NATIONAL RADIO NEWS

FROM N.R.I. TRAINING HEADQUARTERS

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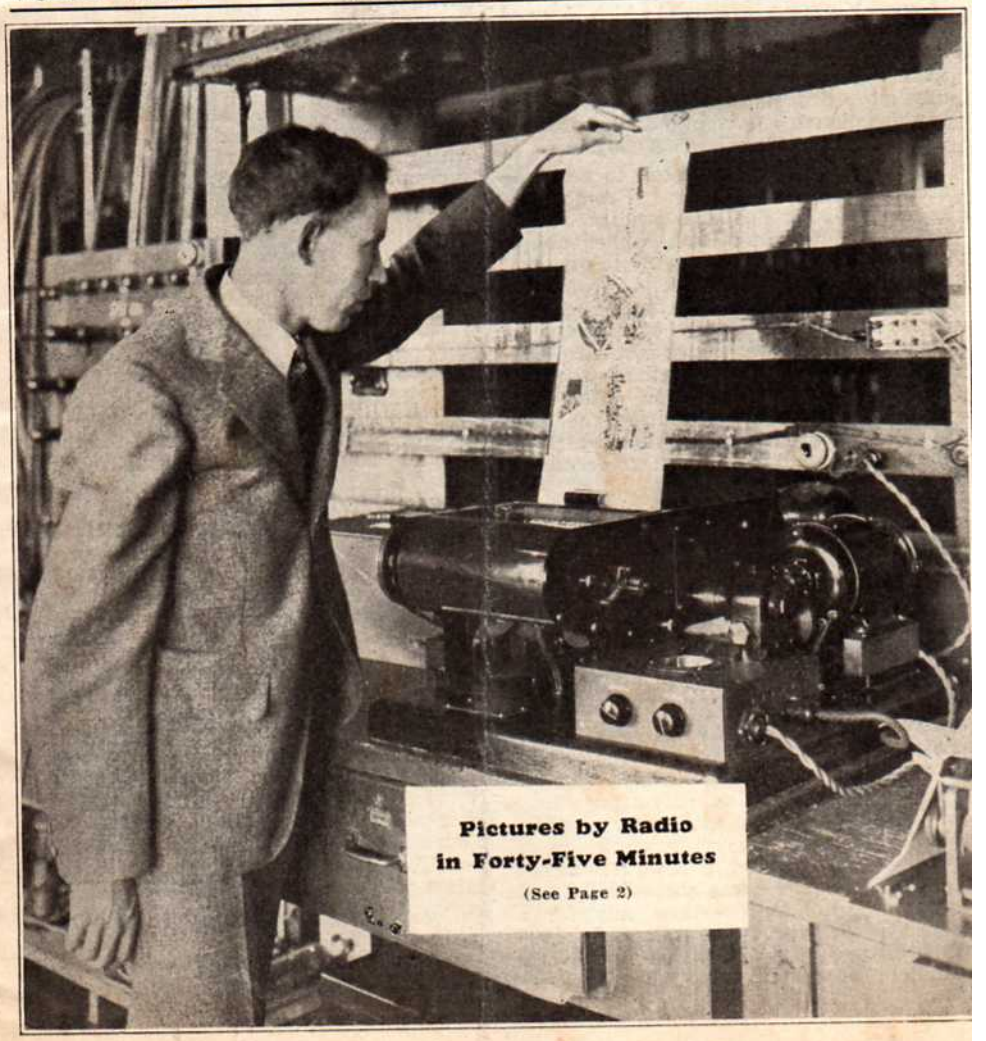


Pictures by Radio in Forty-Five Minutes

(See Page 2)

J. E. SMITH

The PRESIDENT'S PAGE

NOVEMBER the 2nd, 1930, will mark the tenth anniversary of the first Radio broadcast, put on the air by Dr. Frank Conrad, from a garage which housed the KDKA transmitter. A mere handful of Radio enthusiasts were able to pick up this program. Today, more than 600 broadcasting stations in this country alone, send elaborate programs to an audience of 50,000,000.

Ten Years

Just think of it—from one to six hundred stations in ten years. From a garage in 1920, to palatial studios, today. It is small wonder that the phenomenal growth of the Radio industry in general, and of the broadcasting field in particular, has attracted the attention of the entire industrial world. It is easy to understand why so many men are getting into the broadcast game—the opportunities are unlimited. And—the growth of the industry during the past ten years is nothing to that which is bound to come during the next decade.

WITHIN forty-five minutes after Major Kingsford-Smith landed the Southern Cross in Oakland, California, a cartoon of the event was received in Dr. Alexanderson's laboratory at the General Electric Company's plant, Schenectady, N. Y. The cover of this issue pictures the apparatus used to receive the illustration.

Facsimile

Facsimile transmission has risen to commercial application, only after a long period of development and research. While a patent for the transmission of pictures was granted in 1848, it was not until 1891 that one was successfully sent over telegraph wires—then only for a distance of twenty-five miles. In 1906 this distance was increased by several hundred miles. In 1908 the first successful facsimile transmission by Radio took place.

