Radio Ears of Uncle Sam's Army

See Page 14
TOMORROW—WHAT?

How many of us 20 years ago would have dared predict that in 1930 the human voice could encircle the earth without aid of wires? or dreamed of the wizardry of the photo-electric cell? or the controlling of time-pieces by Radio signals? or any of the thousand and one miracles of modern Radio?

And now, what of tomorrow in Radio? We can’t close our eyes to its future. How silly we would be to sit supinely by and say that the climax has been reached—that all of Radio’s wonders have been achieved.

What Radio will do in the years ahead will so dwarf Radio as we know it today that there will really be no comparison. Today we are barely scratching the surface of this giant, mysterious force. We have unscrambled just a few of its secrets—just enough to peep ahead and see what a vast part it will play in the world in the next ten, twenty or thirty years and on—

Today a master clock in the Channing Building in New York is regulated by Radio signals from Arlington Naval Radio Station—tomorrow the piece you carry in your vest pocket may be regulated by Radio. Today a Radio wave carries 200 words per minute—10,000 tomorrow. Today Radio is used to detect approach of enemy aircraft—tomorrow Radio-directed rays may ward off enemy attacks—today Radio a billion dollar industry—tomorrow a giant interlocking world force dominating all commerce and industry.

But why go on? It is common knowledge that the man who is on the Radio “band wagon” today is pioneering in the most dramatic and awe-inspiring pursuit known to man!

J. E. SMITH.

Growth Of Radio In Last Nine Years Is Amazing

By HAROLD A. LAFOUNT

Member Federal Radio Commission

Nine years ago, an amazed world awoke to read that on the night before instrumental and vocal music had been broadcast through a strange electrical apparatus and received many miles away from the sender by persons in various parts of the country. Radio broadcasting was hailed as the miracle of the century—a scientific discovery, infinitely more powerful to the popular imagination than the transmission of the crude wireless telegraphy of Marconi, accomplished in 1896. Since that time, the art has developed with astounding rapidity until now its importance in the industrial world can only be appreciated when we realize that $650,000,000 worth of receiving sets and accessories were manufactured and sold last year. This does not include the enormous sum which went for transmitting sets, studio equipment and other facilities for production of programs. And neither does it include the millions of dollars paid artists and musicians.

Today nearly every family in the United States owns a receiving set. I am told that the investment of the American people in receiving sets, alone, amounts to more than $3,000,000,000. This certainly indicates interest in radio programs. It is proof positive that radio is an indispensable necessity. Naturally this stupendous investment made must be safeguarded. And so it was with a view to your protection that a sympathetic President, his cabinet and Congress exercised the foresight to pass the Radio Act of 1927. And by so doing, they anticipated the universal use of this new and undeveloped discovery of science. The Federal Radio Commission was by the same act created to regulate and limit the use of radio in the best interest of the American public.

Five Radio Zones Created

Possibly you know the act provided that this country be divided into five radio zones and for the appointment of a commissioner from each—not to represent the zone, but to act with his four associate commissioners as a part of the national commission. The new commission was charged with the responsibility of issuing all licenses for radio transmission. Some months later, the law was amended—providing that the radio facilities of the United States be divided equally among the five zones and equally among the several States in each zone according to the distribution of the population in the States. By this you can readily see that a sincere effort has been made by the Government to impartially divide the benefits of this great natural resource among all the citizens of the Nation because they share equally in its ownership.

To make and maintain such a division, or equal quality, was found to be no easy task. In other words, upon 90 wave lengths available for the purpose we must place the 615 broadcasting stations in such a way as to maintain equality.
N R I Alumni Association Founded

By HAL JOHN

News Staff

"...To cultivate fraternal relations among the Alumni of the National Radio Institute, to foster the spirit of unity and loyalty to our Alma Mater, to encourage the Institute in its development of radio knowledge and to promote the welfare of the members by interchange of helpful information."


