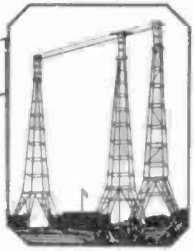
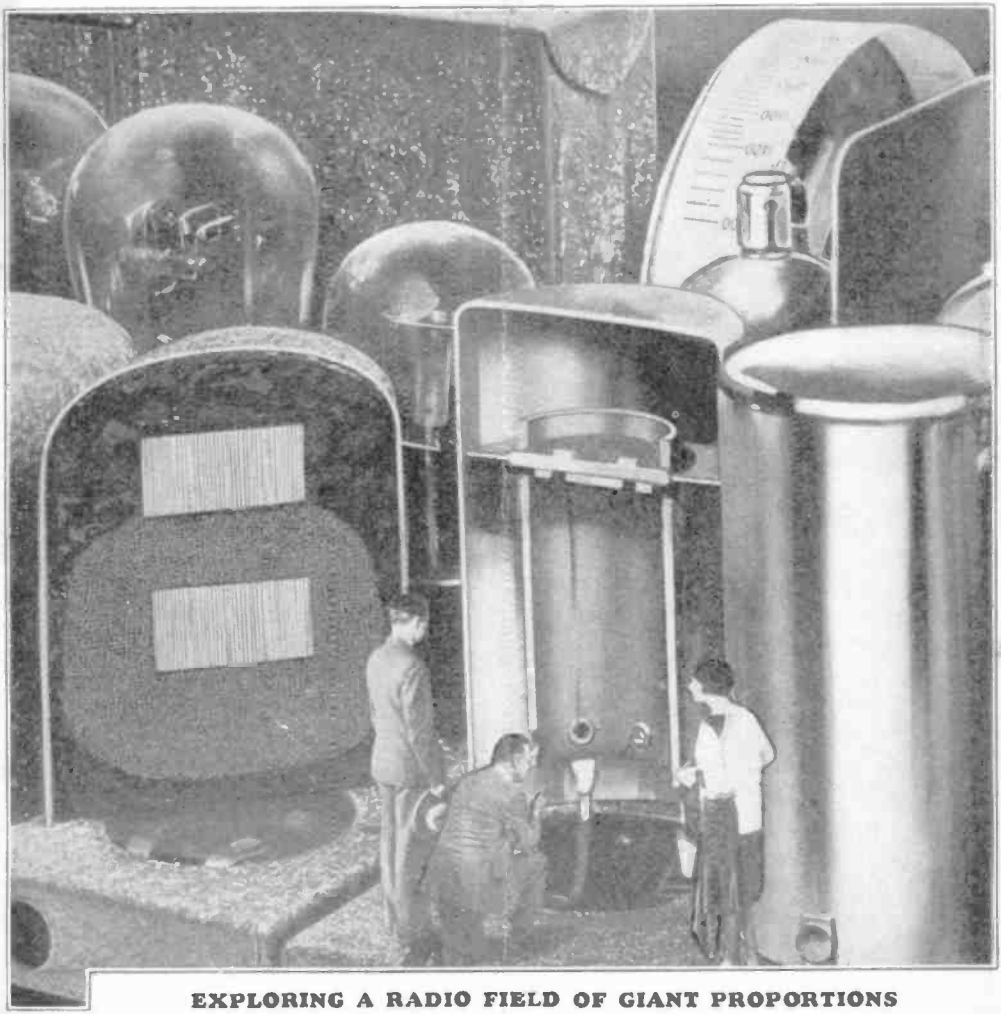
NATIONAL RADIO NEWS



FROM N.R.I. TRAINING HEADQUARTERS

Vol. 2—No. 8 WASHINGTON, D. C. MARCH, 1930



EXPLORING A RADIO FIELD OF GIANT PROPORTIONS

Sound Engineering

New Radio Field Needs Specialists

THERE is a new and profitable branch of Radio opening up to the Radio-trained man. To that field—Public Address or Sound installations—this issue of the News is dedicated. In it we have tried to point out some of the opportunities and to suggest that N. R. I. men give some thought to that branch.

Sound installations are in demand for all kinds of institutions, ranging from the school, church, public auditorium, park and stadium, to the club room, hospital, railway waiting room, train platforms and hotels. On account of the considerable investment represented by such installations, the public as well as the industry are prepared to deal only with the Radio-trained man. The business ability and technical knowledge of N. R. I. graduates and the more advanced students qualify them for these major Sound installations.

This is more than a mere matter of selling amplifiers, pick-ups, wiring and loudspeakers—it is a matter of Sound engineering—an opportunity to become Sound specialists or dealers to sell and service complete Sound installations.

Radio has now reached a stage of development where these public address installations will become increasingly important. The new, modern hotels, for instance, are being Radio equipped. Many of the old ones are being wired for Radio. Every school house in the land is a prospect for these installations. Each presents a separate problem in Radio engineering. The installation must take into account the number of speaker outlets, volume control, power available and many other factors. Good Sound jobs are custom built in the broader sense. That's why the independent or professional Radio man will be sought after to handle this work.

It would be ideal if your local hotel man or school board of directors would come around and talk about this work with you. But the best things don't happen that way. If you want to get your slice of this business you must go after it! Mr. Haas, in his editorial in this issue gives some pointers along that line. Read it. Think it over. In branching out into the more specialized fields of Radio you will make the most of your opportunities in a profession that is ever-widening.

