start toward the Orient by passing it along to 9ZT, Don Wallace, in Minneapolis; but the latter evidently deciding that it would be better to go back a little and get a running start, passed it to the U. S. Navy's experimental station, NKF, at Bellevue, near Washington, D. C.

From Bellevue it was sent over to New Zealand, where 2AC, again enable to connect with China, handed it to a French station. The Frenchman evidently still had faith in the southern route, for he passed it along to a South African amateur. The South African happened to hear a Philippine amateur, so gave it to him, and the Philippine amateur delivered it to an amateur in China who saw that the message reached its ultimate destination.

Casual though this incident is, the average radio public will probably be startled to realize the way the amateur of today tosses messages back and forth between the different continents of the earth. Where five years ago it was considered a noteworthy achievement for an amateur to be able to transmit over a distance of 1,000 miles, the amateur of 1926 finds the world no larger than one of our smallest states.



RESERVE POWER



THORDARSON

Power Amplification and B—Supply From The A. C. Line

Force a car up a steep hill and the engine knocks. Force a radio set and the quality becomes ragged and the reproduction distorted.

Faithful reproduction of the deeper bass tones requires a considerable expenditure of electrical energy,—more, in fact, than the vacuum tube of the average receiver can handle.

A power amplifier built with Thordarson transformers and chokes uses larger capacity tubes and reproduces the heavier, more vibrant tones with undistorted quality and volume.

Operates from the light circuit B—supply for entire receiver. No controls. Requires no adjustment. Uses larger capacity tubes.

TRANSFORMER R-198 supplies 425 V. plate and 7 1-2 V. filament for UX 210 tube.

Price \$12.00

30 HENRY CHOKE R-196, 70 M. A. capacity for filter circuits.

Price \$5.00

Thordarson Electric Mfg. Co.

500 W. Huron St. Chicago, Ill.

Transformer Specialists since 1895 WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS

Transformer Specialists Since 1895 WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS

A new-type radio offers 4 great advantages

- 1 **Greater distance.** Coast to coast in winter. 1000 miles in summer.
- 2 **Finer tone.** No distortion. All tones crystal clear.
- 3 **Better selectivity.** Find any station already logged in 20 seconds.
- 4 **Increased volume.** Brings in distant stations with volume enough to fill an auditorium.

ERLA

FOR CLEAR, QUIET "B" POWER



RADIO Storage "B" Battery

12 Cells 24 Volts Lasts Indefinitely—Pays for Itself
Economy and performance unheard of before. Recharged at a negligible cost. Delivers unflinching power that is clear, pure and quiet. Approved and listed as Standard by leading Radio Authorities, including Pop. Radio Laboratories, Pop. Sci. Inst., Standard, Radio News Lab., Lefax, Inc., and other important institutions. Equipped with **Solid Rubber Case**, an insurance against acid and leakage. Extra heavy glass jars. Heavy rugged plates. Order Yours today!

SEND NO MONEY Just state number of batteries to be received. Extra offer: 4 batteries in series (96 volts), \$10.50. Pay expressman after examining batteries. 5 per cent discount for cash with order. Mail your order now!

WORLD BATTERY COMPANY

1219 So. Wabash Ave., Dept. 81 Chicago, Ill.
Manufacturers of the Famous World Radio "A" Storage Battery.
Prices: 6-volt, 100 Amp. \$11.25; 120 Amp. \$13.25; 140 Amp. \$14.00.
All equipped with Solid Rubber Case.

World STORAGE BATTERIES

Set your Radio Dials at 210 meters for the new 1000 watt World Storage Battery Station, WSBG, Chicago. Watch for announcements.

EVERYTHING IN RADIO AT BARGAIN PRICES

Just hot off the press—1926 Radio Catalog & Guide brimful of latest ideas, newest hookups—all free. Shows savings as high as 50% on standard guaranteed radio parts, sets, kits. Be sure to get this thrifty book before you buy. It puts money in your pocket. Unusual! You'll say so when you get it. Also please send name of radio friend. Write today.

THE BARAWIK COMPANY
102-126 S. Canal St., Chicago, U. S. A.



BOW LEGS and KNOCK-KNEES UNSIGHTLY

Those afflicted with BOW LEGS should wear the "PERFECT LEG FORMS" and overcome this deformity. Trousers hang perfectly straight. Made of the highest grade Aluminum. Sanitary, Light, and Durable. Easy to put on or off. Send for booklet showing photos of men with and without the "PERFECT LEG FORMS."

PERFECT SALES CO., Dept. 70,
140 N. Mayfield Ave., Chicago, Ill.

Stories the Studio Microphone Relates

(Continued from page 28)

group. He strove to efface himself while the rest of the gang did the hip and hurrah stuff. Most of his followers were strutting about the studio letting everyone within earshot know they were with Red Grange. In fact, they were so much in evidence that when it came time for Grange to take his place before the microphone he had to elbow his way through the crowd. Although Grange was nervous, he made a good talk.

"Billy" Mitchell, the "fighting colonel" of the air, was as composed before the microphone as he was when he faced the board in Washington.

John H. Lyle, a prominent Chicago judge, stripped off his coat and collar before he took his place before the microphone and, although he was scheduled to speak but fifteen minutes, talked for fifty-five and was stopped then only by the announcer who wrote on a piece of paper which he laid before the judge, "We must be off the air in two minutes."

Brigadier General Henry J. Reilly, affectionately known as the commander of "Reilly's Bucks," was more worried about getting a box of candy to take home than he was about the microphone. Right up until the time for him to speak he was asking everyone if the candy store below would still be open after he finished his talk.

Incidentally, Gen. Reilly is one of the best radio speakers in the country, according to the stations who have broadcast him. He uses only a few notes but speaks with as perfect coherence and connection as though every word were written out for him. He sits and calmly inspects his nails as he talks and never once falters in his speech.

Forgot the Ladies

WARREN BROWN, one of the best sport writers in the country, took his place before the microphone wearing his cap. In the middle of his speech he stopped, turned red, grabbed his

cap off and flung it violently into the corner.

"I forgot women listened in too," he said in explanation after his talk was over.

Gloria Swanson trembled before the microphone and declared the studio was like an undertaking parlor; Richard Barthelmess nervously drew pictures all during the time he was speaking; Betty Bronson frankly wept before and after her speech and Bill Hart made the most feverish gestures any human ever achieved. After all, you can't blame them. Radio broadcasting really isn't as easy as it looks.

60-page Reference Book

Free

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REFERENCE BOOK FOR
DIRECT MAIL ADVERTISERS

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FOR DIRECT MAIL ADVERTISERS

Shows how to increase your business by the use of Direct Mail Advertising. 60 pages full of vital business facts and figures. Who, where and how many prospects you have. Over 8,000 lines of business covered.

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PATENTS

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Please mention Radio Age when writing to advertisers

Changing the Receiver to Single Control

(Continued from page 11)

characteristics vary considerably between 1450 KC and 600 KC. It was with the idea of eliminating this that I chose this new method of antenna coupling. It will absolutely isolate the antenna from the set as regards any effect in tuning. As regards selectivity that rests on the design of the RF amplifier.

Interesting History of Tube Manufacture

(Continued from page 9)

one tube which is connected to the vacuum system for exhausting, and another which contains magnesium wrapped in sheet nickel.

Tube Exhausted

THE tube, after being sealed on the vacuum system, is exhausted, and then it is baked in an electric oven for a certain length of time, and at a definite temperature, in order to get rid of the water vapor or moisture in the glass. After this bake-out, the current is shut off from the oven, and the tube is allowed to cool. The metal anode, or plate, and the grid are now heated up to a temperature just below the melting point of nickel by a high frequency induction coil in order to get rid of the gas in the metals. The filament is heated to a very high temperature by passing a current through it in order to get rid of its gas. These gases are pumped out as fast as they are liberated. We have now a very high vacuum after pumping out all of the moisture in the glass and the gases in the metal parts, but still, we are not satisfied. The magnesium, wrapped in a piece of thin nickel and held in the small side tube, is now heated by a high frequency induction coil until the magnesium vaporizes, and condenses in the bulb giving it the appearance of a mirror. This metal reacts with the last traces of the more troublesome gases left in the tube, and cleans them up, giving us a still higher vacuum. The tube is now sealed off and based by automatic machinery. The filament, grid and plate wires are soldered to the insulated terminals in the base by an operator and we have the complete tube.

Makes a Fair Set Good and a Good Set Better

See That Screw

A screw-driver adjusts an X-L in crowded places.

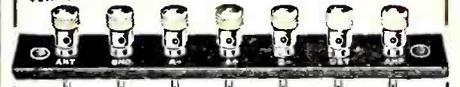


X-L VARIO DENSER

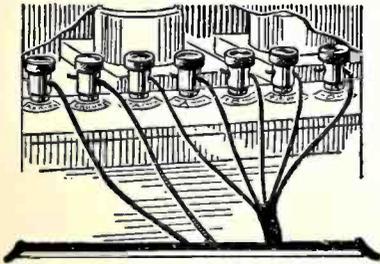
RESULTS in easier tuning, more distance, volume and clarity—greater stability. Indorsed by leading radio authorities. Model "N"—A slight turn obtains correct tube oscillation on all tuned radio frequency circuits. Neutrodyne, Roberts two tube, Browning-Drake, McMurdo Silver's Knockout, etc. Capacity range 1.8 to 20 micro micro farads. Price \$1.00.



Model "G"—as shown above. With grid clips obtains the proper grid capacity on Cockaday's circuits, filter and intermediate frequency tuning in heterodyne and positive grid bias in all sets. Capacity range model G-1-.0002 to .0001 M. F. D., model G-5-.0001 to .0005 M. F. D., model G-10-.0003 to .001 M. F. D. Price \$1.50. X-L Push Post—Push it down with your thumb, insert wire, remove pressure and wire is firmly held. Release instantly. Price 15c. Push Post Panel permanently marked in white or black rubber. In box including soldering lugs, raising bushings and screws for mounting, etc. Price \$1.50.



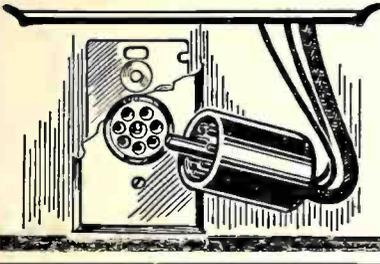
X-L Radio Laboratories 2424 Lincoln Ave. N. CHICAGO, ILL.