A NUMBER OF N. R. I. graduates met in Washington on November 23 and staged quite a surprise by organizing an Alumni Association. From what I have been able to learn it is the first alumni association of home-study school graduates ever organized.

The graduates present represented 32 States—each a successful Radio man. They talked the matter over among themselves, saw that there were many things that an alumni association could do to promote the well being of fellow graduates, etc., and then went about their business of perfecting an organization which should and will reflect credit on N. R. I. men more and more as the years roll by.

Mr. John Petter, pioneer Radio engineer and designer and builder of Station WEMC, Berrien Springs, Michigan, was named President, and the following were named vice presidents: Mr. Harry Barschdorff, 171 N. Summer St., Adams, Mass.; Mr. Alphy Blais, P. O. Box 221, Thetford Mines, P. Q., Canada; Mr. Hoyt Moore, 3901 S. Lyndhurst Drive, R. C. R.

Box 415, Indianapolis, Ind.; and Mr. Donnell O'Connor, Radio Station WBT, Charlotte, N. C. Mr. Earl Merryman, 621 Raleigh Place, S. E., Washington, D. C., was named secretary.

Mr. Petter, in speaking of the association, said that details would be completed very shortly for extending the privileges of the Alumni Association to every N. R. I. graduate. The executive committee is now working upon the final draft of the constitution and the by-laws which will be published in succeeding issues of the National Radio News. More detailed plans for membership and for cooperation of R. I. men will be given in later issues.

Upon the termination of the meeting at which the Alumni Association was founded, the graduates presented a big surprise on President Smith by giving him the beautiful loving cup which is shown on this page. All the graduates who were present at the meeting were made charter members of the association and their names have been engraved on the beautiful cup again N. R. I. men lead the way.

(Continued on page 14)
There's Pleasure and Tall Money in Short Waves

Graduate Barschdorf of Adams, Mass., told me recently about his short-wave experiences. At 3 o'clock one morning he was working a little station out in the South Pacific—just where, he did not know. In surviving he flashed "Q S L, old timer," and the reply came: "I can't." Barschdorf told me—"I was thrilled to know that I'd been talking to a leper who, on account of his affliction, can't even send a postal card from the little island where he is doomed to exile!"

A hurricane sweeps the Atlantic coast, trains are stalled in the northwest snows or a town may be cut off by floods in the Mississippi valley—in nearly every case the amateur or short-wave operator keeps in contact with the outside world and directs supply and rescue operations. One night he talks with Alaska—the next with a cattleman in Spain or a sheep herder in Australia. Thrills! Of course. That's why once a short-wave enthusiast—always one.

If more people realized the pleasure of short-wave work—they would just get right into it.

And that brings us to this point—I know from several N. R. I. men that the Radio trained man who wants to build and sell short-wave transmitters and receivers needn't have any trouble in finding prospects for such apparatus. There's a good market for short-wave stuff and some good profits. Right now we are entering a short-wave era. I look for a big increase in this field. The international broadcasts will stimulate the interest of hundreds of people to reach out with their own short-wave sets and bring in the program as well as the thousand and one fascinating things going on in the short-wave belt.

N. R. I. men will find it to their advantage to encourage this short-wave interest. Don't overlook the tall money in the short waves.

E. E. Haas,
Vice President and Director.

When you move please notify us at once of your new address. We want you to have each copy of the News. Back numbers are seldom available.

Dear Mr. Smith: I made $22 yesterday on repair jobs alone. I charge from $1 to $3 more than my competitors and still Radio repairine has been extremely heavy. I have sold two sets today which will net me about $15. L. D. Deshields, 1725 Greenwich St., Covington, Ky.

The Equasonne receiver consists of three separate units, the selector, radio frequency amplifier and power converter. The selector consisting of four variable condensers and coils, is of the band pass filter type, making four tuned circuits loosely coupled to each other. The coupling is adjusted so as to give a flat top selectivity curve about 10 kilocycles wide.