The Great War forced the abandonment of plans for trans-Atlantic picture transmission, active research not being again begun until 1923, when various laboratories undertook the task of successfully solving the problems of this new field of Radio. Millions of dollars have been spent in exhaustive research which has finally put facsimile transmission upon a commercial basis.

This is a highly specialized field of Radio but one that offers unusual opportunities to trained men. Further developments in perfecting present systems are expected right along, which will, in turn, create new jobs for Radio-Tricians.

A NUMBER of N. R. I. men have requested that we carry more than one Service Manual in each issue of the News. So, in this issue, you will find two complete Service Sheets instead of one Service Manual, one on the Majestic Models 130, 131, and 132, and the other on four new Radio tubes—three battery tubes and the power Pentode tube.

New Plan

In forthcoming issues we will follow this same plan—the pertinent information such as the peculiarities of the receiver on one page, and a complete diagram on the other. Remember—instead of one Service Manual—you'll get two Service Sheets in the future. These Sheets will include Aircraft, Marine, Sound Pictures, Public Address Systems, and Television diagrams, as well as the latest "dope" on new tubes and circuits.

Every N. R. I. man is invited to write us how he feels about this new plan. I know you are going to like it, but I'll welcome suggestions from you.

Radio Opportunity Fields-II

BROADCASTING

By P. J. MURRAY

Manager, N. R. I. Employment and Vocational Departments

In June I told you about the opportunities for trained men in ship operating jobs. Now I am going to discuss another field of Radio—broadcasting.

The phenomenal growth of the Radio industry is a direct result of the programs offered by Radio stations. Millions of dollars are spent every year to bring entertainment and educational broadcasts to an audience of 50,000,000 Radio fans. From 1920, when the first program was put on the air, broadcast stations have sprung up throughout the nation, until at the present time there are more than six hundred, employing anywhere from four to sixty trained men.

The organization of a broadcast station is divided into five general divisions, namely: Program Department, which secures all talent and program material for presentation at the studio; Technical Department, which insures uninterrupted and faithful reproduction of the program; Commercial Department, which secures the income for the station, selling time on the air just as the Advertising Department of a newspaper sells ads; Publicity Department, which maintains contact with the press, sending news and information regarding the activities of the station to newspaper and magazine editors; Executive and Administrative Department, which directs the activities of all the divisions of the station.

Many experts are needed in these departments of a broadcast station. Announcers, Program Managers, Chief Operators, Assistant Operators, Remote Control Operators and their Assistants, Mechanics and Electricians—are but a few of the specialists earning from $1,800 to $5,000 or $10,000 a year. The work itself is fascinating as broadcast men mingle with famous statesmen, financiers, actors, authors—the most notable persons of our time. Remote Control men get opportunities to attend many interesting events—you find these fellows at World Series, political conventions, prize fights, and sporting events of all kinds.

The home of the Columbia Broadcasting System. Here are the facilities and equipment which supplies every requirement of modern broadcasting, including laboratories devoted to research in sound synchronization and television.

The demand for broadcast operators greatly increased in November, 1928, when the reallocation of wave-lengths by the Federal Radio Commission went into effect. When a dozen stations faced suspension for frequency variation, there was immediately a demand for competent, trained operators, having second-class or broadcast licenses to keep the station equipment in proper working order. This demand still continues and the men who are qualified for the work find big opportunities in the broadcasting field.

No man can make a mistake by getting into this work. No expense is spared by the station to provide the best possible programs. However, since the best program in the world cannot be put on the air unless supervised by trained broadcast men, only fellows with thorough knowledge of Radio are employed.

Our own graduates have found broadcasting a very profitable field. Out of the six hundred stations in this country, more than eighty employ N. R. I. men. Any man who earns the N. R. I. Diploma, and gets his license, has the necessary knowledge to fill a good broadcast job—and earn a good salary, too.

You meet all kinds of people in broadcast stations. Here are the Crockett Mountaineers, who broadcast over the Columbia System, with Mayor Walker of New York.

Radio's Next Step

By EDWIN K. COHAN

Director of Technical Operation
Columbia Broadcasting System

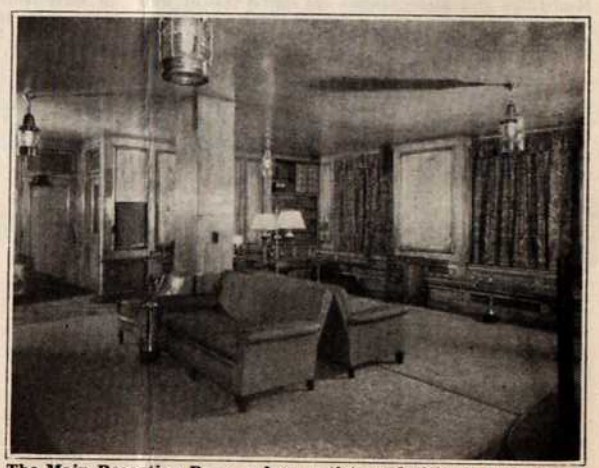
The transmission of programs on a one wave channel from a number of stations simultaneously will be the next step in Radio broadcasting.