Radio Wall Socket

Consider this new style Jones MULTI-PLUG for your present set—or the one you are building. A wall socket connects with batteries, ground and aerial hidden out of sight in basement or near-by room. Plug leads direct from binding posts. Ask your radio dealer.

Jones MULTI-PLUG
THE STANDARD SET CONNECTOR



FOR CLEAR, QUIET "B" POWER



RADIO Storage "B" Battery

12 Cells 24 Volts **Lasts Indefinitely—Pays for Itself**
Economy and performance unheard of before. Recharged at a negligible cost. Delivers unflinching power that is clear, pure and quiet. Approved and listed as Standard by leading Radio Authorities, including Pop. Radio Laboratories, Pop. Sci. Inst., Standards, Radio News Lab., Lefax, Inc., and other important institutions. Equipped with Solid Rubber Cases, an insurance against acid and leakage. Extra heavy glass jars. Order Yours today!

SEND NO MONEY Just state number of batteries wanted and we will ship day order is received. Extra offer: 4 batteries in series (96 volts), \$10.50. Pay expressman after examining batteries. 5 per cent discount for cash with order. Mail your order now!

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1219 So. Wabash Ave., Dept. 81 Chicago, Ill.
Makers of the Famous World Radio "A" Storage Battery
Prices: 6-volt, 100 Amp. \$11.25; 120 Amp. \$13.25; 140 Amp. \$14.00.
All equipped with Solid Rubber Cases.

World STORAGE BATTERIES

Set your Radio Dial at 210 meters for the new 1000 watt World Storage Battery Station, WSSC, Chicago. Watch for announcements.

HEALTH by RADIO

Send for FREE BOOK "RADIO APPLIED TO HEALTH." Tells exactly how to have radiant health through Radio Vibrations. Startling! Scientific! Wonderful!!

Dr. Farnham's Laboratories,
Dept. H-8, Boydell Bldg., Detroit, Mich.

TRANSMITTING APPARATUS

In addition to our regular broadcast apparatus we carry a very good stock of transformers, chokes, grid leaks, high test condensers, etc., for transmitting purposes.

We will shortly issue our new catalog and we quote discounts to dealers or set builders who can give satisfactory buying references. Please address us on your regular letterhead.

CHICAGO RADIO APPARATUS COMPANY
415 South Dearborn St.,
Chicago
CHI-RAD

San Diego Now Has Broadcasting Station

(Continued from page 26)

benefit from this station than it has from all the money spent on advertising in various forms. To date we have received over 3,000 letters, the correspondents representing not only this country, but Alaska, Canada, and Mexico. We have received two letters from New Zealand, and our messages are picked up by boats off the coast, from points 2,700 miles south."

The radio telephone broadcasting plant installed at Station KFSD is a 1,000 watt, 106-A Western Electric, the latest design in modern radio broadcasting equipment. Many improvements and refinements have been made which add to the quality of the programs and increase the sending range.

One of the improvements is a large water-cooler tube which operates with a plate voltage of 4,000 volts. The use of this tube provides great efficiency and affords many broadcasting advantages.

When the microphone is disconnected, power delivered to the antennae is rated at 1,000 watts. During modulation, the instantaneous antennae power often rises to as high as 2,500 watts.

It is possible to check up on the results of this type of station, as there are two similar stations in California, one in San Francisco, Station KPO, and Station KPSN in Pasadena. The results obtained by these stations go to prove that the messages sent through the air are received in each of the United States and in many islands in the Pacific. The distance range at night is increased many hundred miles over the average day broadcasting radius.

The power supply mechanism includes a duplicate motor generator units, the first of which has already been installed; proper control switches and regulators; a master control panel in which the radio transmitter is encased; a speech input board with the program control switches; a water circulation system and a complete receiving set apparatus

with which to check programs either before or after they have been placed on the air.

To protect the equipment from stray currents, all conduit throughout the plant has been grounded every six feet to the steel girders of the hotel building. The motor generator units, after being placed on vibrationless beds of cork and felt overlaid with by a cement block, have been grounded to the steel girders by broad bands of copper ribbons. The entire roof of the studio, reception, and operating rooms has been grounded by a network of copper wires which have been soldered down in checker fashion.

Programs sent through this microphone will have none of the reverberation which marks some of the stations now in the air, such splendid precautions having been taken to insure the walls and windows against noise interference.

A few words about President Hal C. Rogers, "the man who put San Diego on the Air" might be interesting at this point. Mr. Rogers is an ex-showman, and that may explain his amazing gift for making his dreams materialize into successful enterprises. His past experience in providing entertainment for the public is proving useful in his present venture. Mr. Rogers knows that the secret of success with the public lies in providing good programs.

"I will consistently give the radio fans programs of unusual merit. This will establish a reputation for Station KFSD which will result in creating an enviable name in the radio world."

Mr. Rogers cherished the desire for a radio station that would broadcast the wonders of San Diego to the entire world. He worked unceasingly for the realization of his dream, and at last, on April 30, 1925, his efforts brought material results. On that day the Airfan Radio Corporation was created.

To make a model studio, worthy of the Airfan Radio Corporation, interior decorators, radio technicians, and a consulting engineer were set to work. A staff of experienced studio people to insure the success of the

programs was then employed. The operating room is in charge of Gene Merrit, technician, and Lester Pickert, operator.

Chief Operator

THERE is an interesting story in connection with Mr. Pickert. He was always an ardent radio fan, and five years ago, when putting up an antenna, he fell and injured himself for life. His legs were paralyzed, but nevertheless he kept up his interest in radio in spite of this terrible handicap. He was then only a lad in his teens.

As soon as he heard about the plans for a broadcasting station he came to see Mr. Rogers about work. Mr. Rogers promised to do what he could, and when the plans were completed, to the great joy of the boy, he was made chief operator.



WRITTEN 2-YEAR GUARANTEE

ARROW BATTERY

Battery Prices SMASHED!

To Consumers Only
Here is a real battery quality, guaranteed to you at prices that will astound the entire battery-buying public. Order Direct From Factory. Put the Dealer's Profit in your own pocket. You actually save much more than half, and so that you can be convinced of true quality and performance, we give a **Written 2-Year Guarantee**. Here is your protection! No need to take a chance. Our battery is right—and the price is lowest ever made. Convince yourself. Read the prices!

Auto Batteries		Radio Batteries	
6 Volt, 11 Plate, \$8.50	6 Volt, 100 Amp. \$8.50	6 Volt, 13 Plate, 10-25	6 Volt, 120 Amp. 14-25
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Buy Direct—Send No Money
We ask no deposit. Simply send name and address and style wanted. Battery will be shipped same day we receive your order Express C.O.D. subject to your examination on arrival. Our guarantee accompanies each battery. We allow 5% discount for cash in full with order. You cannot lose! Send your order today—NOW!

ARROW BATTERY CO.
Dept. 12. 1215 So. Wabash Ave., Chicago

RADIO We want to hear from hard-hitting radio dealers operating live-wire stores who want to make the best jobber connection in America.

DEALERS

Our eight big warehouses furnish you with the finest products in radio. And we ship fast.

WANTED

Write today on your letterhead for big catalog of nationally advertised lines.
Ask for L 1006

WAKEM & McLAUGHLIN, Inc.
225 E. ILLINOIS STREET, CHICAGO, ILL.

European Radio Notes

From H. de A. Donisthorpe
23 Gledhow Gardens, London, S. W. 5

British Licenses

Interest in radio broadcast-
ing continues to grow in Great
Britain, and the number of re-
ceiving license has now swelled to
1,906,000. During the strike
there were many more numbers
added to the radio listeners, and
it is expected that the next figure
issued by government authorities
will reach the 2,000,000 mark.

Radio Picture Service

As a result of the recent experi-
ments in the transmission of
radio pictures across the Atlantic,
a regular service is now being in-
augurated. An office in London
will accept pictures for transmis-
sion by radio to New York for
the sum of 50 shillings.

Large Sum Obtained

THE German government an-
nounce the total income de-
rived from radio receiving li-
censes in that country amounts to
twenty-eight million gold marks.
As there are nine companies pro-
ducing radio programs for their
audiences this money has to be
shared amongst them and sixty
per cent of the money collected
has been equally distributed be-
tween them.

Radio Beam System

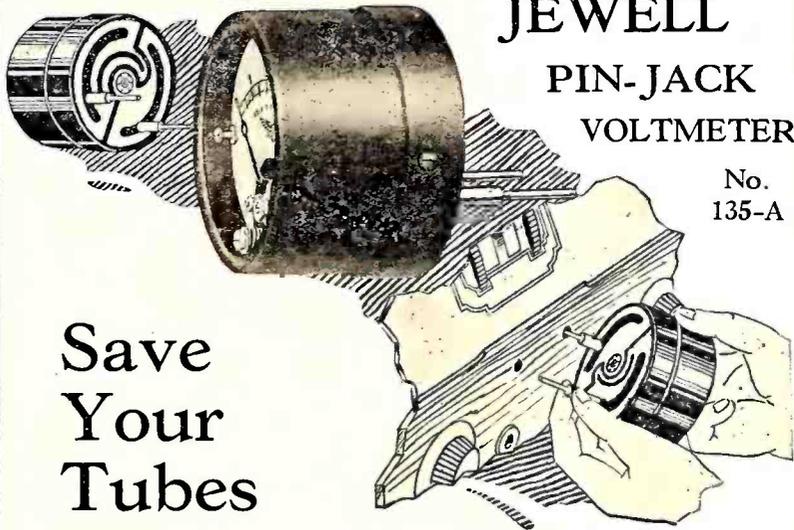
A "BEAM" radio station is be-
ing erected in Australia, and
will be open for public use early
next fall. This station will op-
erate direct with Great Britain,
and from the tests already car-
ried out it would appear a very
reliable and regular service will
be carried on in spite of the great
distance separating the two coun-
tries.



CONDENSERS
VERNIERS
RHEOSTATS

AMSCO PRODUCTS, Inc. New York City

Centralab Radiohms, Modulators, Potentiometers
or Rheostats are standard on 69 leading radio
sets. Ask your dealer, or write for descriptive
literature.
CENTRAL RADIO LABORATORIES,
24 Keefe Ave., Milwaukee, Wis.



**JEWELL
PIN-JACK
VOLTMETER**

No.
135-A

**Save
Your
Tubes**

**FITS ALL
SETS—SCALE
ALWAYS HORIZONTAL**

If you have a new Radiola, Victor or Brunswick set,
you will need a high resistance pin-jack voltmeter. Several
other large set manufacturers are also placing two pin-
jacks in the panel of their sets.