The radio frequency amplifier is a five-stage untuned radio frequency amplifier with a plate rectifier type detector, using six tubes in all. This amplifier amplifies approximately equally well all frequencies within the broadcast band.

The power converter consists of the conventional type rectifier and filter system as well as the one stage of audio frequency amplification. The power converters are of different construction in each respective model ranging from one power tube to two power tubes in push-pull.

Service Data Measurements for Sparton Equasonne Receiver, Model 931.

The Model 931 receiver uses six Cardon tubes No. 484. These tubes are practically the same as the standard five-prong 27 type tube but having filament rating of 3 volts and a filament current reading of 1.1 amperes. The power tubes in this receiver are Cardon 182 type tubes, two of which are connected in push-pull. The Cardon 182 tube is similar to the 245 tube having a standard four-prong base and a filament voltage of 5 volts and a filament current of .3 amperes. These tubes can be tested in any regular testing instrument. The rectifying tube used in this receiver gives the standard 280-type tube.

Q S T U HAMS

The N. R. I. in cooperation with a big short-wave station in New York, wants to make a world-wide test or short waves. All N. R. I. men having short-wave stations or receivers are requested to send in their names at once for the details of this experiment. You will surely be interested in it—or, of course, if not, you'll not be obligated to enter into the experiment with us. So send your name in now—if you have either a short-wave transmitter or short-wave receiver or both!

J. E. Smith.
or connections. Detector bias voltage with pick-up plugged in should read between 3 and 5 volts. More or less than these voltages indicate defective circuit which may be in resistance R 1,000.

TEST NO. 4. Radio frequency bias. Measured between point nine R.F. Bias normally —4.5 volts. The limits being —6 to —3. More or less than this results in loss in volume and indicates defective resistance R 110 or abnormal R.F. plate current. With volume off a wide variation of the above voltage is obtained but is of no consequence.

086 A.C. Voltmeter
TEST NO. 5. Heater voltages. (A) Detector and radio frequency heater voltage measured between terminal three and four. Normal 2.97 volts and more than this is dangerous to the tubes and greatly shortens their life; however, they may be run at as low a voltage as will give satisfactory volume. The maximum voltage allowable on these terminals is 3.1 volts, and this should never be exceeded. If the voltage is higher than normal, place voltage adjuster on next higher voltage tap.

TEST NO. 6. TEST KIT MEASUREMENTS. Remove A.F. tube and place in test kit socket. Place test kit plug in A.F. socket. (A) Measure filament voltage. Normal 4.75 volts. Limits 4.4 to 5.0. (B) Measure grid bias. Normal —40. Limits —30 to —52 volts. Readings greater or less than these show resistance R 1250 defective or abnormal plate current. (C) Plate voltage. Measure plate voltage. Normal 250 volts. Limits 300 to 220.

TEST NO. 7. ADJUSTMENT OF AERIAL COMPENSATING CONDENSER. Select a station, preferably a local, and at a time when it is the only station to be heard. Remove the aerial wire and put it on the connector between the selector and amplifier. If the station is heard at nearly the same volume, the selector is in adjustment. To adjust selector: Turn volume control to full and tune in some station of 1250 kilocycles or higher frequency. Adjust aerial compensating condenser until maximum response is obtained in speaker.

TEST NO. 8. TEST OF POWER CONVERTER. Turn off set and remove detector tube. Connect leads to a 4.5 volt “C” battery. Place one of these leads in terminal No. 1 and touch other to terminal No. 2. If click is heard in speaker, power converter is okay, providing the amplifier is good.

TEST NO. 9. Adjust hum control for minimum hum.

Testing Model 301 Receiver
The circuit diagram of Model 301 is shown in Figure 3. The same tests, with the exception of test No. 6 that have just
been given for Model 331 can be used for Model 301. In place of test No. 6 use the following test No. 10.

**TEST NO. 10. TEST KIT MEASUREMENTS.**

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**Inductance and Capacity Measurements With A Wheatstone Bridge**

By JAMES A. DOWIE, Chief Instructor
Member I. R. E.