Of late the subject of television has been so prominently in the limelight and so many predictions have appeared in print relating to the possible addition of this gift of Science to the public at large in the near future, that another equally important gift of Science, and one which will also have a decided effect upon the listening public, has been very much ignored.

I am thinking now of the simultaneous broadcasting of a large number of stations on the same wave-length, or in other words, the synchronization of many broadcasting transmitters. The progress made in attempting to overcome the obstacles along these lines has been so satisfactory that it is conservative to assume that synchronization of a large number of stations, extending perhaps from coast to coast, will be realized long before any equivalent strides will have taken place in television. For this reason it is logical for us to anticipate the possible effect of synchronization on the amusement value of the Radio receiving set and the changes that will be necessary in the art of broadcasting.

To appreciate what changes will take place in the field of broadcasting and reception by the advent of synchronization, we must first consider the present status of the art and more particularly those branches of it which would be affected. At the present time we have in this country nearly six hundred broadcasting stations operating within the band between 550 and 1500 kilocycles. This does not include the Canadian stations which are also operating within this band and which must also be taken into consideration because of their ability to transmit strong signals within the borders of this country.

Under the present method of assigning frequencies to broadcasting stations, the governing authorities require a separation of 10 kilocycles between broadcasting channels and a separation of 50 kilocycles between the assignments of various stations in the same locality. This means that in order to accommodate all the stations which are now operating within the broadcasting band, it is necessary to assign many stations to one frequency and limit the hours of operation



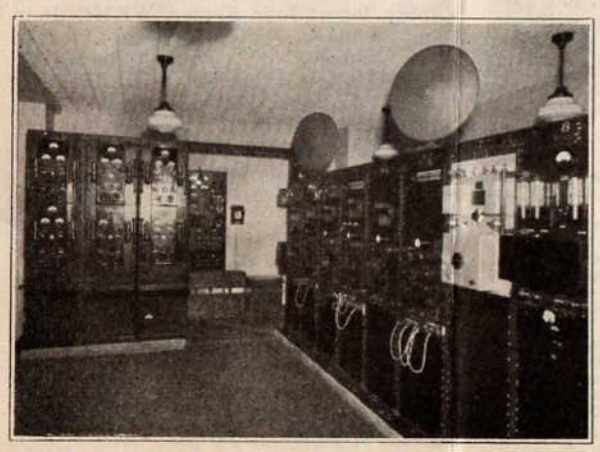
The Main Reception Room, where artists and visitors are greeted in the Columbia Broadcasting System Studio.

of each station on the same frequency so that all will have an opportunity to function with a minimum of interference.

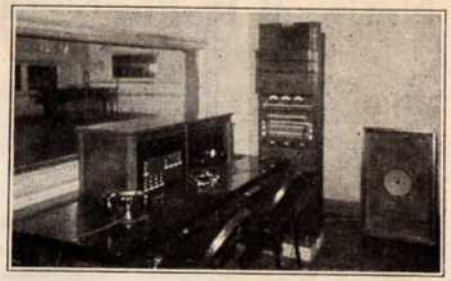
Picture them, perhaps fifty stations all operating simultaneously and on the same wave-length. Think how many other channels this would release for station assignments. Such an arrangement would, of course, require that the programs on all synchronized stations be the same, but even so, this would be an advantage. Successful synchronization would permit the organization, on a national or international basis, of groups of stations operating in this fashion and handling only programs of nation-wide interest. This would mean that there would be certain channels set aside for synchronized groups of stations to which the listener could turn at any time that he desired to listen to nation-wide programs, leaving free the other channels for stations of local character, broadcasting material of purely local interest.

It would also mean that, whereas a listener at present located several hundred miles from a network station is frequently troubled with weak signals, a number of transmitters operating simultaneously on the same frequency would tend, in many sections of the country, to boost the signal strength at a given point, say half-way between two stations, thereby greatly increasing the ability of a Radio receiving set to reproduce programs satisfactorily.

Heretofore the greatest obstacle has been the impracticability of keeping two or more stations on the identical frequency, thus creating an interference



The Main Control Room of the Columbia Broadcasting System.



The Studio Control Room. Here is where the operator watches the program through the glass window.

audible hum equal to the difference between the frequencies at which each station is operating. An analogy would be two electric fans operating in the same room at different speeds. The motor of each electric fan would create a hum of its own, depending on the speed of that particular motor, and in addition to this there would be a third hum which would be the result of the difference between the two hums, that is, one motor revolves at 1,500 revolutions; one revolves at 2,000 revolutions; the third hum would be the difference, or 500 revolutions.

It can, therefore, be seen that in order to successfully overcome this big obstacle, it is necessary to maintain the exact frequency of all stations synchronized on the same channel. At the present time two methods seem the most logical. One is by means of crystal control at each station and the other by means of wire lined synchronization from a central point. Both methods are receiving the undivided attention of capable engineers and the progress along the lines of practical experimentation has been very satisfactory.

We can reasonably expect this latest gift of Science to the broadcasting art in the very near future, even in advance of television.

Simultaneous broadcasting will open up channels for many new broadcast stations; new stations will mean more jobs for trained men. The future looks bright for Radio.—Editor.