These two pin-jacks are for the distinct purpose of
plugging in voltmeter terminals and thus controlling
filament voltages.

The new "JEWELL" pin-jack voltmeter is made with
adjustable prods and back plate to fit either horizontal
or vertical placing of pin-jacks and always have the scale
reading horizontally.

Tubes burned slightly above their rated voltage soon
lose their efficiency and when burned too low, reception is
not good. There is no way of safely controlling the fila-
ment voltage of a tube except by the use of a high resist-
ance voltmeter.

Send for new "JEWELL" pin-
jack voltmeter circular —
No. 1015.

**JEWELL ELECTRICAL
INSTRUMENT CO.**

1650 Walnut St., Chicago

"26 YEARS MAKING GOOD INSTRUMENTS"

An Index to the Best in Radio Hookups!

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

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- A Ten Dollar Receiver.
- Anti-Body Capacity Hookups.
- Reflexing the Three-Circuit Tuner.

May, 1924

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- Radio Panels.
- Third Installment of Radio Age Data Sheets.

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- Adding Radio and Audio to Baby Heterodyne.
- Radio Age Data Sheets.

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- Operating Detector Tube by Grid Bias.
- A Three-Tube Wizard Circuit.

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- Filtered Heterodyne Audio Stages.
- An Audio Amplifier Without an "A" Battery.

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- One Tuning Control for Hair's Breadth Selectivity.
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- Mastering the 3-Circuit Tuner.

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- An Efficient Portable Set.
- A Tuned Plate Regenerator.
- Making a Station-Finder.

February, 1925

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

March, 1925

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- A Short Wave Receiver.
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- An Amplifier for the 3-Circuit Tuner.
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- A Unique Super-Het and an Improved Reinsert.
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- Overcoming Oscillations in the Roberts Receiver.

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- How Much Coupling?
- Blueprints of Conventional Radio.
- Symbols and Crystal Detector Circuit.

August, 1925—50c per copy

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- Alternating Current Tubes.
- Deciding on a Portable Super.
- And a big 60-page blueprint section.

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- Tuning efficiency with two controls.
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- Blueprints of Circuits Using Single and Dual Controls.

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- An Efficient Short-Wave Transmitter.
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December, 1925

- Tuned R. F. and Regeneration.
- Radio Age Model Receiver.
- Inductive Gang-Control Receiver.
- Tuning with Chart Curves.

January, 1926

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- Balanced Capacity Receiver.
- Several Sets on One Antenna.

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- Simplifying Battery Charging.
- List of European Broadcasters.
- Protecting your Inventions.

June, 1926

- Antenna Design.
- Simple Crystal Set.
- Improving the Neutrodyne.
- Golden Rule Receiver—Blueprints.

Radio Age, Inc., 500-510 N. Dearborn St., Chicago

Burnie Orchestra Is Now at Congress

THE orchestra that has been entertaining KYW fans; from the Congress Hotel, is not a new one to Chicago. Burnie and his orchestra have performed in this city before, and their present musical exploitation over KYW is meeting with much applause.

Mr. Burnie's career is not altogether a common one. Having been a dancer on the Keith Vaudeville circuit he had been quite well-known before organizing his orchestra. His leap into orchestration was brought about because of failing health, due to strenuous stage work that permitted little or no rest. His first real big hit was at the Belleview Biltmore Hotel in Bellaire, Fla., where he presented his orchestra as well as playing personal entertainment.

He then moved on to the Atlanta Biltmore, at Atlanta, Ga., where he played with the New York Company during their visit to Atlanta. His most recent engagement before coming to the Congress Hotel, Chicago, was at the Swiss Gardens, Cincinnati, Ohio. At the Congress, Burnie and his orchestra are playing daily over Westinghouse Station KYW.

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Howard B. Luce of Friedens, Pa., made \$320 in 7 weeks during his spare time. D. H. Suitt of Newport, Ark., writes, "While taking the course I earned in spare time work approximately \$900." Earl Wright of Omaha, reports making \$400 in a short time while taking his course—working at Radio in his spare time only! Sylvester Senso, 207 Elm Street, Kaukauna, Wis., made \$500.

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KDLR	Radio Electric Co.	Devils Lake, N. D.	231	KFQP	G. S. Carson, Jr.	Iowa City, Ia.	224
KDYL	Newhouse Hotel	Salt Lake City, Utah	246	KFQU	W. Riker	Holy City, Calif.	217
KFAB	Nebraska Buick Auto Co.	Lincoln, Neb.	341	KFQW	C. F. Knierim	North Bend, Wash.	216
KFAD	McArthur Bros. Mercantile Co.	Phoenix, Ariz.	273	KFQZ	Taft Products Co.	Hollywood, Calif.	225
KFAF	A. E. Fowler	San Jose, Calif.	217	KFRB	Hall Bros.	Beeville, Texas	248
KFAU	Independent School Dist.	Boise, Idaho	280	KFRC	City of Paris Dry Goods Co.	San Francisco, Calif.	268
KFBB	F. A. Buttrey & Co.	Havre, Mont.	275	KFRU	Stephens College	Columbia, Mo.	500
KFBC	W. K. Azbill	San Diego, Calif.	216	KFRW	G. & G. Radio Shop	Olympia, Wash.	219
KFBK	Kimball-Upson Co.	Sacramento, Calif.	248	KFSB	Airfan Radio Corp.	San Diego, Calif.	246
KFBL	Leese Bros.	Everett, Wash.	224	KFSG	Echo Park Evan. Assn.	Los Angeles, Calif.	275
KFBS	School District No. One	Trinidad, Colo.	238	KFUL	Thomas Groggan & Bros. Music Co.	Galveston, Texas	258
KFBU	Bishop N. S. Thomas	Laramie, Wyo.	270	KFUM	W. D. Corley	Colorado Springs, Colo.	239
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238	KFUO	Concordia Seminary	St. Louis, Mo.	545
KFDD	St. Michaels Cathedral	Boise, Idaho	278	KFUP	Fitzsimmons General Hospital	Denver, Colo.	234
KFDM	Magnolia Petroleum Co.	Beaumont, Texas	316	KFUR	Peery Bldg. Co.	Ogden, Utah	224
KFDX	First Baptist Church	Shreveport, La.	250	KFUS	Louis L. Sherman	Oakland, Calif.	256
KFDY	South Dakota State College	Brookings, S. D.	273	KFUT	University of Utah	Salt Lake City, Utah	261
KFDZ	Harry O. Iverson	Minneapolis, Minn.	231	KFUU	Colburn Radio Labs.	Oakland, Calif.	220
KFEC	Meier & Frank Co.	Portland, Ore.	248	KFVD	McWhinnie Electric Co.	San Pedro, Calif.	205
KFEL	Winner Radio Corp.	Denver, Colo.	254	KFVE	Film Corporation of America	St. Louis, Mo.	240
KFEQ	J. L. Scroggin	Oak, Neb.	268	KFVG	First M. E. Church	Independence, Kans.	236
KFEY	Bunker Hill & Sullivan Min. & Con. Co.	Kellogg, Idaho	233	KFVI	Headquarters Troop, 56th Cavalry	Houston, Texas	240
KFFP	First Baptist Church	Moberly, Mo.	242	KFVN	Carl E. Bagley	Fairmont, Minn.	227
KFGQ	Crary Hardware Co.	Boone, Iowa	226	KFVS	Hirsch Battery and Radio Co.	Cape Girardeau, Mo.	224
KFH	Hotel Lassen	Wichita, Kans.	268	KFVY	Radio Supply Co.	Albuquerque, N. M.	250
KFHA	Western State College of Colo.	Gunnison, Colo.	252	KFWA	Browning Bros. Co.	Ogden, Utah.	261
KFHL	Penn. College	Oskaloosa, Iowa	240	KFWB	Warner Bros.	Hollywood, Calif.	252
KFI	E. C. Anthony, Inc.	Los Angeles, Calif.	468	KFWC	L. E. Wall	San Bernardino, Calif.	211
KFIF	Benson Polytechnic Institute	Portland, Ore.	248	KFWF	St. Louis Truth Center	St. Louis, Mo.	214
KFIO	North Central High School	Spokane, Wash.	265	KFWH	F. Wellington Morse, Jr.	Chico, Calif.	254
KFIQ	First Methodist Church	Yakima, Wash.	256	KFWI	Radio Entertainments, Inc.	South San Francisco, Calif.	226
KFIU	Alaska Electric Light & Power Co.	Juneau, Alaska	226	KFWM	Oakland Educational Society	Oakland, Calif.	207
KFIZ	Daily Commonwealth	Fond du Lac, Wis.	273	KFWO	Lawrence Mott	Avalon, Calif.	211
KFJB	Marshall Electrical Co.	Marshalltown, Iowa	248	KFWU	Louisiana College	Pineville, La.	238
KFJC	R. B. Fegan (Episcopal Church)	Junction City, Kans.	219	KFWV	Wilbur Jerman	Portland, Ore.	213
KFJF	National Radio Manf. Co.	Oklahoma City, Okla.	261	KFXB	Bertram O. Heller	Big Bear Lake, Calif.	203
KFJI	Liberty Theatre (E. E. Marsh)	Astoria, Ore.	246	KFXD	Service Radio Co.	Logan, Utah	205
KFJM	University of North Dakota	Grand Forks, N. D.	278	KFXF	Pike's Peak Broadcasting Co.	Colorado Springs, Colo.	250
KFJR	Ashley C. Dixon & Son	Portland, Ore.	263	KFXH	Bledsoe Radio Company	El Paso, Texas	242
KFJY	Tunwall Radio Co.	Fort Dodge, Iowa	246	KFXJ	Mt. States Radio Dist. Inc. (Portable Station)	Denver, Colo.	216
KFJZ	W. E. Branch	Ft. Worth, Tex.	254	KFXR	Classen Film Finishing Co.	Oklahoma City, Okla.	214
KFKA	Colo. State Teachers College	Greeley, Colo.	273	KFXZ	Mary M. Costigan	Flagstaff, Ariz.	205
KFKU	The University of Kansas	Lawrence, Kans.	275	KFYF	Carl's Radio Den.	Oxnard, Calif.	205
KFKX	Westinghouse Elec. & Mfg. Co.	Hastings, Neb.	288	KFYJ	Chronicle Publishing Co.	Houston, Texas	238
KFKZ	Chamber of Commerce	Kirkville, Mo.	226	KFYO	Buchanan-Vaughan Co.	Texarkana, Tex.	210
KFLR	University of New Mexico	Albuquerque, N. M.	254	KFYR	Hoskens-Meyers, Inc.	Bismarck, N. Dak.	248
KFLU	San Benito Radio Club	San Benito, Texas	236	KGO	General Electric Co.	Oakland, Calif.	361
KFLV	Swedish Evangelical Church	Rockford, Ill.	229	KGTT	Glad Tidings Tabernacle	San Francisco, Calif.	207
KFLX	George Roy Clough	Galveston, Texas	240	KGU	Marion A. Mulrony	Honolulu, Hawaii.	270
KFLZ	Atlantic Automobile Co.	Anita, Ia.	273	KGW	Portland Morning Oregonian	Portland, Ore.	491
KFMR	Morningside College	Sioux City, Iowa	261	KGY	St. Martins College	Lacy, Wash.	246
KFMW	M. G. Sateren	Houghton, Mich.	263	KHJ	Times-Mirror Co.	Los Angeles, Calif.	405
KFMX	Carleton College	Northfield, Minn.	337	KHQ	Louis Wasmer	Seattle, Wash.	394
KFNF	Henry Field Seed Co.	Shenandoah, Iowa	263	KJBS	J. Brunton & Sons	San Francisco, Calif.	220
KFOA	Rhodes Department Store	Seattle, Wash.	454	KJR	Northwest Radio Service Co.	Seattle, Wash.	384
KFOB	Chamber of Commerce	Burlingame, Calif.	226	KLDS	Reorganized Church	Independence, Mo.	441
KFON	Echophone Radio Shop	Long Beach, Calif.	233	KLS	Warner Brothers Radio Supplies Co.	Oakland, Calif.	250
KFOO	Latter Day Saints' University	Salt Lake City, Utah	236	KLX	Tribune Publishing Co.	Oakland, Calif.	508
KFOR	David City Tire & Electric Co.	David City, Neb.	226	KLZ	Reynolds Radio Co.	Denver, Colo.	266
KFOT	College Hill Radio Club	Wichita, Kans.	231	KMA	May Seed & Nursery Co.	Shenandoah, Iowa	252
KFOX	Board of Education, Tech. High School	Omaha, Nebr.	248	KMJ	Fresno Bee	Fresno, Calif.	234
KFOY	Beacon Radio Service	St. Paul, Minn.	252	KMMJ	M. M. Johnson Co.	Clay Center, Nebr.	229
KFPL	C. C. Baxter	Dublin, Texas.	252	KMO	Love Electric Co.	Tacoma, Wash.	250
KFPM	The New Furniture Co.	Greenville, Texas.	242	KMOX	Voice of St. Louis	St. Louis, Mo.	280
KFPR	Los Angeles County Forestry Dept.	Los Angeles, Calif.	231	KMTR	Turner Radio Corp.	Los Angeles, Calif.	238
KFPW	St. Johns M. E. Church	Cartersville, Mo.	258	KNRC	C. B. Juneau	Los Angeles, Calif.	208
KFPY	Symons Investment Co.	Spokane, Wash.	266	KNX	Los Angeles Evening Express	Los Angeles, Calif.	337
KFQA	The Principia	St. Louis, Mo.	261	KOA	General Electric Co.	Denver, Colo.	322
KFQB	The Searchlight Publishin Co	Fort Worth, Texas	263				