J. E. Smith

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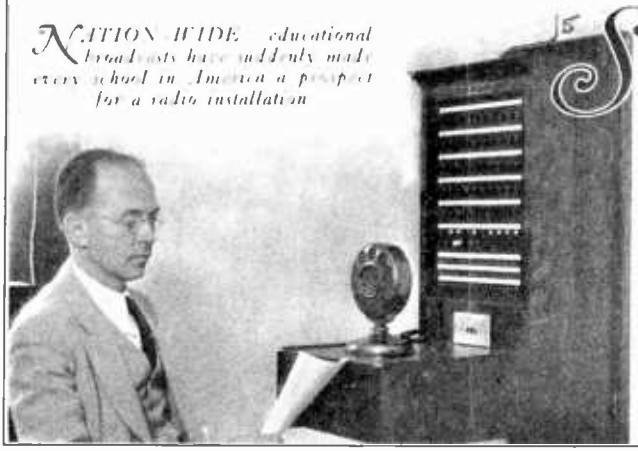
Radio Is the New School Bell

NATION-WIDE educational broadcasts have suddenly made every school in America a prospect for a radio installation



"I WISH to make an announcement," says Principal Gaffney of the high school of Great Neck, Long Island (left) from his office chair. Instantly any particular rooms or all of the forty-four rooms hear the announcement

The Great Neck High School, L. I., New York, claims to have the most modern and complete Radio installation ever made. A loud speaker in each of the 44 class rooms, with additional high volume speakers in the auditorium and cafeteria make this school a model of efficiency and educational opportunity. The circuits are so arranged that the speakers may be used for the reproduction of radio broadcasting, phonograph selections or statements and announcements made from the principal's office. The principal at the radio switchboard operates the individual control over each speaker and distributes the incoming educational Radio program to any single room or combination of rooms.

A feature of this installation which is of great interest to the independent Radio man is that the entire contract for this installation was handled by Wm. Barrow, Jr., the local Radio man. He "sold" the school authorities on the advantages of school Radio equipment, purchased the equipment from the Stromberg-Carlson Company and with the aid of assistants installed it. This shows that public address installations are not limited to Radio contracting companies or the large dealers. Even the largest of these jobs can be handled by the trained professional Radio man.

After seeing this system in operation Mr. Barrow said, "Within a surprisingly short time any school, new or old, that is not equipped with an up-to-date radio installation will be considered out of date. Such an installation would be fully justified if used only for announcements. I consider our schools one of the most promising markets for radio equipment of all kinds, a market that is not only vast but eager. When our local school board was told what remarkable services a radio installation would give, they were eager to have the best obtainable. School boards everywhere will feel the same way, because it is so obvious that a radio installation is one of the best investments a community can make. Not only does it save a surprising amount of time by smoothing out the control of the school, but it opens up the world to the classroom. Put a radio in every school and the whole standard of education will be raised. Tell school boards what can be done with radio in the school and every school will be equipped for receiving programs."

So here's a new big field of Radio opening up to the qualified technical man. The use of Radio in education is growing. The American School of the Air, Ohio School of the Air, Damrosch's Concert, and other radio offerings for the school room mark the beginning of a new day in American educational methods. The thousands of schools throughout the land must be radio equipped—the small, one to four room schools with receivers, and the larger ones with public address systems. It's up to the professional Radio men throughout the United States to see that the school house in their community is properly equipped!

(Courtesy "Electrical Record")

Some Practical

Pointers on Public Address Systems

By H. K. BRADFORD
Member Technical Department

SUPPOSE that you have landed the job of installing an amplifier system in a 15-room school building. You must size up the job, draw up your plan of attack, estimate the cost, and purchase and install the apparatus. You will need an amplifier capable of supplying 17 or 18 speakers, one for each room, one for the auditorium and one as a monitor by which to operate the amplifier.

Probably the first thing to be considered when making an installation of a public address system is the type of power supply available. The most common type of power supply is, of course, the 110-volt A. C. line. Fortunately, the radio man has a good starting place because he is quite familiar with the transformer, rectifier and filter used with the modern all-electric receiver. More power, however, is required to operate a system of this kind because it must supply more than one speaker with voice current. The transformer used should have a power rating of 150 to 200 watts and should have a voltage output of 600 volts each side of the center tap of the secondary winding. Proper filament windings adaptable to the amplifier and rectifier tubes will be necessary. The 280 rectifier tube cannot be used here because it lacks the power necessary to operate the system. The 281 rectifiers have been found most practical, having a maximum voltage value of 700 volts and 85 milliamperes per tube.

You will notice that the filter choke in Fig. 1 is a complete transformer. When the reproducing apparatus is placed at a great distance from the amplifier the noise level introduced by the 60-cycle hum is higher than the equivalent in an A. C. receiver. For this reason the common coil type of filter choke is not practical. Here we have two coils wound as a transformer and the rectified alternating current is passed through them in opposite directions. The fields produced by these two coils are opposite in polarity so that each suppresses and attempts to stabilize the other. The remaining part of the filter consists of the usual condensers constructed in this case to stand high voltage. Fairly high capacity values are used to further suppress the hum.

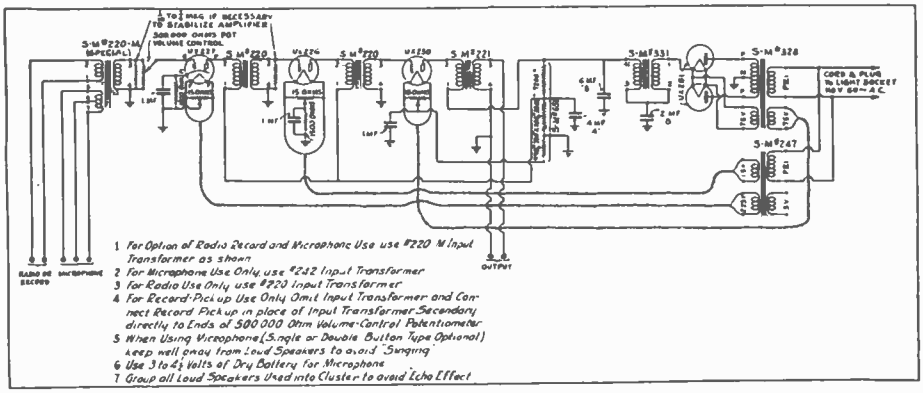
Fortunately, the installation engineer has only to consider audio frequency amplification in connection with the public address system. The development of the audio frequency amplifier has been made principally by telephone companies and not by the radio manufacturer as is commonly believed. "Talking Movies" have been in existence more than 20 years, but could not be made practical because they could not be properly amplified. The amplifiers used for reproducing talking pictures do not differ materially from the common public address system.