National Radio News

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Washington, D. C. September, 1930

E. R. HAAS

STICK-TO-IT-IVENESS

Recently at the seashore I noticed a small boy playing in the sand. He would pick up a pretty shell, admire it for a time—and then drop it to search for another. His actions reminded me of a fellow I once knew—Herb Bender.

Herb decided to be a doctor. He studied medicine for three months and then thought he would find bigger opportunities as an engineer. He studied engineering for another three months—gave it up to become a lawyer. His law studies, like the others, was soon dropped—he became a salesman.

He could have made a "go" of this, had he only stuck to one job long enough to master it. He didn't do this—instead, he would quit one employer to work for another. When I saw him last he was peddling soap from house to house.

He told me it was a tough job; doors shut in his face; uncertain pay, too. He was discouraged—getting old, with no regular job, no sure income. I felt sorry for Herb but no sorrier than he felt for himself. He knew his failure was his own fault—had he carried out any one of his earlier plans, and stuck to it, he could have been a successful doctor, engineer, or lawyer—instead of a house-to-house peddler.

The world is full of "Herb Benders"—men who lack stick-to-it-iveness. On the other hand, there is another kind of man—the fellow who sets his goal, plans how to reach it, and then works his plan until his ambition is realized. This is the fellow who makes good—he sticks to the job until his goal is reached.

I have watched carefully the records of N. R. I. students and graduates. I have found invariably that the fellow who studies regularly until he gets his Diploma and then gives the best in him to his Radio work, is the man who wins his way to the "top."

E. R. HAAS,
Vice-President and Director.

JOINS N. R. I. STAFF

A. C. KALBFLEISCH

Mr. A. C. Kalbfleisch, a graduate of Massachusetts Institute of Technology, recently joined the N. R. I. instruction staff. Mr. Kalbfleisch is well known to the Radio industry. He brings to his present position a wide background of Radio experience, having been connected with such concerns as the General Electric Company, General Radio Company, and Wireless Specialty Apparatus Company.

Mr. Kalbfleisch will be active in helping students understand modern Radio communication methods.

N. R. I. MEN IN EIGHTY BROADCAST STATIONS

Eighty out of six hundred broadcasting stations in this country have employed N. R. I. men. From Maine to Florida, from Texas to Washington, N. R. I. men are putting programs "on the air." Graduates of the Institute are operating stations in thirty-two States, Canada and Cuba.

There is Glen Gingles at Station KGBZ, York, Nebr.; K. W. Griffith, KGJF, Little Rock, Ark.; J. Henderson, KFBU, Laramie, Wyo.; P. W. Sires, KSOO, Sioux Falls, S. Dak.; D. O'Connor, WBT, Charlotte, N. C.; J. Hajduk, KWCR, Cedar Rapids, Iowa; John Fetzer, WEMC, Berrien Springs, Mich.; Edward Stanko, WGR, Buffalo, N. Y.; B. Keough, WJSV, Washington, D. C.; J. Geise, WKJC, Lancaster, Pa.; John Gantt, WOL, Washington, D. C.; W. J. Kotera, WOW, Omaha, Nebr.; Earl Merryman, WRC, Washington, D. C.; N. B. Coil, WRHM, Minneapolis, Minn.; R. D. Compton, WREN, Lawrence, Kan.; W. H. Davis and D. C. Woods, WRVA, Richmond, Va.; S. J. Ebert, WSIU, Iowa City, Iowa; S. E. Rushing, WTIC, Hartford, Conn.; Earl Downey, WTNT, Nashville, Tenn.; Norman Hood, KGCU, Manden, N. Dak.

I could go on down the long list, naming others who are making remarkable success in the broadcasting game; fellows who are filling good jobs as operators, program directors, station managers, etc. These men are making good in an uncrowded field. Other N. R. I. men will follow in their footsteps.

RADIO-TRICIAN SERVICE SHEET

REG. U. S. PAT. OFF.

COMPILED SOLELY FOR STUDENTS & GRADUATES

MAJESTIC MODELS 130, 131 AND 132

The Circuit

These Majestic receivers use 3 Majestic screen grid tubes G-24 in the Radio-frequency amplifier, a G-24 screen grid power detector and 2 G-45 tubes in a push-pull audio amplifier. The rectifying tube is the Majestic G-80 tube. The 3 control points on the panel are as follows: The left knob is the line switch; the center knob is the tuning control, and the knob on the right is the volume control. Two tuned circuits precede the first amplifier; a fixed tuned transformer precedes the second amplifier; two tuned circuits precede the third amplifier and one tuned circuit precedes the power detector.

Screen Grid Power Detection

The screen grid power detector operates the push-pull tubes directly, thus eliminating the first audio stage used in the earlier models. By using the screen grid power detector better tone quality is obtained and A. C. hum and tube noise is decreased.

Antenna Adjustment

A small compensating condenser is provided to adjust the reflected capacity of the antenna being used. Adjustment of this condenser is possible through the hole in the rear of the condenser gang housing. When the installation of the receiver is completed, a station between 1000 and 1400 kilocycles should be tuned in, and the volume control on the panel adjusted to low volume. Then adjust the antenna compensating condenser by turning the black knob, until maximum volume is attained. Further adjustment of this condenser is not necessary unless antenna length or position is changed.