Amateurs Want Naval Radio Service

AMERICAN amateur radio operators to the number of 13,050 have responded to an invitation of the Naval Communication Service to enlist for special radio service and training in the reserve corps, according to Commander Glassford in charge of this national drive for the Navy Department.

Sixteen thousand letters were mailed out recently chiefly to members of the American Radio Relay League, and the responses, totaling over eighty per cent, is considered remarkable. Most of the replies were from young men, although a number from men too old to be accepted in the reserve corps were received.

Amateurs in the Ninth district, with headquarters in Chicago, and representing the middle-western states, showed the greatest interest, indicating that many farmers' sons desire marine and naval radio communications training. In many localities large numbers of amateurs are already participating in the regular weekly drills with the Naval Reserve. Arrangements are being made in each district to give the young operators practical experience at either naval shore or ship radio stations. Enlistment in the reserve corps requires only that the applicant be an American citizen of eighteen years, without other Governmental service affiliation, and in this instance with some experience in radio operation.



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What Users Say:

"246 Florence Ave., Highland Park, Mich. April 26, 1926
Ferbend Electric Co. Gentlemen: My reception is easily enhanced at least 60% by the installation of the Ferbend Eliminator, and I am a very satisfied customer. Performance is far in excess of excellence that I have ever before experienced with the use of batteries. I am using a 5 tube R. F. (Trahman Circuit), employing a C-4 battery and am at a loss to know how I can do all improve it since using your Eliminator. In fact, I am so pleased that I solicit inquiries from such as may be your prospects. I have compared the performance of the "Maxim" with others of far greater price and find that none produce the clarity of reception as does your instrument. (Signed) Wilson E. Rogers"

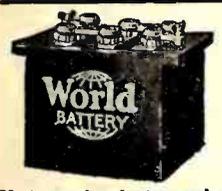
"San Francisco, April 20, 1926
Ferbend Electric Co. Dear Sirs: I have been using your "B" Eliminator steadily since I received it, and must say that it lives up to all the claims you make for it. This letter, I feel is the least I could do to thank you. (Signed) Philip A. Reilly, 1167 Valencia St."

"17 Sewall St. Framingham, Mass. April 12, 1926
Ferbend Electric Co. Dear Sirs: I have tried the "B" Eliminator which I purchased some time ago and find it works satisfactorily in every way. I have recommended this to several radio friends in this locality. I have had it on three different sets of 5 tubes each. Two of these sets are the tuned, radio frequency and the other is a straight Freeland. (Signed) Edw. A. Browning"