**PART II**

In the last issue of the National Radio News, I gave a description of how a Wheatstone Bridge could be used to measure an unknown resistance, such as used in Radio work. In this issue, I will take up the measurement of Inductance using the Wheatstone Bridge method.

First, Inductances as used in Radio work are operated with alternating currents. Therefore, measurements should be carried out with alternating current.

In my explanation of the fundamental theory of the Wheatstone Bridge, a battery was used to obtain the direct current, hence a delicate voltmeter was used as the balancing instrument. However, when alternating current has to be used instead of direct current, another device in place of the voltmeter must be used to find out when a balance has been secured, that is, when there is no flow of current from point C to point D of the Wheatstone Bridge.

Figure 3 shows the circuit arrangement and apparatus used in this bridge. In place of the battery, "E," alone, a buzzer is added to the battery circuit and the combination utilized to give an alternating current through the various arms of the bridge. With this arrangement, the voltmeter is replaced by a pulser.

**Fig. 3—Circuit of Wheatstone Bridge Using Buzzer and Phones as Indicator.**

The circuit arrangement of this bridge for inductance measurements is shown in Fig. 4. m and n are the slide wire arms of the bridge, C, the sliding contact and L is the known inductance and X is an unknown coil whose inductance is to be measured.

The theory of this circuit is the same as the resistance measurement, that is, when the slider, C, is moved along m and n until a balance is obtained, a minimum sound will be heard in the telephones, then the following relation is true:

\[ X = \frac{m}{n} \]

Thus, if a single standard inductance, a slide wire bridge, with phones and bat-
tory and buzzer, are available, inductances may be easily measured.

This relationship is only true provided the unknown inductance is of the same order of magnitude as the standard inductance. By this I mean inacuracies will arise with these measurements if the standard inductance is about 0.1 millihenry, while the unknown inductance is 1 millihenry, then the ratio of m to n would be too great to obtain a balance. If the ratio of m and n is about 1 or 2, then a sharp balance will be had.

The following notes should be of interest to Radio-Trickers interested in accurate measurements with a bridge.

The formula (4) for inductance is sufficiently accurate for all practical purposes. However, it does not take into consideration the resistance of the inductance coils. If there is a great discrepancy between the resistances of the two coils L and X, it is quite possible that a sharp balance will not be obtained.

Balancing a Wheatstone Bridge circuit is something like tuning a radio receiving circuit, as resistance in a radio circuit makes for extremely broad tuning.

Balancing a Wheatstone Bridge is equivalent to reducing the resistance and thus enables sharp balance or tuning. If the resistances of the coils are not balanced, a sharp balance will not be secured and hence the accuracy of the measurement will be destroyed, as the accuracy of the measurement in a Wheatstone Bridge depends upon the sharpness of the balance.

Since all inductance coils have some resistance, a better arrangement of a bridge is shown in Fig. 5, where each coil has its corresponding resistance in series with it.

For precision measurements, it is necessary to strike a balance for the resistances of the coils and for their inductances. The inductance balance is secured by means of the buzzer and telephones, while the resistance balance is secured by a voltmeter and battery for the source of supply. In this bridge, Fig. 5, we use two double pole double throw switches; one is used for switching on either the buzzer or battery for source of current, the other is for switching on either voltmeter or telephones for the balancing indicator.

The buzzer and telephones are used for the alternating current inductance balance, the battery and voltmeter for securing a direct current resistance balance. The variable resistance placed in series with each of the inductances enables balancing the inductance arms for resistance.