Alignment of Gang Condenser

Should a receiver need re-alignment the following procedure should be adopted:

First: Turn Antenna Compensating Condenser right, to maximum capacity, then turn the knob back ½ turn. Tune in a signal, preferably from a modulated oscillator of approximately 1300 kilocycles and align the receiver in the usual manner as described in previous instructions which you have already received in your Radio course.

In case one alignment condenser will not indicate a peak of sensitivity slightly advance or retard the tuning control, and proceed to readjust the alignment condensers and the Antenna Compensating Condensers as before.

Speaker Characteristics

The field coil resistance of the G-5 speaker is 7,650 ohms and the voice coil impedance is 15 ohms. The output transformer is in the base of the speaker.

Different colored wires on the G-4 and G-5 speakers are used to indicate the plate and high voltage field coil leads in the cable. So that the Radio-Trician may easily check the circuits the 3 different groups are listed as follows:

Group No. 1. 2 black leads—plates of power tubes. 1 red lead—high voltage side of field coil. 1 yellow twist on red lead—low voltage side of field coil (ground).

Group No. 2. 2 blue leads—plates of power tubes. 1 red lead—high voltage side of field coil. 1 black lead—low voltage side of field coil (ground).

Group No. 3. 2 red leads—plates of power tubes. 1 yellow lead—high voltage side of field coil. 1 green lead—low voltage side of field coil (ground).

For example, you may be called upon to check a receiver and speaker and upon examination you find that the leads of the plates of the power tubes are colored red or possibly blue or black. Reference to the groups shown above will eliminate any trouble in determining whether the leads in question are plate or field coil leads.

TABLE OF VOLTAGES

The voltage readings given below were taken with the volume control set at maximum. When taking comparative readings, be certain that the volume control is set at maximum.

Type of Tube	Position	Filament Voltage	Plate Voltage	Grid Bias Voltage	Cathode Volts	Normal Plate Milliamperes	Screen Grid Voltage
G-24	1st R. F.	2.35	180	3	3	3	90
G-24	2nd R. F.	2.35	180	3	3	3	90
G-24	3rd R. F.	2.35	180	3	3	3	90
G-24	Power Detector	2.35	263	12	12	0.5	125
G-45	Power	2.45	250	50	—	32	—
G-45	Power	2.45	250	50	—	32	—

Line voltage 115 A. C. on 115-volt tap.
Variations in voltage readings will occur, due to different line voltage, tubes, etc.
The accuracy of the meters used affects, to a great degree, the readings obtained. When using other than accurate meters, a variation of from 5 to 10% from the above readings may be noted.