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KOAC	Oregon Agricultural College.....	Corvallis, Oreg.	280	WBAP	Wortham-Carter Pub.(Star Telegram).....	Ft. Worth, Texas	476
KOB	N. Mex. College Ag. & Me. Arts. State College, N. Mex.		349	WBAW	Braid Elec., & Waldrum Drug Co.....	Nashville, Tenn.	236
KOCH	Central High School.....	Omaha, Neb.	258	WBAX	John H. Stenger, Jr.....	Wilkes-Barre, Pa.	256
KOCW	Oklahoma College for Women.....	Chickasha, Okla.	252	WBBL	Grace Covenant Presbyterian Church.....	Richmond, Va.	229
KOIL	Monarch Manufacturing Co.....	Council Bluffs, Iowa	278	WBBM	Atlas Investment Co.....	Chicago, Ill.	226
KOIN	H. B. Read.....	Portland, Ore.	319	WBBP	Petoskey High School.....	Petoskey, Mich.	238
KOMO	Bert F. Fisher.....	Seattle, Wash.	306	WBBR	People's Pulpit Assoc.....	Rossville, N. Y.	273
KOWW	Blue Mt. Radio Assn.....	Walla Walla, Wash.	256	WBBS	First Baptist Church.....	New Orleans, La.	252
KPO	Hale Bros.....	San Francisco, Calif.	428	WBBW	Ruffner Junior High School.....	Norfolk, Va.	222
KPPC	Pasadena Presbyterian Church.....	Pasadena, Calif.	229	WBBY	Washington Light Inf. Co. "B" 118th inf, Charleston, S.C.		268
KPRC	Houston Post Dispatch.....	Houston, Texas	297	WBBZ	C. L. Carrell.....	Chicago, Ill.	216
KPSN	Star-News Publishing Co.....	Pasadena, Calif.	316	WBCN	Foster & McDonnell.....	Chicago, Ill.	266
KQV	Doubleday-Hill Electric Co.....	Pittsburgh, Pa.	275	WBDC	Baxter Laundry Co.....	Grand Rapids, Mich.	256
KQW	Charles D. Herrold.....	San Jose, Calif.	231	WBES	Bliss Electrical School.....	Takoma Park, Md.	222
KRE	Berkeley Daily Gazette.....	Berkeley, Calif.	256	WBNY	Shirley Katz.....	New York, N. Y.	210
KSAC	Kansas State Agricultural College.....	Manhattan, Kans.	341	WBOQ	A. H. Grebe & Co., Inc.....	Richmond Hill, N. Y.	236
KSD	Pulitzer Printing Co.....	St. Louis, Mo.	545	WBPI	I. R. Nelson.....	Newark, N. J.	263
KSL	Radio Service Corp. of Utah.....	Salt Lake City, Utah	300	WBRC	Bell Radio Corporation.....	Birmingham, Ala.	248
KSMR	Santa Maria Valley Railroad Co.....	Santa Maria, Calif.	210	WBRE	Baltimore Radio Exchange.....	Wilkes-Barre, Pa.	231
KSO	A. A. Berry Seed Co.....	Clarinda, Iowa	242	WBT	Charlotte Chamber of Commerce.....	Charlotte, N. C.	275
KTAB	Associated Broadcasters.....	Oakland, Calif.	240	WBZ	Westinghouse Elect. & Mfg. Co.....	Springfield, Mass.	331
KTBI	Bible Institute.....	Los Angeles, Calif.	294	WBZA	Westinghouse Elect. & Mfg. Co.....	Boston, Mass.	242
KTBR	Brown's Radio Shop.....	Portland, Ore.	263	WCAC	Connecticut Agricultural College.....	Mansfield, Conn.	275
KTHS	New Arlington Hotel Co.....	Hot Springs, Ark.	375	WCAD	St. Lawrence University.....	Canton, N. Y.	263
KTNT	N. Baker.....	Muscatine, Iowa	256	WCAE	Kaufmann & Baer Co. & The Pitts. Pr.....	Pittsburgh, Pa.	461
KTW	First Presbyterian Church.....	Seattle, Wash.	454	WCAJ	Nebraska Wesleyan University.....	University Place, Nebr.	254
KUOA	University of Arkansas.....	Fayetteville, Ark.	300	WCAL	St. Olaf College.....	Northfield, Minn.	337
KUOM	State University of Montana.....	Missoula, Mont.	244	WCAM	Galvin Radio Supply Co.....	Camden, N. J.	236
KUSD	University of South Dakota.....	Vermillion, S. D.	278	WCAO	A. A. and A. S. Brager.....	Baltimore, Md.	275
KUT	University of Texas.....	Austin, Texas	231	WCAP	Chesapeake & Potomac Tel. Co.....	Washington, D. C.	468
KVOO	The Voice of Oklahoma.....	Bristow, Okla.	375	WCAR	Southern Radio Corp. of Texas.....	San Antonio, Texas	263
KWCR	H. F. Paar.....	Cedar Rapids, Iowa	278	WCAT	State College of Mines.....	Rapid City, S. Dak.	240
KWG	Portable Wireless Telephone Co.....	Stockton, Calif.	248	WCAU	Universal Broadcasting Co.....	Philadelphia, Pa.	278
KWKC	Wilson Duncan Studios.....	Kansas City, Mo.	236	WCAX	University of Vermont.....	Burlington, Vt.	250
KWKH	W. G. Patterson.....	Kennonwood, La.	261	WCBA	Charles W. Heimbach.....	Allentown, Pa.	254
KWSC	State College.....	Pullman, Wash.	349	WCB D	Wilbur C. Voliva.....	Zion, Ill.	345
KWUC	Western Union College.....	Le Mars, Iowa	252	WCB E	Uhalt Radio Co.....	New Orleans, La.	263
KWWG	City of Brownsville.....	Brownsville, Texas	278	WCBH	University of Mississippi.....	Oxford, Miss.	242
KYW	Westinghouse Electric & Mfg. Co.....	Chicago, Ill.	535	WCBM	Charles Swarz.....	Baltimore, Md.	229
KZIB	I. Beck.....	Manila, P. I.	250	WCBR	C. H. Mester.....	Providence, R. I.	210
KZKZ	Electrical Supply Co.....	Manila, P. I.	270	WCCO	Washburn-Crosby Co.....	Anoka, Minn.	416
KZM	Preston D. Allen.....	Oakland, Calif.	240	WCLO	C. E. Whitmore.....	Camp Lake, Wisc.	231
KZRQ	Far Eastern Radio.....	Manila, P. I.	222	WCLS	H. M. Couch.....	Joliet, Ill.	214
KZUY	F. J. Elser.....	Manila, P. I.	360	WCMA	Culver Military Academy.....	Culver, Ind.	222
NAA	U. S. Navy Dept.....	Arlington, Va.	434	WCOA	City of Pensacola.....	Pensacola, Fla.	222
WAAD	Ohio Mechanics Institute.....	Cincinnati, Ohio	258	WCSH	Henry P. Rines.....	Portland, Maine	256
WAAF	Chicago Daily Drivers Journal.....	Chicago, Ill.	278	WCSS	Wittenberg College.....	Springfield, Ohio	248
WAAW	Omaha Grain Exchange.....	Omaha, Nebr.	278	WCWS	Chas. W. Selene (Portable).....	Providence, R. I.	210
WABB	Harrisburg Radio Co.....	Harrisburg, Pa.	204	WCX	Free Press and Jewett R. & P. Co.....	Detroit, Mich.	517
WABC	Asheville Battery Co., Inc.....	Asheville, N. C.	254	WDAD	Dad's Auto Accessories, Inc.....	Nashville, Tenn.	226
WABI	1st Universalist Church.....	Bangor, Me.	240	WDAE	Tampa Daily Times.....	Tampa, Fla.	273
WABO	Lake Avenue Baptist Church.....	Rochester, N. Y.	278	WDAF	Kansas City Star.....	Kansas City, Mo.	366
WABQ	Haverford College, Radio Club.....	Haverford, Pa.	261	WDAG	J. Laurence Martin.....	Amarillo, Texas	263
WABR	Scott High School.....	Toledo, Ohio	263	WDAH	Trinity Methodist Church.....	El Paso, Texas	268
WABW	College of Wooster.....	Wooster, Ohio	207	WDAY	Radio Equipment Corp.....	Fargo, N. Dak.	261
WABX	Henry B. Joy.....	Mt. Clemens, Mich.	246	WDBE	Gilham-Schoen Elec. Co.....	Atlanta, Ga.	270
WABY	John Magaldi, Jr.....	Philadelphia, Pa.	242	WDBJ	Richardson Wayland Elec. Corp.....	Roanoke, Va.	229
WABZ	Coliseum Place Baptist Church.....	New Orleans, La.	275	WDBK	M. F. Broz.....	Cleveland, Ohio.	227
WADC	Allen T. Simmons (Allen Theatre).....	Akron, Ohio	258	WDBO	Rollins College, Inc.....	Winter Park, Fla.	240
WAFD	Albert B. Parfet Co.....	Port Huron, Mich.	275	WDBZ	Boy Scouts, City Hall.....	Kingston, N. Y.	233
WAGM	R. L. Miller.....	Royal Oak, Mich.	225	WDEL	Wilmington Elec. Specialty Co.....	Wilmington, Del.	266
WAHG	A. H. Grebe & Co.....	Richmond Hill, N. Y.	316	WDG Y	Dr. George W. Young.....	Minneapolis, Minn.	263
WAIT	A. H. Waite Co.....	Taunton, Mass.	229	WDOD	Chattanooga Radio Co., Inc.....	Chattanooga, Tenn.	256
WAIU	American Insurance Union.....	Columbus, Ohio	294	WDR C	Doolittle Radio Corp.....	New Haven, Conn.	268
WAMD	Radisson Radio Corp.....	Minneapolis, Minn.	244	WDWF	Dutee Wilcox Flint, Inc.....	Cranston, R. I.	441
WAPI	Alabama Polytechnic Institute.....	Auburn, Ala.	248	WDZ	J. L. Bush.....	Tuscola, Ill.	278
WARC	American Radio & Research Corp.....	Medford, Mass.	261	WEAF	Broadcasting Co. of America.....	New York, N. Y.	491
WATT	Edison Electric.....	Boston, Mass.	244	WEAI	Cornell University.....	Ithaca, N. Y.	254
WBAA	Purdue University.....	W. Lafayette, Ind.	273	WEAM	Bor. of N. Plainfield.....	North Plainfield, N. J.	261
WBAK	Pennsylvania State Police.....	Harrisburg, Pa.	275	WEAN	Shepard Co.....	Providence, R. I.	270
WBAL	Consolidated Gas & Elec. Co.....	Baltimore, Md.	246	WEAO	Ohio State University.....	Columbus, Ohio	294
WBAO	James Millikan University.....	Decatur, Ill.	270	WEAR	Willard Battery Co.....	Cleveland, Ohio	389

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THE American Electric Company of Chicago, with thirty-two years of manufacturing experience, are offering in their BURNS "B" Eliminator, an instrument that will deliver full plate voltage without a perceptible drop in voltage under load. The Raytheon rectifying tube is used. This Eliminator is of neat size and fits readily in place of the dry batteries in any cabinet or can be placed near the receiving set. There is no acid or fumes.

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Moullin Book on R. F. Measurements

AN interesting and informative book on Radio Frequency Measurements by E. B. Moullin has just been received by the editorial department of RADIO AGE, having been sent by J. B. Lippincott Co., Philadelphia, well-known publishers.

Though primarily a laboratory manual it may well serve as a useful textbook for advanced students and experimenters. Many of the formulas and methods of procedure will be especially welcomed by those desiring to do experimental work and who do not have access to an extensive research library.

The description of the Moullin high frequency voltmeter is very interesting. Quartz crystals as frequency standards are also covered by the author who is located at the Engineering Laboratory at Cambridge, England.