The following gives the method used for balancing this type of bridge circuit. First, a balance is obtained for alternating current. The double-pole, double-throw switches are both thrown so as to use the buzzer and telephones. The sliding contact c on the wire m and n is varied until a balance is obtained. The switches are then thrown so as to place the battery and voltmeter in the circuit. With the sliding contact c fixed at the position previously obtained, vary the resistances R3 and R4 until the voltmeter indicates a balance by zero deflection. Now switch over to the buzzer and telephones and vary the position of the sliding contact until a balance is obtained as indicated by a minimum sound in the telephones. Then switch to battery and voltmeter and keep the sliding contact fixed in new position previously found, then the resistances R3 and R4 until a balance is obtained. Alternate this way until a very sharp direct and alternating current is obtained, then note the

(Continued on page 11)

**Visual Type Radio Beacon Superior**

A recent report made by the Department of Commerce shows that the visual type Radio beacon has many advantages over the aural type. This report is based on a large number of experiments and tests performed by the Bureau of Standards.

The visual type of Radio beacon operates on an entirely different principle from that of the aural type and thus gives a good opportunity for a comparison of the two types. In the visual Radio beacon the pilot is kept informed at all times by a reed affixed to the instrument board which veers to one side or the other depending upon the drift of the plane from the path charted by the Radio beacon signals. In the aural type the pilot wears headphones and he must depend upon his sense of hearing in a large degree to tell whether or not he is drifting off the charted path. For in the aural type if the signal is heard in one ear with greater intensity than in the other, he is not on the direct path. If the signal intensities are equal in both ears he knows that he is flying along the charted line.

The Department of Commerce report states that the visual type has these advantages over the aural system: 1. The visual system is simpler. 2. The operation of the visual indicators is less subjective than the aural system to interference from other radio stations, such as the marine beacons. This is due to the audio-frequency selectivity of the reed indicators. 3. For the same reason 'static' has less effect on the visual than on the aural system. The visual system will give direction in fairly severe static when the aural system would fail completely. The reed vibrations produced by exceptionally severe static can in no way be confused with the beacon signal indications. 4. Less skill is required on the part of the pilot to differentiate between the amplitudes of vibration of two reeds than to compare the relative strength of the two signals making up the aural beacon 'interlock'. 5. The visual system takes advantage of the psychological superiority of sight. The mind is stimulated to a greater degree by sight than by any of the other senses. Actual seeing rivets the attention immediately. A mere glance at the indicator gives the pilot his position with respect to the course. 6. The visual system has the inherent advantage that it can be so designed as to place an indication of direction at the pilot's disposal at all times, including the times when the pilot is receiving information by radio telephone. In the aural system simultaneous furnishing of the two services is impossible; this violates a cardinal principle of safety devices. With the increasing use of high-frequency communication between airplane and ground the pilot will have to interrupt his beacon service more and more.

7. In order to reduce the radio direction service to its simplest terms, viz. no manipulation whatever by the pilot, there must be automatic control of the volume of the received signal, as the distance of the airplane from the beacon station changes. This is possible with the visual and not with the aural system.
John Fetzer Named Alumni Association President
(Continued from page 5)

The many accomplishments of N. R. I. men as individuals will now be augmented by the world-wide influence of the first home-study school Alumni Association. Mr. Smith is overjoyed with the thought of the formal spirit that will be fostered by this association. He expresses the sentiment of the Institute when he says “Graduates of residence schools have alumni associations, and now I’m glad that N.R.I. graduates can enjoy the advantages and privileges to be derived from an alumni association of this kind. I’m proud of the spirit that graduates have shown in meeting here and forming this association. We at the Institute will do everything we can to foster its growth and ensure that the good work it is destined to do for N. R. I. men the world over.”

NICE PROFITS!

Mr. Smith: Please be advised that during the month of December my profits in radio were $24.00. This is mostly spare-time work. If it were not for the training that I received from the National Radio Institute, it would have been impossible for me to do this work. I live in a town where you have not had the chance to make this money. Your school has put me in a position where I am in demand. I have 20 sets in my shop to repair and more coming.

MR. JOHN J. BRODERICK, JR.
215 Ramhill Street
Corbin, Ky.