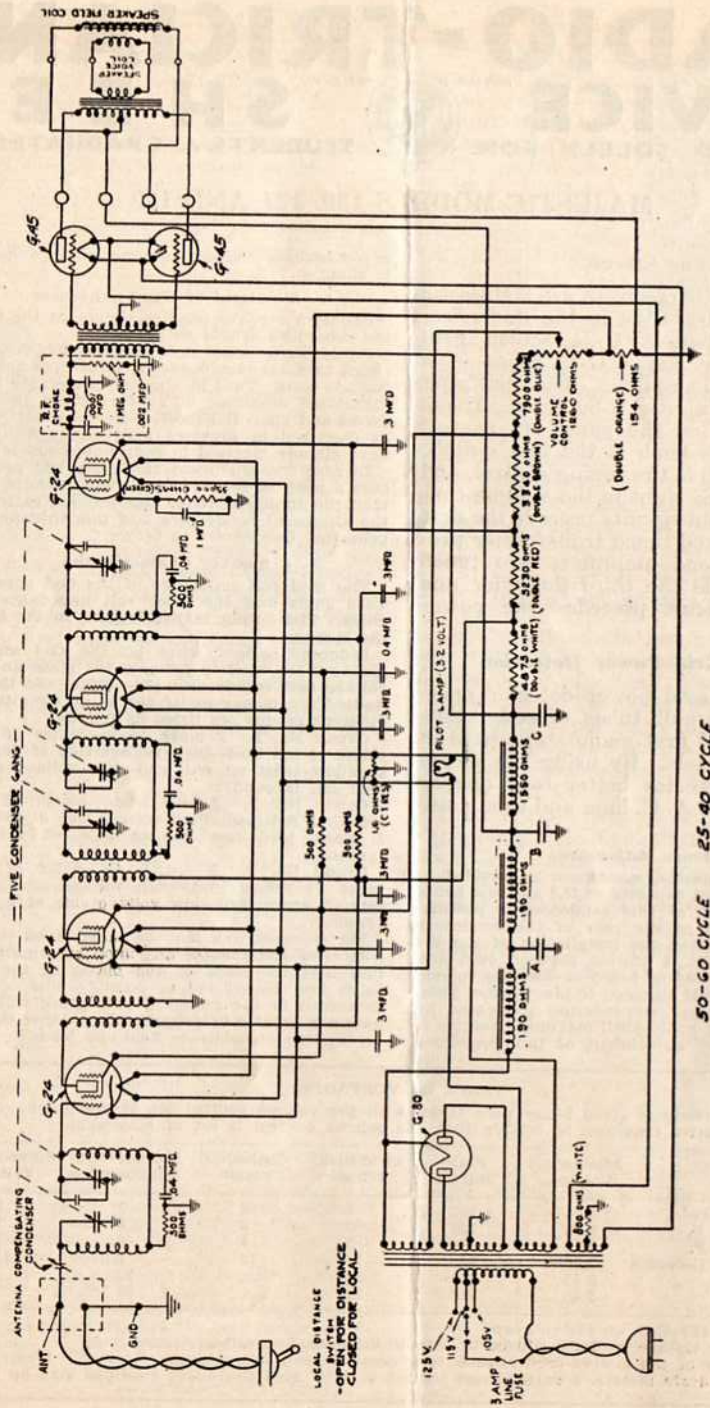


Diagram of Majestic Super Screen Grid Receiver Model 130-A.

The Company Behind Graham McNamee

The National Broadcasting Company was born in 1926; a process in which one incidental was the purchase of WEAF for $1,000,000.00. Today NBC provides a nation-wide Radio service presenting programs from studios in four principal cities of the United States, strategically located to serve the Coast-to-Coast network of seventy-four associated stations.

Although the NBC's home office is in New York, branch headquarters and elaborate studio facilities are maintained also in Washington, Chicago, and San Francisco. A honeycomb of special wire lines, nearly 33,000 miles of exclusive Radio connections, link the four operating stations with any required network, or welds the whole nation-wide system into one single unit concentrated on a single microphone at a moment's notice.

One thousand engineers, program builders, and business executives direct the steady parade of musical artists and the world's celebrities which pass before NBC microphones at the rate of 6,000 a month. Even such statistics convey but a poor idea of the energetic organization that moves like chained clock-work behind the voice of every announcer and the features he presents for the entertainment or information of the American audience.

For instance, nearly 6,000 miles of land wire connections were added in the last year alone, to bring new member stations within NBC's 33,000 mile hook-up. These lines are not to be confused with the ordinary telephone long distance wires, designed to carry the modest range of the average speaking voice. Special engineering and equipment is necessary to safely transmit the full range of a big symphony orchestra, so that each member station receives the program with the same high quality.

M. H. Aylesworth, President of the National Broadcasting Company.

The New York office of the National Broadcasting Company can be compared only with the fantastic Genii-castles of the "Arabian Nights," and the branch headquarters in Washington, Chicago, and San Francisco are on a proportionate scale. In the heart of New York's exclusive up-town Fifth Avenue, high above the twinkling lights of Central Park and within sight of the blazing glare of the Times Square theatrical center, is the ultra-modern NBC home which cradles eleven large broadcasting studios nestled snugly around a central control room which links them with the outside world. Executive offices, rehearsal and audition rooms, vast music libraries, engineering laboratories, luxurious reception rooms for artists and guests, and row after row of walnut desks buried under the mass of detail incidentals to creating a program, writing the dialogues, selecting the music, engaging the stars and beginning rehearsals.

And the largest studio of all, latest marvel of the Radio world, not even contained within the building, but a stone's throw away and linked by direct wire with the central control room—the new Times Square Studio of NBC, formerly known as the New Amsterdam Roof. One of New York's most famous theatres, leased out-right by NBC and adapted by means of a six-ton glass screen to the purpose of Radio, to be the scene of feature broadcasts where an audience of 600 can be accommodated without interrupting studio routine.

A scene in a NBC Studio—"Empire Builders" on the air. Perfect co-operation between technicians and directors is necessary to successfully broadcast such programs.

The real marvels which make the Times Square

The control room of the NBC Times Square Studios. Here skilled operators put programs on the air.

Studio possible are over on Fifth Avenue, in the main studios where most of the broadcasting still takes place. First of all, the main control room—the heart and lungs of the nation-wide NBC hookup. The wires which lead from this room to the transmitters of WEAF and WJZ thirty miles away mean no more to the alert engineers than any of the other wires leading out to the other seventy-two associated NBC stations, scattered from coast to coast. Their only concern is to keep two sets of programs running smoothly through their master circuits—no matter where the programs come from—and as smoothly flowing out through the out-bound loops leading to pre-arranged networks.

The electric control panels are arranged around three walls, and are studded with glowing bulbs that rival the magic of Aladdin's lamp. These are the preliminary amplifiers, which magnify the speech and music millions of times before it reaches the antennae of individual broadcast stations.

Besides these are other panels marked "Line Terminals" bearing names like Yankee Stadium, City Hall, Roxy, Hotel Pennsylvania, Capitol Theatre, Carnegie Hall,—and the most magic work of all, marked "RCA Experimental Lab." At the end of this connection lies Germany, England, Holland, Denmark, France,—whatever remote quarter of the world has arranged to relay on short waves that day, to the keen ears of RCA Experimental Receiving Station on the shores of Long Island.

The room is filled with the incessant clatter of telegraph instruments, by which the stations report on the quality of programs coming in from this room. In the center of the room is the master switchboard, like the console of a theatre organ, where the chief engineer controls the 33,000 mile hook-up pictured at his finger tips in rows of blinking colored lights.