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WEBC	Walter Cecil Bridges	Superior, Wisc.	242	WHEC	Hickson Electric Co., Inc.	Rochester, N. Y.	258
WEBD	Electrical Equip. & Service Co.	Anderson, Ind.	246	WHK	The Radio Air Service Corp.	Cleveland, Ohio	273
WEBH	Edgewater B. H. & Herald Examiner	Chicago, Ill.	370	WHN	George Schubert	New York, N. Y.	361
WEBJ	Third Avenue Railway Co.	New York, N. Y.	273	WHO	Banker's Life Co.	Des Moines, Ia.	526
WEBL	Radio Corp. of America (Portable)	New York, N. Y.	226	WHT	Radiophone Broadcasting Corp.	Deerfield, Ill.	238
WEBQ	Tate Radio Corp.	Harrisburg, Ill.	226	WHT	Radiophone Broadcasting Corp.	Deerfield, Ill.	400
WEBR	H. H. Howell	Buffalo, N. Y.	244	WIAD	Howard R. Miller	Philadelphia, Pa.	250
WEBW	Beloit College	Beloit, Wisc.	268	WIAS	Home Electric Co.	Burlington, Iowa	254
WEBZ	Savannah Radio Corp.	Savannah, Ga.	263	WIBA	The Capital-Times Studio	Madison, Wis.	236
WEEI	The Edison Elec. Illuminating Co.	Boston, Mass.	349	WIBG	St. Paul's Protestant E. Church	Elkins Park, Pa.	222
WEHS	Robert E. Hughes	Evansston, Ill.	203	WIBH	Elite-Radio Stores	New Bedford, Mass.	210
WEMC	Emanuel Missionary College	Berrien Springs, Mich.	285	WIBI	Frederick B. Zitteli, Jr.	Flushing, N. Y.	219
WENR	All-American Radio Corp.	Chicago, Ill.	266	WIBJ	C. L. Carrell (Portable)	Chicago, Ill.	216
WEW	St. Louis University	St. Louis, Mo.	248	WIBM	Billy Maine (Portable)	Chicago, Ill.	216
WFAA	Dallas News & Dallas Journal	Dallas, Tex.	476	WIBO	Nelson Brothers	Chicago, Ill.	226
WFAM	Times Publishing Co.	St. Cloud, Minn.	273	WIBR	Thurman A. Owings	Werton, W. Va.	246
WFAV	University of Nebraska	Lincoln, Neb.	275	WIBS	T. F. Hunter (portable)	Elizabeth, N. J.	203
WFBC	First Baptist Church	Knoxville, Tenn.	250	WIBU	The Electric Farm	Poynette, Wis.	222
WFBE	John Van De Walle	Seymour, Ind.	226	WIBW	Dr. L. L. Dill	Logansport, Ind.	220
WFBG	The Wm. F. Gable Co.	Altoona, Pa.	278	WIBX	WIBX, Inc.	Utica, N. Y.	205
WFBH	Concourse Radio Corp.	New York, N. Y.	273	WIBZ	A. D. Trum	Montgomery, Ala.	231
WFBJ	St. John's University	Collegeville, Minn.	236	WIL	Benson Radio & The Star	St. Louis, Mo.	273
WFBL	Onondaga Hotel Co.	Syracuse, N. Y.	252	WIOD	Wonderful Isle of Dreams	Miami, Fla.	248
WFBM	Merchants Heat & Light Co.	Indianapolis, Ind.	268	WIP	Gimbel Bros.	Philadelphia, Pa.	508
WFBR	Fifth Inf. Md. Nat'l Guard	Baltimore, Md.	254	WJAD	Jackson's Radio Eng. Laboratories	Waco, Texas	353
WFBZ	Knox College	Galesburg, Ill.	254	WJAG	Norfolk Daily News	Norfolk, Nebr.	270
WFDF	F. D. Fallain	Flint, Mich.	234	WJAK	Clifford L. White	Kokomo, Ind.	254
WFI	Strawbridge and Clothier	Philadelphia, Pa.	394	WJAM	D. M. Perham	Cedar Rapids, Iowa	268
WFKB	F. K. Bridgman (Inc.)	Chicago, Ill.	217	WJAR	The Outlet Co. (J. Samuels & Bro.)	Providence, R. I.	306
WFRL	Robert Morrison Lacey	Brooklyn, N. Y.	205	WJAS	Pittsburgh Radio Supply House	Pittsburgh, Pa.	275
WGAL	Lancaster Elec. Supply & Const. Co.	Lancaster, Pa.	248	WJAX	City of Jacksonville	Jacksonville, Fla.	337
WGBB	Harry H. Carman	Freeport, N. Y.	244	WJAZ	Zenith Radio Co.	Mt. Prospect, Ill.	322
WGBC	First Baptist Church	Memphis, Tenn.	278	WJBA	D. H. Lentz, Jr.	Joliet, Ill.	207
WGBF	Fink Furniture Co.	Evansville, Ind.	236	WJBB	Financial Journal	St. Petersburg, Fla.	254
WGBI	Scranton Broadcasters, Inc.	Scranton, Pa.	240	WJBC	Hummer Furniture Co.	LaSalle, Ill.	234
WGBR	George S. Ives	Marshfield, Wis.	229	WJBI	Robert S. Johnson	Red Bank, N. J.	219
WGBS	Gimbel Brothers	New York, N. Y.	316	WJBK	E. F. Goodwin	Ypsilanti, Mich.	233
WGBU	Florida Cities Finance Co.	Fulford By-The-Sea, Fla.	278	WJBL	Wm. Gushard Dry Goods Co.	Decatur, Ill.	270
WGBX	University of Maine	Orono, Me.	234	WJBO	Valdemar Jensen	New Orleans, La.	268
WGCP	D. W. May, Inc.	Newark, N. J.	252	WJBR	Geusch and Stearns	Omro, Wis.	227
WGES	Coyne Electrical School	Chicago, Ill.	250	WJBU	Bucknell University	Lewisburg, Pa.	211
WGHB	G. H. Bowles Developments	Clearwater, Fla.	266	WJJD	Supreme Lodge, L. O. of Moose	Mooseheart, Ill.	370
WGHP	G. H. Phelps	Detroit, Mich.	270	WJR	Jewett Radio & Phon. Co. & D. F. P.	Pontiac, Mich.	517
WGMU	A. H. Grebe & Co. Inc., (Portable)	Richmond Hill, N. Y.	236	WJY	Radio Corp. of America	New York, N. Y.	405
WGN	The Tribune	Chicago, Ill.	303	WJZ	Radio Corp. of America	New York, N. Y.	454
WGR	Federal T. and T. Co.	Buffalo, N. Y.	319	WKAF	WKAF Broadcasting Co.	Milwaukee, Wis.	261
WGST	Georgia School Technology	Atlanta, Ga.	270	WKAQ	Radio Corp. of Porto Rico	San Juan, P. R.	341
WGY	General Elec. Co.	Schenectady, N. Y.	379	WKAR	Michigan State College	East Lansing, Mich.	285
WHA	University of Wisconsin	Madison, Wis.	535	WKAU	Laconia Radio Club	Laconia, N. H.	224
WHAD	Marquett Univ. & Milw. Journal	Milwaukee, Wis.	275	WKBB	Sanders Bros.	Joliet, Ill.	214
WHAM	Univ. of Rochester (Eastman S. of M.)	Rochester, N. Y.	278	WKBE	K. & B. Electric Co.	Webster, Mass.	231
WHAP	W. H. Taylor Finance Corp.	Brooklyn, N. Y.	240	WKBG	C. L. Carrell (Portable)	Chicago, Ill.	216
WHAR	Seaside House	Atlantic City, N. J.	275	WKRC	Kodel Radio Corp.	Cincinnati, Ohio	326
WHAS	Courier-Journal & Louisville Times	Louisville, Ky.	400	WKRC	Kodel Radio Corp.	Cincinnati, Ohio	422
WHAZ	Rensselaer Polytechnic Institute	Troy, N. Y.	379	WKY	WKY Radio Shop	Oklahoma City, Okla.	275
WHB	Sweeney School Co.	Kansas City, Mo.	366	WLAL	First Christian Church	Tulsa, Okla.	250
WHBA	C. C. Shaffer	Oil City, Pa.	250	WLAP	Wm. V. Jordan	Louisville, Ky.	275
WHBC	Rev. E. P. Graham	Canton, Ohio	254	WLAQ	Arthur E. Shilling	Kalamazoo, Mich.	283
WHBD	Chas. W. Howard	Bellfontaine, Ohio	222	WLB	University of Minnesota	Minneapolis, Minn.	278
WHBF	Beadsley Specialty Company	Rock Island, Ill.	222	WLBL	Bureau of Marketing	Stevens Point, Wis.	278
WHBG	John S. Skane	Harrisburg, Pa.	231	WLIB	Liberty Magazine	Elgin, Ill.	303
WHBJ	Lauer Auto Co.	Ft. Wayne, Ind.	234	WLIT	Lit Bros.	Philadelphia, Pa.	394
WHBL	C. L. Carrell	Chicago, Ill.	216	WLS	Sears Roebuck & Co.	Crete, Ill.	345
WHBM	C. L. Carrell, (Portable Station)	Chicago, Ill.	216	WLSI	Lincoln Studios	Cranston, R. I.	441
WHBN	First Ave. Methodist Church	St. Petersburg, Fla.	238	WLTS	Lane Technical High School	Chicago, Ill.	258
WHBP	Johnstown Automobile Co.	Johnstown, Pa.	256	WLW	Crosley Mfg. Co.	Cincinnati, Ohio	422
WHBQ	St. John's M. E. Church South	Memphis Tenn.	233	WLWL	Miss. Society of St. Paul the Apostle	New York, N. Y.	288
WHBU	Riviera Theatre & Bing's Clothing	Anderson, Ind.	219	WMAC	C. B. Meredith	Casnovia, N. Y.	275
WHBW	D. R. Kienzle	Philadelphia, Pa.	216	WMAF	Round Hills Radio Corp.	Dartmouth, Mass.	441
WHBY	St. Norbert's College	West de Pere, Wis.	250	WMAK	Norton Laboratories	Lockport, N. Y.	266
				WMAL	M. A. Lesse Optical Co.	Washington, D. C.	213

Beginner May Make 200 Mile Crystal Receiver

(Continued from page 18)

short as possible. A ready made "back of panel" inductance switch may be used as it eliminates considerable work.

The circuit may be connected with bus-bar or annunciator wire. All connections should of course be tight and preferably soldered.

Operation

AERIAL design preferred by the writers is as follows: Single wire, number 12 or 14, solid copper, enamel insulated, erected in a straight line as high above surrounding objects as conveniently possible and having a total length including the lead to the set of not less than 100 feet and not much more than 250 feet. Insulators should be used at all points of suspension.

The ground lead may be of the same wire as the aerial. It should be well connected to a water pipe system or some other grounded metallic structure.

Tuning is so simple that it would be a waste of time to give elaborate instructions. The switch and condenser control the wave length while the knob of the electrically regulated detector functions as a selectivity and volume adjustment, in that way controlling the overall sensitivity.