The input transformer supplying the amplifier with the speech or music consists of a double primary and a secondary winding. It is a step-up transformer of rather high ratio depending on the number of stages following. One of the primary windings is center-tapped to provide for the double button carbon microphone and the other winding is simply a double lead winding for accommodating the magnetic pick-up.

The secondary is shunted by proper stabilizing resistances and the potential changes existing between the variable arm and ground is fed to the grid of a heater tube.

The rest of the amplifier is simply a powered audio system not materially differing from the usual form of audio amplifier contained in the modern receiver.

Now, returning to the concrete example upon which we were working, the speakers for the rooms of our 15-room school house should be of the magnetic cone type having a large diaphragm.



Circuit diagram of a modern public address system 3-stage amplifier and power supply. The input transformer feeds a cathode '27 type tube. The output of this feeds a '26 tube and this in turn modulates the '50 type tube. The power and filament transformers, rectifier tubes and filter system are shown on the right of the diagram. The plate supply is evaluated for the various tubes by the tapped resistor to the left of the filter system. Biasing is accomplished by resistors throughout.

There are many types of amplifiers using the '50 type output tube which will furnish plenty of volume to all the speakers.

The method at attaching a number of speakers is to wire them in a parallel line. The maximum output will be obtained when the impedance of the entire speaker system matches the impedance of the transformer. The primary of the output transformer will have a much lower impedance when a load is attached to the secondary. For this reason a resistance must be used for each speaker. The combined impedance of the speaker system is thus reduced.

The amplifier may be placed in the office of the school under supervision and control of the principal. A switching panel should be placed at the amplifier so that all the speakers may be directly controlled at the office and a volume control should be placed at each speaker. There are three principal ways in which the wiring may be made from the amplifier to the speakers. These are metal cable or conduit, wire moulding, or a twisted pair as telephone wiring is done, the latter being the cheapest method. The wiring should not be run very close to any telephone lines in the building unless metal covered. The panel may be either purchased or constructed and should consist of a master control switch for each speaker in the building. A galvanometer may be used to assist the operator in maintaining a constant volume level. This meter should be placed in the plate circuit of the output tube. The current capacity of the meter should be fairly low and a variable low resistance of about 50 ohms should be shunted across it. Its sensitivity may be adjusted for maximum scale deflection if desired by using all of the shunt resistance.

The type of speaker using the large coil diaphragm will furnish its own baffle board but the small cone speaker should be mounted in a suitable frame which will furnish as a baffle board.

For auditorium reproduction, the dynamic type of speaker is preferable. It is only necessary to obtain an input transformer having a high impedance primary which furnishes a high current component to the secondary wound with large wire and having but few turns. In this way the proper output impedance of the amplifier is balanced and little current is lost in transformation. It would be impossible to obtain any amount of volume using the speakers direct. As many as three or four speakers will be necessary for a large auditorium and it will hardly ever be necessary to operate the auditorium speakers at the same time as the individual room speakers, hence plenty of volume is available to both. The amplifier input is fitted for an all-purpose device. Victrola records may be reproduced at any or all of the speakers, addresses from the office of the school, and messages may be effectively distributed through the local microphone, and a receiver having several stages of tuned radio frequency and detector may be used to furnish radio programs throughout the school.

Capacity Measurement With a Wheatstone Bridge

PART III

By JAMES A. DOWIE

Chief Instructor National Radio Institute

Member I. R. E.

THE WHEATSTONE "slide wire" bridge may be used also to measure unknown capacities, there being required in this circuit but one known capacity. Figure 6 illustrates the connections for this bridge in which C is the known capacity and CX the unknown capacity and m and n are the lengths of the two arms of the slide wire which are adjusted for a balance for a minimum sound in the telephones.

When such a balance has been secured, it may be shown by a mathematical analysis that the unknown capacity is given by the following formula—

$$CX = \frac{C \times n}{m}$$

For example, the scale has 100 divisions and the sound is minimum in the telephones at a point on the wire 25 divisions from E (Fig. 8), leaving 75 divisions for n between F and C. Assuming that we use a standard capacity value of .002 mfd for C, we may substitute these values, giving

$$CX = \frac{.002 \times 75}{25} = .006 \text{ mfd.}$$

$$\text{Value for } CX \frac{75}{25} = 3$$

$$3 \times .002 = .006$$

In all these measurements using a buzzer to supply the alternating current to the bridge, it is advisable to set the buzzer at some distance from the bridge or muffle it in some way, otherwise it will be difficult to determine whether the note is coming from the telephones due to the current passing through them, or whether it is direct noise from the buzzer.

In these measurements, a calibrated variable air condenser should be used as a standard; with this, a very large range of capacities may be very simply measured.

First, the slider is set at the midpoint of the length of resistance wire, making m equal to n. The variable standard air condenser is then varied until a balance is obtained. Then, whatever the variable air condenser C reads will be the capacity of the unknown condenser CX, since m and n are equal. A small fixed condenser, A, is necessary in this measurement so that a balance may be had and the reading taken of C without the unknown condenser CX in the circuit.

The effective resistance of the condensers enters exactly the same in the measurement of capacities as in the measurement of inductances, but in the case of condensers using air as the dielectric, this is not very important as the resistance of such condensers is almost zero. However, where condensers

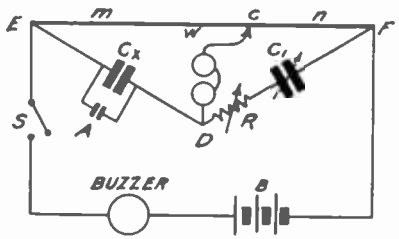


Fig. 6—Slide Wire Bridge for measurement of capacity.

have different dielectrics, there will be a considerable difference in their resistance which means it will be impossible to get a silent point in the telephones. However, a fair balance point can be secured in the usual case.