Upstairs in the studios, famous orchestras and singers are awaiting their turn before the microphone. One studio is the criterion of all the rest: the example shall be the Cathedral Studio on the fifteenth floor—so called because it is here that Dr. Cadman and other noted clergymen conduct the weekly Sunday religious programs for a nation-wide Radio congregation. Tonight the Cathedral Studio is a scene of an opera broadcast. A symphony orchestra is arranged on the stage. At the Director's elbow is a microphone and beyond that the rank of soloists and singers of the chorus. Sitting in absolute silence facing this array of musical talent is an audience of several hundred invited guests.

A strange phenomenon takes place after the music begins. The lights grow dim, and are replaced by blended colors. The source of the light cannot be discovered, but merely the reflected glow from behind decorative pylons, and along the borders of the walls. The shifting colors seem to change the temperature, and even the very shape of the room. Regardless of such psychological effects, the color scheme rather attempts to follow the mood of the music, and provides an inspirational atmosphere for the artists who need this compensation to make up for the missing audience they cannot see—out there, numbering millions. As the program draws to its close, the announcer lifts his hand in warning, for continued silence during the closing announcement.

While he is uttering the last words, the program engineer in the adjoining glass walled room lifts a telephone connecting his monitor controls with the main switchboard downstairs.

"This is a presentation of the National Broadcasting Company. Your announcer was Graham McNamee." He drops a switch, and the light at his elbow blinks out.

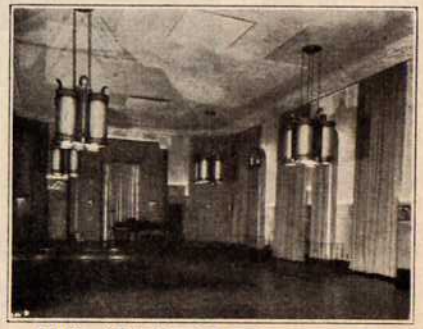
"Take it away," says the engineer inside.

A distant voice crackles through the receiver, sounding many miles away although it comes from just downstairs:

"Okay."

And a light blinks up for Chicago's turn on the network, or perhaps it's California.

Or Dunedin, New Zealand.



Studio "H," the NBC's largest studio.

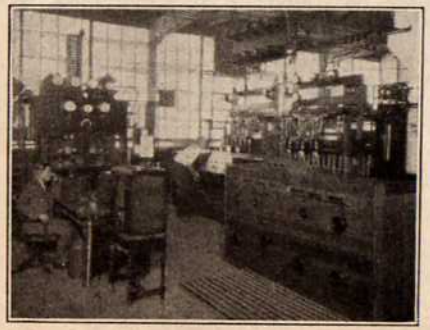
WGY's 200 KW Broadcast Transmitter

By J. A. DOWIE
Chief Instructor

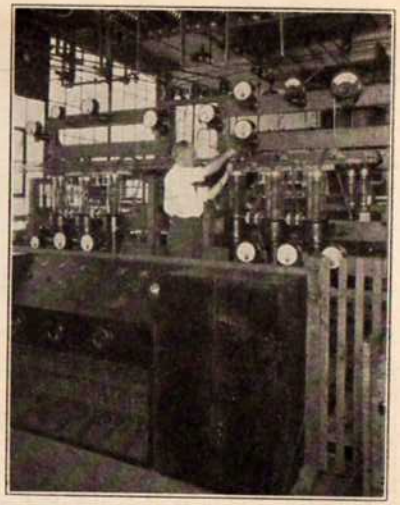
Operating under a special license, station W2XAG uses for testing purposes 200 kilowatts of power for broadcast transmission. The transmitter is located on the 54-acre radio laboratory a few miles south of Schenectady where facilities are available for the power and cooling requirements of a large number of transmitters. There are, for example, four steel antenna towers, three 300 feet high, and one 150 feet high, and in addition a large number of small masts, between all of which are many different types of radiators or antennas.

The design of apparatus capable of handling 200 kilowatts of power was preceded by years of exhaustive investigation and a slow progress from low to higher power. Probably the greatest single impetus to the art of high powered broadcasting was the development of the 100 kilowatt, water-cooled power radiotron. Instead of complicating design to produce high power through the medium of many 20 kilowatt water-cooled tubes, the design was simplified by the use of a few 100 kilowatt tubes. 100 kilowatts is a conservative rating for these power tubes which are actually capable of considerably greater outputs.

In the 200 kilowatt transmitter there are six 100 kilowatt power tubes. Each tube is five feet long or seven and a half feet when included with its water jacket.



A general view of intermediate power amplifier (left) and main power amplifier and operated control equipment.



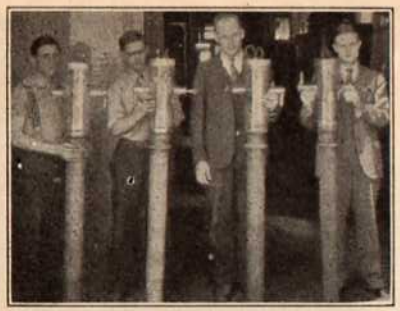
Power amplifier stage of 200 kilowatts transmitter showing six super-power Radiotrons in their sockets or jackets.