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| 4 Amplifiers | 50 Lightning arresters |
| 5 "B" batteries, all kinds | 51 Loud speakers |
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| (a) Dry | 53 Meters, all types |
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| 17 Code practice sets | 67 Rheostats |
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| 20 Condensers, variable | 70 Screws |
| 21 Contact points | 71 Schools, radio |
| 22 Cords, headset, etc. | 72 Sets, transmitting |
| 23 Couplers, vario, etc. | 73 Sets, receiving |
| 24 Crystals | (a) Factory Built (b) kits |
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| 26 Detector (crystals) | 2 Radio Frequency |
| 27 Detector tubes | 3 Reflex |
| 28 Detector units | 4 Regenerative |
| 29 Dials | 5 Super-heterodyne |
| 30 Dies | 74 Shellac |
| 31 Drills | 75 Sockets |
| 32 Electrolyte | 76 Solder |
| 33 Fibre | 77 Supports, aerial |
| 34 Filters | 78 Switches |
| 35 Fuses, tube | 79 Transformers, a. f. |
| 36 Grid leaks | 80 Transformers, r. f. |
| 37 Ground clamps | 81 Transformers, sending |
| 38 Head phones | 82 Tubes, all types |
| 39 Horns, all types | 83 Variometers |
| 40 Hydrometers | 84 Wave meters |
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WMAQ	Chicago Daily News.....	Chicago, Ill.	447	WRC	Radio Corp. of America.....	Washington, D. C.	468
WMAY	Kingshighway Presbyterian Church.....	St. Louis, Mo.	248	WRCO	Wynne Radio Co.....	Raleigh, N. C.	252
WMAZ	Mercer University.....	Macon, Ga.	261	WREC	Wooten's Radio & Electric Co.....	Coldwater, Miss.	254
WBMB	American Bond & Mortgage Co.....	Chicago, Ill.	250	WREO	Reo Motor Car Co.....	Lansing, Mich.	285
WBMC	Michigan Broadcasting Co.....	Detroit, Mich.	256	WRHF	Radio Hospital Fund.....	Washington, D. C.	256
WMBF	Miami Beach Hotel.....	Miami Beach, Fla.	384	WRHM	Rosedale Hospital, Inc.....	Minneapolis, Minn.	252
WMC	Commercial Appeal.....	Memphis, Tenn.	500	WRK	Doron Bros.....	Hamilton, Ohio	270
WMCA	Hotel McAlpin (Greenley Sq. Hotel Co.).....	New York, N.Y.	341	WRM	University of Illinois.....	Urbana, Ill.	273
WNAB	Shepard Stores.....	Boston, Mass.	250	WRMU	A. H. Grebe & Co., Inc., M. Y. "MU-1".....	New York, N.Y.	236
WNAC	Shepard Stores.....	Boston, Mass.	280	WRNY	Experimenter Publishing Co.....	New York, N. Y.	258
WNAD	University of Oklahoma.....	Norman, Okla.	254	WRR	Municipal Station.....	Dallas, Tex.	246
WNAL	Omaha Central High School.....	Omaha, Nebr.	258	WRST	Radiotel Mfg. Co., Inc.....	Bay Shore, N. Y.	216
WNAT	Lenning Bros. Co. (Frederick Lenning).....	Philadelphia, Pa.	250	WRVA	Larus & Brother Co., Inc.....	Richmond, Va.	256
WNAX	Dakota Radio Apparatus Co.....	Yankton, S. Dak.	244	WRW	Tarrytown Radio Res. Labs.....	Tarrytown, N. Y.	273
WNBH	New Bedford Hotel.....	New Bedford, Mass.	248	WSAI	United States Playing Card Co.....	Cincinnati, Ohio	326
WNJ	Radio Shop.....	Newark, N. J.	252	WSAJ	Grove City College.....	Grove City, Pa.	229
WNOX	Peoples Tel. & Tel. Co.....	Knoxville, Tenn.	268	WSAN	Allentown Call Publisher Co.....	Allentown, Pa.	229
WNRC	W. B. Nelson.....	Greensboro, N. C.	224	WSAR	Daughy & Welch Electrical Co.....	Fall River, Mass.	254
WNYC	Dept. of Plant & Structures.....	New York, N. Y.	526	WSAU	Camp Marien.....	Chesham, N. H.	229
WOAI	Southern Equipment Co.....	San Antonio, Texas	394	WSAX	Zenith Radio Corp. (Portable).....	Chicago, Ill.	268
WOAN	Vaughn Con. of Music.....	Lawrenceburg, Tenn.	283	WSAZ	Chase Electric Shop.....	Pomeroy, Ohio	244
WOAW	Woodman of the World.....	Omaha, Nebr.	526	WSB	Atlanta Journal.....	Atlanta, Ga.	428
WOAX	Franklyn J. Wolff.....	Trenton, N. J.	240	WSBC	World Battery Co.....	Chicago, Ill.	210
WOC	Palmer School of Chiropractic.....	Davenport, Iowa	484	WSBF	Stix-Baer-Fuller D. G. Co.....	St. Louis, Mo.	273
WOCL	A. E. Newton.....	Jamestown, N. Y.	275	WSBT	South Bend Tribune.....	South Bend, Ind.	275
WODA	James K. O'Dea.....	Paterson, N. J.	224	WSDA	Seventh Day Adventist Church.....	New York, N. Y.	263
WOI	Iowa State College.....	Ames, Iowa	270	WSKC	World's Star Knitting Co.....	Bay City, Mich.	261
WOK	Neutrowound Radio Mfg. Co.....	Homewood, Ill.	217	WSM	Nashville Life & Accident Ins. Co.....	Nashville, Tenn.	283
WOKO	Otto Baur.....	New York, N. Y.	233	WSMB	Saenger Amuse. Co. & Maison B. Co.....	New Orleans, La.	319
WOO	John Wanamaker.....	Philadelphia, Pa.	508	WSMH	Shattuck Music House.....	Owosso, Mich.	240
WOOD	Grand Rapids Radio Co.....	Grand Rapids, Mich.	242	WSMK	S. M. K. Radio Corp.....	Dayton, Ohio	275
WOQ	Unity School of Christianity.....	Kansas City, Mo.	278	WSOE	School of Engineering.....	Milwaukee, Wisc.	246
WOR	L. Bamberger and Co.....	Newark, N. J.	405	WSRO	Radio Company.....	Hamilton, Ohio	252
WORD	People's Pulpit Assn.....	Batavia, Ill.	275	WSSH	Tremont Temple Bap. Church.....	Boston, Mass.	261
WOS	State Market Bureau.....	Jefferson City, Mo.	441	WSUI	State University of Iowa.....	Iowa City, Iowa	484
WOWL	Owl Battery Company.....	New Orleans, La.	270	WSVS	Seneca Vocational School.....	Buffalo, N. Y.	219
WOWO	Main Auto Supply Co.....	Fort Wayne, Ind.	227	WSWS	Illinois Broadcasting Corp.....	Wooddale, Ill.	275
WPAK	N. D. Ag. College.....	Agricultural College, N. D.	275	WTAB	Fall River Daily Herald Publishing Co.....	Fall River, Mass.	266
WPCC	North Shore Cong. Church.....	Chicago, Ill.	258	WTAD	Robt. E. Compton.....	Carthage, Ill.	236
WPDQ	H. L. Turner.....	Buffalo, N. Y.	205	WTAG	Telegram Pub. Co.....	Worcester, Mass.	268
WPG	The Municipality of Atlantic City.....	Atlantic City, N. J.	300	WTAL	Toledo Radio & Electric Co.....	Toledo, Ohio	252
WPRC	Wilson Printing & Radio Co.....	Harrisburg, Pa.	216	WTAM	Williard Storage Battery Co.....	Cleveland, Ohio	389
WPSC	Pennsylvania State College.....	State College, Pa.	261	WTAP	Cambridge Radio & Electric Co.....	Cambridge, Ill.	242
WQAA	Horace A. Beale, Jr.....	Parkersburg, Pa.	220	WTAQ	C. S. Van Gordon.....	Eau Claire, Wisc.	254
WQAC	Gish Radio Service.....	Amarillo, Tex.	234	WTAR	Reliance Electric Co.....	Norfolk, Va.	261
WQAE	Moore Radio News Station.....	Springfield, Vt.	246	WTAW	Agricultural & Mech. Col. of Texas.....	College Sta., Texas	270
WQAM	Electrical Equipment Co.....	Miami, Fla.	263	WTAX	Williams Hardware Co.....	Streator, Ill.	231
WQAN	Scranton Times.....	Scranton, Pa.	250	WTAZ	Thomas J. McGuire.....	Lambertville, N. J.	261
WQAO	Calvary Baptist Church.....	New York, N. Y.	360	WTIC	Travelers Insurance Co.....	Hartford, Conn.	476
WQJ	Calumet Rainbo Broadcasting Co.....	Chicago, Ill.	447	WWAE	Electric Park.....	Plainfield, Ill.	242
WRAF	The Radio Club (Inc.).....	LaPorte, Ind.	224	WWAO	Michigan College of Mincs.....	Houghton, Mich.	263
WRAK	Economy Light Co.....	Escanaba, Mich.	256	WWGL	Radio Engineering Corp.....	Richmond Hill, N. Y.	213
WRAM	Lombard College.....	Galesburg, Ill.	244	WWI	Ford Motor Co.....	Dearborn, Mich.	266
WRAY	Antioch College.....	Yellow Springs, Ohio	263	WWJ	Detroit News.....	Detroit, Mich.	353
WRAW	Horace D. Good.....	Reading, Pa.	238	WWL	Loyola University.....	New Orleans, La.	275
WRAX	Berachah Church.....	Philadelphia, Pa.	268				

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(8-26)

Use the
Log-a-Wave
Chart
on Page 64

The Genealogy of a Grid Leak

By H. G. RICHTER
Chief Engineer, Electrad, Inc.

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

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

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

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

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

Rating Uncertain

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

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

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

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

Metallic Leaks

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

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

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12-Cell—24-Volt Storage 'B' Battery

Positively given free with each purchase of a WORLD "A" Storage Battery. You must send this ad with your order. WORLD Batteries are famous for their guaranteed quality and service. Backed by years of successful manufacture and thousands of satisfied users. Equipped with Solid Rubber Case, an insurance against acid and leakage. You save 50 per cent and get a

2-Year Guarantee

Bond in Writing "tell their friends." That's our best proof of performance. Send your order in today.

Solid Rubber Case Radio Batteries

6-Volt, 100-Amperes	511.25
6-Volt, 120-Amperes	13.25
6-Volt, 140-Amperes	14.00

Solid Rubber Case Auto Batteries

6-Volt, 11-Plate	511.25
6-Volt, 13-Plate	13.25
12-Volt, 7-Plate	16.00

Send No Money Just state battery wanted and we will ship day order is received. Express C. O. D. subject to your examination on arrival. **FREE "B"** Battery included. Extra Offer: 5 per cent discount for cash in full with order. Buy now and get a guaranteed battery at 50 per cent saving to you.

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Set your Radio Dials at 210 meters for the new 1000 watt World Storage Battery Station, W5BC, Chicago. Watch for announcements.

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FOR ALL TUBES
ALLEN-BRADLEY CO.

Bradleystat
PERFECT FILAMENT CONTROL

FOR noiseless filament control and maximum range, ask your dealer for the Bradleystat. This graphite disc rheostat can be used for **all tubes** without change of connections. The bakelite knob is removable if desired. The one-hole mounting and small size make the Bradleystat easily adaptable to any radio set.

ALLEN-BRADLEY COMPANY
289 Greenfield Ave., Milwaukee, Wis.

Please send me your literature on the Allen-Bradley line of perfect radio devices.

Name.....
Address.....