Due to the insulating properties of condensers, it is impossible to balance this bridge with direct current. However, a good balance is generally found

(Continued on page 15)

National Radio News

Published monthly in the interest of
N. R. I. students and graduates, by the
NATIONAL RADIO INSTITUTE
16th and U Streets, N. W.
Washington, D. C.

J. E. SMITH, Publisher. E. R. HAAS, Editor.

Washington, D. C. March, 1930

Selling Sound

The time is ripe for N.R.I. men to cash in on the public address field. The best prospects for these Sound installations are hotels, apartment houses, schools and convention halls. The job may cost $100 or $100,000 depending upon the circumstances. But, don't expect this business to fall in your laps. These big jobs, like all worth-while things in life, are won by those who go after them.

So, if you're interested and want to go after this work, put plenty of planning and thought into it. Survey your territory or community. Check over the number of schools, churches and hotels that are not Radio equipped. Consider each one as a separate sales and engineering problem. Think up all the reasons you can why a certain building should be radio equipped and then with the facts in hand take the matter up with the prospect. If you have gone about it in the right way he will no doubt be much impressed with your understanding and knowledge of the proposition and will consider your plan. If it's a school you'll probably deal with the director or trustees. And, of course, this summer is the best time to equip the schools. Have them ready for the opening next September!

There's good money to be made in this work and I don't know of any body of men who are better fitted to handle it than N. R. I. graduates and students who have gone quite a way through the course. The Radio Engineer now may also be a Sound Engineer.

E. R. HAAS.
Vice President and Director.

RADIO is fast becoming standard automobile equipment. Sets are being installed on a number of the new cars. Present owners of cars are prospects for built-in sets. N. R. I. men should be qualified to handle this work and service and repair the equipment on new cars. Valuable information on the Delco-Remey auto set is found in this issue. See pages 10-11-12-13. Read them. Be prepared for this work.—Editor.

Below are listed for your convenience some of the foremost makers of public address equipment. You may want to get information from them in your Sound installation work.

Silver-Marshall, 6401 W. 65th St., Chicago, Ill.

Graybar Elec. Co., Lexington Ave. & 43d St., New York City.

General Electric Co., Schenectady, N. Y.

Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.

Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Samson Elec. Co., 227 Washington St., Canton, Mass.

Thordarson Elec. Mfg. Co., 500 W. Huron St., Chicago, Ill.

Ferranti, Inc., 130 W. 42nd St., New York.

DX fans may be interested in knowing that CKPR, Midland, Ont., Canada, is now broadcasting on 322.4 meters, 930 K.C.

Graduate W. R. Lord has just accepted a position as Radio operator on a Pan-American transport plane flying between Havana and Miami. Young "W. R." is just 18—good work!—Editor.

Dear Mr. Smith:

"Just think—one year ago I mailed my first lesson to you. I was then working for $70.00 per month, with board and room. Now it's different. In the last 10 working days with my salary, commissions, and spare-time work, I have made $114.50. I have complete charge of the Radio Department. I do all the ordering of the different models of Radios and all accessories. And, by the way, the manager has recommended me for a promotion. I get on the average six sets a week to repair in my spare time. Last week I had to hire a young fellow to help me as I had more than I could do."—H. W. Snider, 605 So. Division, Walla Walla, Wash.

OUR COVER—

The NEWS is indebted to Brunswick-Balke-Collender of Chicago for the cover picture. The novel effect is created by the "Lilliputians" inspecting the chassis of the S-31 Brunswick Panatrope with Radio.

The smart hotel is Radio equipped.

Hotels and Apartments Are Good Radio Prospects

By J. E. SMITH

I NEVER fully realized how valuable Radio could be to hotels until I inspected the $65,000 Radio installation in Washington's newest—the Ambassador. It is very modern and practical in every respect. In this article I shall describe some of its features and point out how any qualified Radio man can handle these bigger jobs and reap the financial returns this work offers.

On the top floor is the operator's room. In it two master receivers are located as well as the speech input amplifier, monitoring panel, volume control, a reproducing turn-table and a microphone.

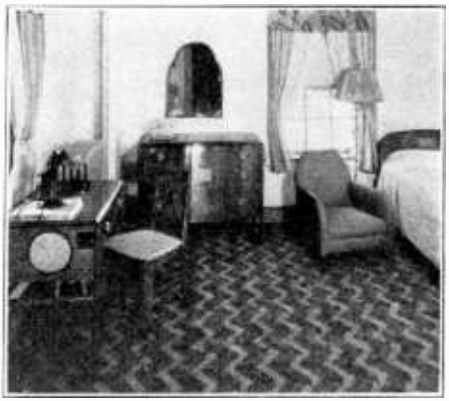
Two outside broadcast programs are picked up in the studio and distributed to the 525 speaker outlets in the various rooms and lobbies, swimming pool and gymnasium, smoking room, club room, etc.

The volume is controlled from the operating room and whether there are ten speakers or two hundred speakers on a circuit the volume remains constant.

One of the latest model magnetic cone speaker-units is installed in every room. The speaker cabinet, of course, is custom built and specially designed to match the furnishings of the particular room in which it is installed. Dynamic speakers are used in the lobbies and dining room. The subdued, clear tone of these speakers do credit to the Radio art.

Of course the wiring for this Radio installation was done right along with the construction of the hotel and all speaker plug-in connections and other features are very convenient and practical.

As the public learns more of the advantages of Radio in hotels those without Radio equipment will be sadly out of date. Practically every hotel and large apartment house in the United States and Canada is a prospect for a master Radio installation.



A typical Ambassador guest room. Note the speaker built in the writing desk.

One must see the equipment at the Ambassador or other large hotel in operation to appreciate the many and varied practical uses for public address systems of this type. It would justify its cost if it were used only to provide guests with Radio entertainment from the outside. In this particular hotel the system is used for quite a number of other purposes.