The Army’s Radio Ears

The weird looking set of “mechanical ears” shown on the cover of this issue is what is known as the “sound locator” employed by the Ordnance Department of the U. S. Army. These mechanical ears can detect the buzzing of propellers or the faint whir of an aircraft engine more than 15 miles distant. These sound locators are, in reality, Radio loud speakers in the sense of being the exponential type of horn—practically the same form of loud speaker that is used in talking motion pictures and public address systems. This type of horn is capable of reproducing the sound emanating from an airplane from 100 to 400 cycles. With the aid of these sound locators or Radio ears the operator can make the necessary calculations and deductions and within 30 seconds after a

Inductance and Capacity Measurements
With a Wheatstone Bridge
(Continued from page 12)

values of m and n and apply the following formula.

\[ X = L \cdot \frac{m}{n} \]

It will be noted that the important adjustment of the sliding contact was not changed in balancing the resistances R3 and R4. This is so arranged since the important adjustment of the slider determines the inductance measurement. The above formula is absolutely correct and is based upon both types of balance thus obtained.

The third article of this series will be published in the next issue of the N. R. I. News.

J. A. D.

OPERATORS BADLY NEEDED

Employment Manager Murray has more calls for Radio operators than he can fill. Graduates and students holding government operators’ licenses should notify him at once if available for work. The shortage is so serious that we want to extend the privileges of our Employment Department to men who have not taken N. R. I. training. If you have any acquaintances who hold operators’ licenses and who want an operating job—send in their names and addresses at once!

J. E. SMITH.

MISTAKE

Applicant—Well, here I am to see if that job you advertised.

Boss—I see. Do you think you can do the work?

Applicant—Work? Good gosh, I thought you wanted a foreman!

RIGHT! The more Radio knowledge the easier it is to grab the dollars.

Dear Mr. Smith:

When I enrolled I was working on a surveying gang making $4 per day for twelve hours work. Now I am considered one of the leading Radio service men in town. I have my own shop, own all of the equipment and am my own boss and make all the profit.

Just recently I designed and built a test board that has no equal in the Bay District. It is now given A.C. operated. It contains power pack, modulation, Wave length dial, neon lamp, neon tube voltmeter, capacity meter, continuity tester, A.C. to D.C. converter, transformer and all necessary meters for testing plate, grid, filaments, all at one time in a receiver. I would not take a thousand times the price of my course—LeRoy Bronson, 2004 Walnut Ave., Venice, Calif.

MAIL YOUR LESSONS IN PROMPTLY THEN GO AFTER THE DOLLARS

—Drawn by Student Mosebeck, Detroit, Mich.
AMERICAN SCHOOL OF THE AIR

On February 4 the American School of the Air will be launched. It is sponsored by Grigsby-Grunow, makers of the Majestic set. Already 35 stations of the Columbia Broadcasting System have agreed to carry the feature.

This is the first nation-wide attempt to give instruction to public school students by means of Radio. For 90 minutes on Tuesday and Thursday of each week, from February 4 to May 16, special high class educational lectures will be directed to school children throughout the country. A faculty of 16 prominent educators are preparing the special broadcasts on history, literature, civics, art, music, health, nature study and international good will. These programs mark a big step forward.

Radio is going to equalize educational opportunities. It will pay you to encourage the experiment. See that the schoolhouse in your locality is equipped to receive these programs. Radio will play a bigger part in education as time goes on. That means, also, a greater demand for Radio apparatus. It means that children will become Radio-conscious and will accept Radio more readily as a medium of education, entertainment and business information. If you want more information about these programs write to the American School of the Air, Box 100, Chicago, Ill.—J. E. S.

HOW ALDRICH GOES OUT AFTER RADIO BUSINESS

Student A. Lee Aldrich, 1137 Vincent Ave., N., Minneapolis, Minn., sends us this picture. It looks like a handy piece of machinery to set around with, conducting demonstrations and handle repair jobs quickly. Mr. Aldrich believes in advertisements, too. It would be a safe bet to say that he had a firm grip on a large share of the St. Paul Radio business. With him, George Medved and several other N. R. I. graduates, the people of St. Paul ought to have their sets in top-notch working order!