Dominion of Canada

CFAC	Calgary Herald.....	Calgary, Alta.	434	CJCL	A. Couture.....	Montreal, Que.	279
CFCA	Toronto Star Pub. & Prtg. Co.....	Toronto, Ont.	356	CJGC	London Free Press.....	London, Ont.	329
CFCH	Marconi Wireless Teleg Co., (Ltd.) Can.....	Montreal, Que.	411	CKAC	La Presse.....	Montreal, Que.	411
CFCK	Abitibi Power & Paper Co. (Ltd.).....	Iroquois Falls, Ont.	500	CKCD	Vancouver Daily Province.....	Vancouver, B. C.	397
CFCK	Radio Supply Co.....	Edmonton, Alta.	517	CKCK	Leader Pub. Co.....	Regina, Sask.	476
CFCN	W. W. Grant (Ltd.).....	Calgary, Alta.	434	CKCL	Dominion Battery Co.....	Toronto.	357
CFCR	Laurentide Air Service.....	Sudbury, Ont.	410	CKCO	Ottawa Radio Association.....	Ottawa, Ont.	434
CFCT	Victoria City Temple.....	Victoria, B. C.	329	CKCX	P. Burns & Co. (Ltd.).....	Calgary, Alta.	434
CFCU	The Jack Elliott (Ltd.).....	Hamilton, Ont.	341	CKFC	First Congregational Church.....	Vancouver, B. C.	411
CFHC	Henry Birks & Sons.....	Calgary, Alta.	434	CKLC	Wilkinson Electric Co. (Ltd.).....	Calgary, Alta.	434
CFKC	Thorold Radio Supply.....	Thorold, Ont.	248	CKNC	Canadian National Carbon Co.....	Toronto, Ont.	357
CFQC	The Electric Shop (Ltd.).....	Saskatoon, Sask.	329	CKOC	Wentworth Radio Supply Co.....	Hamilton, Ont.	341
CFRC	Queens University.....	Kingston, Ont.	450	CKY	Manitoba Tel. System.....	Winnipeg, Man.	384
CFXC	Westminster Trust Co.....	Westminster, B. C.	291	CNRA	Canadian National Railways.....	Moncton, N. B.	312
CFYC	Commercial Radio (Ltd.).....	Vancouver, B. C.	411	CNRC	Canadian National Railways.....	Calgary, Alta.	436
CHBC	The Calgary Albertan.....	Calgary, Alta.	434	CNRE	Canadian National Railways.....	Edmonton, Alta.	517
CHCM	Riley & McCormack (Ltd.).....	Calgary, Alta.	434	CNRM	Canadian National Railways.....	Montreal, Que.	411
CHCS	The Hamilton Spectator.....	Hamilton, Ont.	341	CNRO	Canadian National Railways.....	Ottawa, Ont.	435
CHIC	Northern Electric Co.....	Toronto, Ont.	357	CNRR	Canadian National Railways.....	Regina, Sask.	476
CHNC	Toronto Radio Research Society.....	Toronto, Ont.	357	CNRS	Canadian National Railways.....	Saskatoon, Sask.	329
CHUC	International Bible Ass'n.....	Saskatoon, Sask.	329	CNRT	Canadian National Railways.....	Toronto, Ont.	357
CHXC	R. Booth, Jr.....	Ottawa, Ont.	434	CNRV	Canadian National Railways.....	Vancouver, B. C.	291
CHYC	Northern Electric Co.....	Montreal, Que.	411	CNRW	Canadian National Railways.....	Winnipeg, Man.	384
CJCA	Edmonton Journal.....	Edmonton, Alta.	511				

Republic of Mexico

CYB	Mexico City.....	380	CYL	Mexico City.....	400	CZE	Mexico City.....	350
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Republic of Cuba

PWX	Cuban Telephone Co.....	Havana	400	2OL	Oscar Collado.....	Havana	257	6KW	F. H. Jones.....	Tuinucu	272
2BY	F. W. Borton.....	Havana	260	5DW	R. S. Calderon.....	Matanzas	200	7SR	S. Rionda.....	Central Elia	350
2OK	M. G. Velez.....	Havana	360	6VY	Jose Ganduxe.....	Cienfuegos	260	8BY	A. Ravelo.....	Santiago de Cuba	250
				6JK	F. H. Jones.....	Tuinucu	340				

Great Britain

2LO	London.....	365	5XX	Daventry.....	1600	5NO	Newcastle.....	404
5IT	Birmingham.....	479	2RN	Dublin.....	390	5SC	Glasgow.....	422
5WA	Cardiff.....	353	6BM	Bournemouth.....	386	2BD	Aberdeen.....	495
2BE	Belfast.....	440	2ZY	Manchester.....	378			

France

YN	Lyons.....	550	8AJ	Paris.....	1,780
FL	Paris (Eiffel Tower).....	2,650	ESP	Paris.....	458

Short Wave Phone Broadcasting

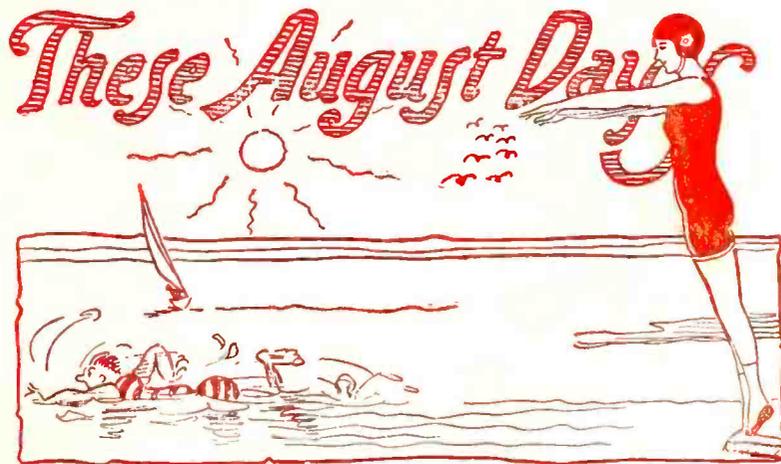
		KC	Meters
2XK	Schenectady, N. Y.*	4600	65.16
KDKA	Pittsburgh, Pa.*	4760	63.00
KDKA	Pittsburgh, Pa.*	5100	58.79
2XAF	Schenectady, N. Y.*	9143	32.79

*Crystal Control

KC	Meters	STATIONS	DIALS		
			1	2	3
1480	202.6				
1470	204.0				
1460	205.4				
1450	206.8				
1440	208.2				
1430	209.7				
1420	211.1				
1410	212.6				
1400	214.2				
1390	215.7				
1380	217.3				
1370	218.8				
1360	220.4				
1350	222.1				
1340	223.7				
1330	225.4				
1320	227.1				
1310	228.9				
1300	230.6				
1290	232.4				
1280	234.2				
1270	236.1				
1260	238.0				
1250	239.9				
1240	241.8				
1230	243.8				
1220	245.8				
1210	247.8				
1200	249.9				
1190	252.0				
1180	254.1				
1170	256.3				
1160	258.5				
1150	260.7				
1140	263.0				
1130	265.3				
1120	267.7				
1110	270.1				
1100	272.6				
1090	275.1				
1080	277.6				
1070	280.2				
1060	282.8				
1050	285.5				
1040	288.3				
1030	291.1				
1020	293.9				

KC	Meters	STATIONS	DIALS		
			1	2	3
1010	296.9				
1000	299.8				
990	302.8				
980	305.9				
970	309.1				
960	312.3				
950	315.6				
940	319.0				
930	322.4				
920	325.9				
910	329.5				
900	333.1				
890	336.9				
880	340.7				
870	344.6				
860	348.6				
850	352.7				
840	356.9				
830	361.2				
820	365.6				
810	370.2				
800	374.8				
790	379.5				
780	384.4				
770	389.4				
760	394.5				
750	399.8				
740	405.2				
730	410.7				
720	416.4				
710	422.3				
700	428.3				
690	434.5				
680	440.9				
670	447.5				
660	454.3				
650	461.3				
640	468.5				
630	475.9				
620	483.6				
610	491.5				
600	499.7				
590	508.2				
580	516.9				
570	526.0				
560	535.4				
550	545.1				

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P You could be imitating the swimmer in the picture above. But if you are human and a radio fan you are probably tinkering with the old set, getting it ready for the heavy radio dates during the good weather which is just around the corner.

P Knowing this we hasten to tip you off that the September issue of RADIO AGE will thoroughly satisfy you with a full line of power supply devices—how to make them, with full details, plenty of pictures and drawings.

P But if you took only the September issue you will not be satisfied. We are placing a handy coupon blank at the bottom of this page so you can assure yourself of a steady stream of RADIO AGES coming to your home during the year. The original blueprint magazine still leads in that field, and we know how you like blueprints. So dive into the space below and affix your signature. We do the rest for twelve months.

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Radio Age, Inc.,
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Gentlemen: Please enter my subscription for RADIO AGE, the Magazine of the Hour, for one year, beginning with your next issue, for which I enclose \$2.50.

Name.....

Street Address.....

City.....

State.....

(Use coupon on page 66 if you don't care to mutilate the cover)

STRAIGHT LINE SELECTIVITY

IS ONE BUT AMONG MANY NEW FEATURES FOUND IN THE

NEW

COUNTERPHASE



That B-T products are unusually successful has never been questioned. B-T advertising claims are never stretched beyond the possibilities of the products advertised, yet B-T claims are not half so important as the indirect advertising done by enthusiastic, satisfied users.

With such a past record extending back to the beginning of broadcasting it is natural that the radio public should be interested in the COUNTERPHASE-EIGHT and the new COUNTERPHASE-SIX Receivers, which have been developed as PERMANENT models, designed not only to offer the user the most he can secure at this time but for a long time to come.

Entirely new accomplishments

The new improvements are not novelties, but common sense refinements, designed with the object of insuring lasting satisfaction.

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An absolutely ACCURATE CALIBRATION of each individual set is made possible by a new idea covered by B-T patents and not found in any other receiver.

Further refinement in Counterphase methods give UNIFORM SENSITIVITY across the scale without a variable oscillation control.

STRAIGHT LINE SELECTIVITY, the B-T idea of ideal tuning is provided using new B-T SLF condensers.

A degree of SUPER-SELECTIVITY has been attained that we have never before reached, even with more tuning controls.

It is impossible here to even touch upon all the new features which are described in circulars that will be mailed upon request.

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There is a demand in your locality for receivers of B-T quality. The public is looking around for a permanent receiver and a demonstration will convince the prospect that the new COUNTERPHASE fulfills the requirements.

**AUTHORIZED DEALERS ONLY WILL
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Chicago, Ill.

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(Address)

(City)

(State)

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BT
Bremer
Tully
Manufacturing Company

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CHICAGO ILLINOIS



Eliminate guess-work
with the

B-T B SUPPLY UNIT

The B-T B-POWER UNIT was designed and developed in order that we might have a product that we could recommend to give satisfaction with our receivers. Its fundamental feature is the elimination of guess-work. There are no knobs to turn and like all other B-T products if we did not believe it was superior it would not be on the market. We don't feel that we can offer any stronger endorsement than the fact that the B-T B-POWER UNIT is recommended by us with B-T COUNTERPHASE Sets. It furnishes the voltages necessary for any outfit of two to seven tubes, including the new power tubes.

INVESTIGATE
THIS NEW
PRODUCT