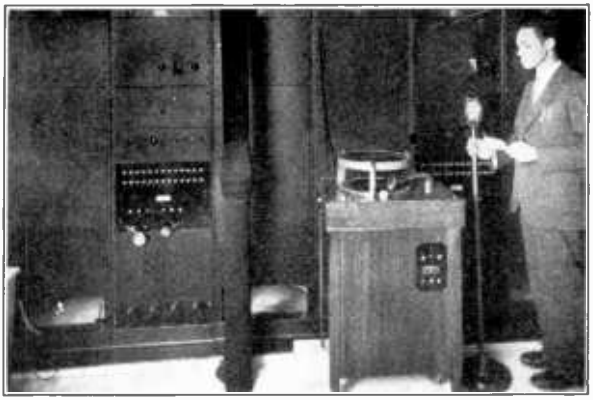
For instance, if the program coming from the broadcast station during the dinner hour is not appropriate, the hotel Radio operator in the studio selects a number of concert records from their large record library and reproduces them, distributing the concert through the system to the dining room and lobbies.

The system is also used to carry the health club instructions and swimming lessons to guests enjoying the privileges of the gymnasium and swimming pool.

One of its most novel and practical services is its use as a means of paging guests. Instead of the bell-boy making the rounds of the lobbies calling for a certain person, the Radio operator is notified. He then cuts in on one circuit and with a subdued voice calls through

the loud speakers in the lobbies and public rooms of the hotel for the party desired. Indeed this hotel takes full advantage of its Radio facilities. Naturally, these conveniences are valued highly by its guests which simply means that the progressive hotel and large apartment house must be Radio equipped.

I have felt for some time that this public address field offers N. R. I. men a considerable amount of very profitable business. It is waiting for them. A number have made public address installations, but there are hundreds of opportunities for more of the work and room for many more N. R. I. men to participate in it.



View of input panel in hotel Radio room. N. R. I. Student E. Lewis in charge. He handles this equipment and is responsible for the operation of the hotel Radio system—a nice job in itself.

Some are under the impression that jobs of this kind can be handled only by the larger Radio contracting companies, but that is not so. I'm confident that there are scores of N. R. I. men who have the business ability and the technical knowledge required to handle a job as big as this one. And when you consider that the equipment—speakers, wiring, master receivers and all in this hotel cost $65,000 you can mark it down that there was a neat profit and plenty of work for the man who handled the installation—to say nothing of the reputation a job of that kind has made for him.

Radio can be installed in new apartment houses as they are erected much more inexpensively than in the case of hotels where speaker units must be provided. Many apartment house jobs require the master receivers, wiring and plug-in connections. The tenant must in that case furnish the speaker unit.

It's a good idea to keep in touch with the local contractor and architect. Urge him to include Radio equipment in new apartment house jobs, etc. Cooperating with him you ought to get more of this type of work.

$65,000 worth of Radio equipment is installed in this new Washington $4,000,000 hotel.

Business Sense Essential

In handling the large public address jobs make sure of the facts before making a written contract. Equipment for the bigger jobs is rather expensive and the contract must usually be undertaken on the basis of guaranteed satisfaction. The manufacturers of the equipment are usually willing to cooperate in every possible way with the installation man. Their engineers will lend technical assistance in determining the equipment requirements and often even go so far as to assist in closing the contract and give supervisory or consulting service on the installation.

* * * *

Every large hotel, apartment house, school, auditorium, amusement park, hospital, restaurant and church in the country is a potential prospect for a public address system of some kind. Don't let the other fellow get away with the biggest part of this new business. If you're interested, appoint yourself a committee of one to run down and sell at least one or two of these good prospects in your community this spring and summer.

NATIONAL RADIO INSTITUTE
Washington D. C.

Radio-Trician
(TRADE MARK REGISTERED U. S. PATENT OFFICE)

Service Manual

Compiled solely for Students & Graduates

on the

Delco-Remy R-5A Receiver For Automobile Installation

The Delco-Remy radio R-5A, installed on some of the General Motors' cars, is a five-tube receiver designed for automobile installation. The set is installed out of sight under the cowl, and is remote-controlled by a flexible shaft, which is connected to a tuning dial, located on the instrument board of the car. At the left side of the tuning dial is a volume control and at the right side is the switch. The dial, volume control, and switch are the only parts of the equipment visible to the operator. (See Figure 1.)

The current for the receiver is obtained from the storage battery of the car; four vertical type standard size 45-volt "B" batteries and three 4½-volt "C" batteries.

The "B" batteries are located in a metal battery box, beneath the floor boards. The "C" batteries are located in a convenient place, dependent upon the design of the car, and may be mounted on the dash or in the same box with the "B" batteries.

A cone speaker is located on the dash with a junction block to which all the battery and set leads are connected.

The aerial consists of several parallel wires concealed in the car top and is the maximum amount of aerial that can be used in the space available on a car.

The set is shielded to reduce ignition interference to the minimum. Special condensers and resistances are placed in all interfering circuits. Nevertheless, a ticking noise will normally be heard in the speaker when the tuning dial is turned between stations and the engine is running. This ticking sound will practically disappear during reception of signals. The resistance units in the spark plug and ignition coil circuits have no effect whatever on the running of the engine.

TUBES: The five tubes used in the set are of the following types:

Radio frequency amplifiers—two Type —12A tube.

Detector—one Type —12A tube.

Audio frequency amplifiers—one Type —12A tube, one Type —27 tube.

To replace or examine the tubes, the set must be removed from the mounting brackets and the nine screws holding the metal cover on the set removed. The tubes are removed from their sockets by lifting straight up. Be sure to replace tubes in correct sockets.

The two Type —24 and the one Type —27 tubes are connected in series, so that if one of the tubes in this series does not heat due to a burn-out or loose connection in a socket, none of the three tubes will heat. Therefore, each tube should be tested in order to find which tube or socket is at fault.

Installation of Set on Car

First read carefully the Car Manufacturer's Instruction Booklet that is supplied with a new car then read Car Wiring Instructions.

The external connections of the R-5A radio set consist of nine leads of different colors, as listed below, and are connected to the speaker terminal block. (See Figure 1.)

Terminal No.	Battery Voltage	Color
1	B Positive 180	Red
2	B Positive 112.5	Black-red tracer
3	B Positive 45	Maroon
4	B Negative A Positive	Yellow
5		Brown
6		Black
7	A Negative	Black-oak tracer
8	C Negative (0 to 3)	Blue
9	C Negative 13.5	Green

Leads 1 to 4 and 5 to 9 are separately grouped in graduated lengths so as to connect to the junction block in correct rotation.

A wiring harness, containing the four battery wires leading from the "B" batteries to the speaker terminal block, is used for all the "B" battery connections. The leads are of the same color combination as those from the set and are attached to terminals 1 to 4 as given in the above table. In addition to the "B" yellow lead connected to terminal No. 4, the "A" positive ground lead is connected to this terminal.

The "C" battery leads, the volume control leads, and the switch leads are all contained in a harness called the Control Wiring Harness. These wires are colored and connected as follows: (See Figure 1.)

Terminal No.	Color	Connection
6	Black	Right side of Volume Control.
7	Black-oak Tracer	Left side of Volume Control and to left side of lock switch.
8	Blue	"C" Zero (yellow), or negative 1½ or 3-volt.
9	Green	C Negative 13½-volt.

In addition to these connections to the speaker, there are two other wires in the control harness: A yellow lead from "C" Positive to the middle point on the volume control and a red lead from the ammeter to the right side of the lock switch.

Resistance units are connected in series with the high tension leads at each spark plug and in the coil lead at the distributor or coil.

A condenser is mounted on the generator at the cut-out relay and is held in place by the cut-out relay mounting screw. The flexible condenser lead is connected to the generator main brush lead at the relay terminal. Another condenser is mounted on the starting motor switch by means of the regular switch mounting screw. The condenser lead is connected to the battery side of the start switch terminal.

The aerial is composed of several parallel wires concealed in the car top and is connected to the radio set at the aerial terminal as shown on the diagram. The lead-in should be shielded and the shielding should be grounded to the radio set.

If the radio set is mounted so that there is no positive ground connection, one should be provided.

ADJUSTMENT:

Turn the radio control switch to the right, which is the "on" position. This will register a slight discharge at the ammeter. Due to the fact that the filament of the tubes heats rather slowly, it may take two minutes or more for the receiver to start operating.

Turn the volume control knob in clockwise rotation, about midway towards full volume position, and turn the station selector dial until signal is located.

After the set is in operation on a powerful signal, it will be necessary to tune the antenna circuit so that weaker signals will be received with maximum volume. The best way to do this, is to connect a milliammeter, with a ten milliampere scale, in series with the B plus 45-volt maroon lead. (Connect positive side of meter to set.) Insert a small screwdriver in the hole in the bottom of the receiver, located nearest the antenna terminal and adjust the large screw that is located about two inches above this hole. This adjustment is a very delicate operation and requires only a slight movement in either direction, not to exceed one full turn. If a meter is not available, a weaker signal should be selected and the set adjusted to maximum volume by varying the position of the screw.

CAUTION: Care should be taken not to apply excessive pressure in making this adjustment. While it will do no damage to ground the screwdriver to the set while adjusting the screw, the signals will be cut out whenever the screwdriver touches the case. A little tape wound around the screwdriver will prevent this. It is impossible to receive a shock while making this adjustment.

Adjustments should be made by turn-

ing the screw until the minimum reading on the meter is obtained. While this adjustment is being made, the station selector should be turned slightly either way to determine whether or not the reading can be further decreased.

NOTE: There are three holes in the bottom of the receiver. Make this adjustment only through the hole located nearest the antenna connection.

It may now be necessary to make a few minor adjustments in order that the set function properly. The connection of the blue lead to the "C" battery will depend upon the characteristics of the detector tube installed in the set. If this tube is replaced by one of different characteristics, it will be necessary to change the position of this lead. The proper connection is determined as follows:

With the set tuned to a powerful signal and the blue lead connected to the C 1½-volt terminal, turn the volume control toward the left. This should gradually reduce the volume, but should not reduce it to zero unless the control is turned more than half-way toward the left, which is the "off" position.

If the volume cannot be reduced to a low level when the control is turned to the "off" position, shift the blue lead to the "C" positive terminal to which the yellow lead is connected.

If the volume becomes zero before the control is turned half-way, shift the blue lead to the "C" 3-volt terminal.

After the set is operating properly, a weak signal should be tuned in and the volume control knob fastened on the shaft with the arrow in a vertical position at the point of maximum volume, which will indicate the point of maximum sensitivity.

TESTING AND REPAIRING

TESTING IN THE CAR: Failure of the set to operate properly can usually be traced to low "B" battery voltage or dead tubes. Run down "B" batteries are detected by a falling off of signal strength and noisy or distorted reception.

In case of faulty reception, the receiver should be given a preliminary check-up before removing it from the car. This check-up should consist of the following tests in order:

1. CHECK THE AERIAL CONNECTION: In addition to checking the aerial connection, make sure that the aerial lead-in wire is of the shielded type and is no longer than is necessary to reach the aerial terminal and that it is kept separate from all other wires, control linkage, and cables under the cowl.

2. TEST THE "B" AND "C" BATTERIES: The "B" batteries may be tested at the speaker terminal block. The minimum voltage allowable at each terminal is as follows:

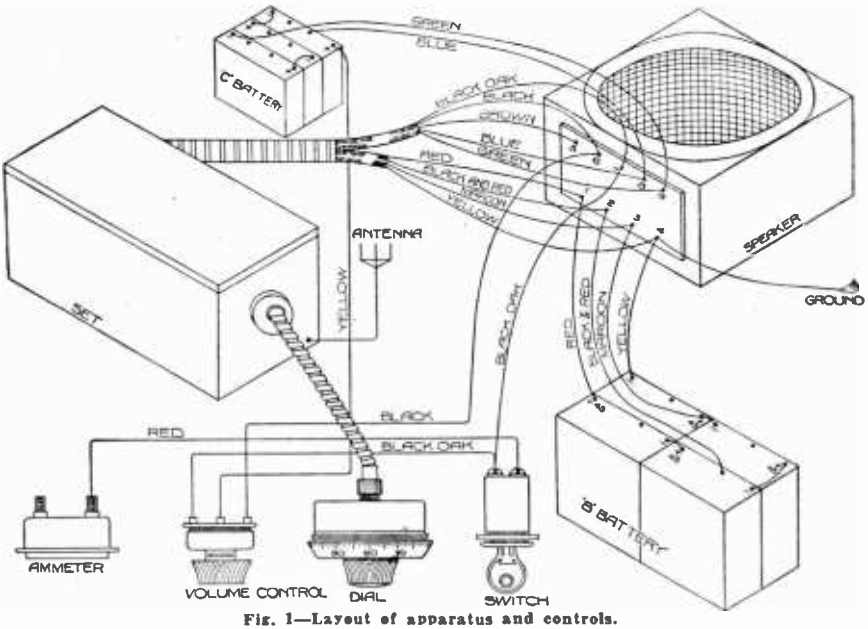


Fig. 1—Layout of apparatus and controls.

Yellow to Maroon Lead.... 35 volts
Yellow to Black with Red Tracer Lead ..... 87 volts
Yellow to Red Lead.....140 volts

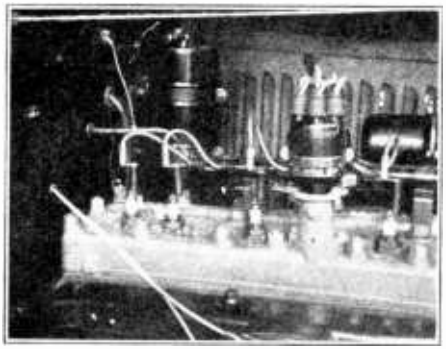
When the voltage falls below the above specifications on any of the circuits tested, each individual battery should be tested. When the voltage across any 45-volt battery falls below 35 volts, it should be replaced.

3. INSPECT FOR LOOSE OR BROKEN CONNECTIONS AT THE BATTERIES AND TERMINAL BLOCK.

4. TEST ALL TUBES: To replace or inspect the tubes, the set must be removed from the mounting brackets and the nine screws holding the metal cover on the set must be removed. The tubes are removed from their sockets by lifting straight up.

The two Type —24 tubes and the one Type —27 tube are connected in series. If one of the tubes in this series goes dead, due to a burn out or loose connection in the socket, none of the three tubes will light. Each tube, therefore, should be tested individually in order to find which tube or socket is at fault.

If the above points are all found to be in good condition and the trouble is still apparent, the receiver should then be removed from the car for test and repair. Any tests commonly used in testing battery operated receivers can then be applied to the receiver.



Dodge Senior Ignition system showing spark suppressors and Bonding. The Dodge is equipped with Transitone Radio.

Moved recently? Then—send us your new address. Help us keep the News mailing file up to date. Thanks. J.E.S.

Cashing In—

Hundreds of letters reach us every month telling of the progress of N. R. I. men everywhere. Here are a few typical ones:

Dear Mr. Smith:
I am trying to confine my spare time to selling new receivers. I sold during the month of December, 3 radios from the Allied Radio Corp., and today I sold my 5th Lafayette, for the Wholesale Radio Service Co. These 8 sales will give me a net profit of $568.00.—Mr. M. Nimelstein, 610 Keefer Place, N. W., Washington, D. C.

Dear Mr. Smith:
I am in business for myself now and am doing much better than I ever had any hopes of, and my thanks go to you and the rest of the staff at N. R. I.—Lewis Miller, Newton Falls, Ohio.

Dear Mr. Smith:
I've just rewired a set for A. C. operation and received $15.00 for the job.—Mr. S. Soloway, 406 Joseph Ave., Rochester, N. Y.

Dear Mr. Smith:
In the last three weeks I have made between $70 and $80 in spare time.—Herbert Buller, 1161 Shakespeare Ave., New York, N. Y.

Dear Mr. Smith:
I have been averaging $30 and $35 a week, in my spare time, not being occupied with Radio work in the day time. In three days I cleaned up a profit of $47. I serviced six Radio receivers, and installed two aerials.—Mr. Alexander C. Hendriksen, 2019 No. Neva Avenue, Chicago, Ill.

Dear Mr. Smith:
I'm sure getting my share of repair work so that I do really too much, as I like to get on with my lessons, but I don't like to disappoint people. I haven't failed to give every satisfaction so far and more than that, I don't think I will if I follow the principles of your course. I had 4 sets brought to me one night this week.—G. Green, 829 11th St., San Diego, Calif.

Dear Mr. Smith:
Those cards you sent me started a regular cyclone of repair work and I have been very busy working on sets. That's why I am way behind with this lesson.—Mr. Francis J. Holland, 520 3rd Avenue, Brooklyn, New York.

Dear Mr. Smith:
Having had some experience in the field before taking your course of instruction, I feel I can appreciate the training more than one not having this experience. I have been averaging about one hundred dollars a month in spare time work.—Milton H. Schertle, 3611 Ellsworth Street, Los Angeles, Calif.

Dear Mr. Smith:
I am having all the work that I can do at the present time at home and making $35 a week extra over my regular pay.—Elisha P. White, 104 Court Street, Freehold, N. J.

Dear Mr. Smith:
I handed out the business cards you sent me the other day and they made me thirty dollars last week.—Mr. Mike Rabely, Box 62, Curtisville, Penna.

Dear Mr. Smith:
I made about $45.00 in the first two weeks after receiving my business cards and I am now representative for this City of the Scott Transformer Co., with the Scott World Record Super.—Emil Bock, Fanshawe St. & Tabor Ave., Philadelphia, Penna.

The Metro family is reprinted through courtesy of "Metropolite Electric Topics," the publication of employees of New York Edison System.—Editor.

CAPACITY MEASUREMENT WITH A WHEATSTONE BRIDGE

(Continued from page 6)

giving fair accuracy with this arrangement.

In order to secure a more accurate balance with this bridge, it is necessary to connect a resistance, R, in one or the other of the condenser arms, as may be found by trial. This will compensate for any resistance effect introduced by the condenser in the other condenser arm. The readings of this resistance, with and without the condenser CX, are indicative of the losses in the condenser under test.

Construction of a Slide Wire Bridge

There are a very few parts needed for the construction of a slide wire bridge and these are comparatively easy to make. All that is required is a meter rule which is divided into 100 centimeter divisions, and a uniform resistance wire having a length of 100 centimeters. As the bridge must be long enough to mount a meter scale, 45 inches should be allowed for the length of the base; and the width 8 inches will be sufficient.

The connections between the components of the bridge are made on the top of the wood base by means of brass straps 1½ inches wide and ¼ inch thick as shown in Fig. 8. The holes for the terminals are tapped the correct size which allows the minimum amount of resistance between them and the straps.

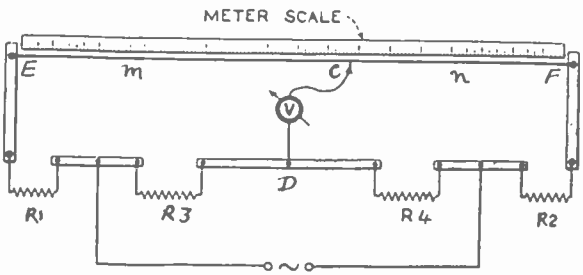


Fig. 8—General layout of connections of the complete slide wire bridge.

The wire used for m and n may be of any standard make, such as nichrome, German silver, manganin, etc., and its gauge No. 24 or No. 28 B & S. This is the most convenient size with which to work.

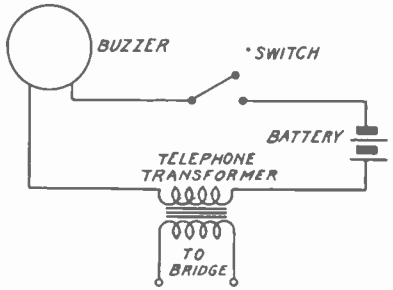


Fig. 7—Circuit connections for high frequency buzzer.

NOTE: Be careful in securing uniform wire as the two arms of the bridge m and n are proportional to their lengths only if their cross sections are equal.

The resistance wire is stretched taut and securely fastened to the brass strap at each end of the bridge E and F, and the meter scale is mounted directly beneath the resistance wire, allowing the slide wire about 1/16" above the meter scale. A slider for making contact with the bridge should be a flexible wire, such as rubber covered lamp cord; this can be soldered to one end of a thin brass rod, the other end should be ground to rather a sharp edge in order to obtain an accurate reading on the scale.

Having these items, all that is required is the battery, buzzer, galvanometer or voltmeter, phones and standard inductance and standard condenser. The use to which this bridge can be put will repay any experimenter for the little trouble in putting this apparatus together, and will give him a start in learning how measurement can be made with a Wheatstone Bridge. Measuring radio constants is very important and is an art in itself which should be learned by all Radio-Tricians.

You Are Invited to Write for Bulletins of Interest to You

The "Disturbo-Ducon" is a filter for power-line disturbances and is described in a new leaflet issued by the Dubilier Condenser Corporation, 342 Madison Avenue, New York City.

A new bulletin of the Amrad Corp., of Medford Hillside, Mass., describes the mershon condenser and some of its uses.

The Yaxley Manufacturing Co. announces a new booklet describing radio convenience outlets for use in hotels, residences, hospitals, schools, and apartments.

A "Condenser and Resistor Manual" is available without cost to all who request it. Address the Aerovox Wireless Corp., 70 Washington St., Brooklyn, N. Y.

A pamphlet entitled "Polymet Radio Essentials" covers the condensers and resistors manufactured by the Polymet Mfg. Corp., 829 East 134th Street, New York City.

The Lynch Mfg. Co., 1775 Broadway, New York City, offers a folder describing its complete line of resistors.

A leaflet describing multiple variable condensers and other products of the DeJur-Amsco Corp. may be had by addressing that organization at 418 Broome Street, New York City.

King's Voice Heard Around the World

The picture shows King George V of England before the microphone, officially opening the Naval Arms Conference in London. Short waves and chain hook-ups carried his voice into every section of the globe.

In the historic Royal Gallery in the House of Lords in London upon the walls of which are pictures of brilliant English naval victories delegates of the world sea-powers are striving to reach an agreement in the matter of naval armaments. Radio carries their discussions into the homes of their countrymen. That's a far cry from the old day when shrewd diplomats and kings met in secret to form treaties and alliances of which their subjects back home knew nothing. Once again Radio engineering triumphs in spanning oceans and continents, bringing these meetings to the humblest subject. Radio is a great civilizing influence—a world-wide force that is indispensable. Men pioneering in Radio today have the satisfaction of knowing that they are playing a part in one of the greatest movements in history.

Mountain Sides

Once there was a man who lived in a home on a mountain side. He had many comforts, and should have been fairly happy. But he wasn't. He used to look about him and say:

"Rocks and tangled underbrush. That's all I see here. Underbrush, rocks and the same old home. Why don't I live over on that other hilltop? That's a beautiful place. In the early morning the hillside glows with warmth and that little house up there is a golden orange. In the late afternoon that mountain top is purple and mauve. That must be a beautiful place to live. I shall go there some day."

For years he made the same plaint, and then, as he grew old, he decided to make the trip to the other mountain. He set out in the early dawn, went down his own mountain side, and at noon ate his meal in the valley. Then, all afternoon he climbed, up and up, to the other home on the other mountain.

And just at twilight he reached it—and then came the surprise.

"Why, it's just like my own place," he said, "rocks and tangled underbrush!"

And as the dream of a lifetime shattered, he turned, and then, through tear-misted eyes, he saw, across the valley, his own mountain side. In the dying sunset it was glimmering in purple and heliotropes.

"My own mountain side!" he breathed. "So beautiful and all my life I never knew it."

The moral of all this is that most of us wear long-distance glasses. We go through the world with a sort of mental telescope in front of us that makes those things farthest away most alluring.

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