The transmitter employs a 200 kilowatt linear power amplifier, incorporating in a push-pull circuit six superpower radiotrons.

Direct current supply for the 200 kw. power linear amplifier is obtained from a six-phase rectifier utilizing twelve phanotrons, which are air-cooled, hot-cathode, mercury-vapor rectifier tubes. The power amplifier feeds a radiator system consisting of a vertical cage antenna and radical counterpoise. The antenna current corresponding to 200 kilowatts is 92 amperes.

The 200 kilowatt power amplifier is driven by a five kilowatt intermediate power amplifier very similar to the commercial five kilowatt broadcast transmitter and uses two 20 kilowatt water-cooled tubes in a push-pull circuit.

The frequency of the transmitter is controlled by a 790 kilocycle Piezo-electric quartz crystal maintained at constant temperature. The deviation from 790 kilocycles is never more than a few cycles. A recent measurement of the overall frequency characteristic showed a departure from ideal transmission of only two per cent at frequencies corresponding to the lowest notes produced by any musical instrument, and but slightly greater reduction at 10,000 cycles. The transmitter is thus able to reproduce faithfully the overtones of any musical instrument. In the 200 kilowatt trans-



Four 100 kilowatt tubes outside their jackets.

mitter the identity of musical instruments is well preserved because the higher harmonics which color the tone of each instrument are not lost on the way through the various stages of the transmitter.

In order to keep the giant tubes of the transmitter properly cooled, it is necessary to circulate 15 gallons of water per minute through the water jacket surrounding the anode of each tube. For the transmitter proper a flow of 100 gallons per minute is required. This is obtained from a cistern with approximately 20,000 gallons capacity. On its return from the tubes where it absorbs considerable heat the water is passed through a radiator unit where it is cooled by a current of air supplied by a large blower. The water is then returned to the cistern. Protection from dust and other impurities is afforded and the water continues in use over a long period without replenishment.

Special protective devices have been provided to trip off the power in the case of tube failure and to give warning to the operator in case of the failure of the water supply.

Lands Public Address Job

Student Otto E. Holz is getting his share of the Public Address business. The job he just landed to install an apartment hook-up for 52 apartments will put a nice chunk of money in his pocket.

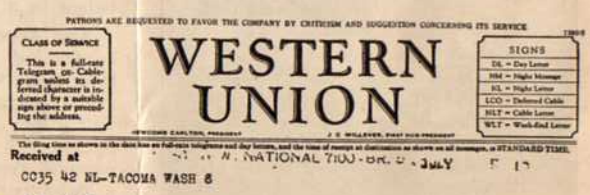
Installation of Public Address Systems is one of the most profitable fields of Radio and right now hotels, apartments, hospitals and other institutions are planning to add Radio to their present equipment. N. R. I. men who go out after this business should cash-in quick.

N. R. I. Man Finds New Use For Radio

Student Thomas Y. Waite, Service Manager of the Washington Branch of the Dictaphone Corporation, found the way for the proceedings of the Seven Day Adventist Convention, held in San Francisco, to be published in the Review and Herald here in Washington, and returned to San Francisco in time for the delegates at the convention to read their own reports.

Something speedier than the telegraph was necessary to shoot the news from San Francisco to Washington, D. C. Here is where student Waite's knowledge of Radio came in handy. He arranged for the proceedings to be telephoned to Washington. He then built a portable amplifier which was connected with the telephone receiver. The voice current passed through the receiver, was stepped up in the amplifier, and passed into a dictaphone. The cylinders were transcribed by an operator, who shot the "copy" to a linotype operator. This was "set" and then rushed to the pressman. The printed issue was dispatched immediately by air mail to San Francisco, where it is read by convention delegates within three days after the actual happenings.

Student Waite's achievement is remarkable as it is the first known hook-up of the telephone, Radio and Dictaphone. The Institute is proud of Mr. Waite's accomplishment—just as he is proud to have acquired the knowledge he needed to do this work through his N. R. I. course. To quote him, "This is just one of the many ways I have had the opportunity of applying the knowledge obtained from my N. R. I. course. Without this knowledge, 'old man opportunity' would have knocked but I would not have been able to answer."



PATRONS ARE REQUESTED TO FAVOR THE COMPANY BY CRITICISM AND SUGGESTION CONCERNING ITS SERVICE

CLASS OF SERVICE

This is a full-rate Telegram, or Cable-gram unless its de-ferred character is in-dicated by a suitable sign above or preced-ing the address.

WESTERN UNION

SIGNS

DL = Day Letter
NM = Night Message
NL = Night Letter
LCO = Deferred Cable
NLT = Cable Letter
WLT = Week-End Letter

The filing time as shown in the date line on full-rate telegrams and day letters, and the time of receipt at destination as shown on all messages, is STANDARD TIME.

Received at ... N. NATIONAL 7100-BR. ... JULY ...

CC35 42 NL=TACOMA WASH 8

J E SMITH-
NATIONAL RADIO INSTITUTE WASHINGTON D C -
HAVE JUST RECEIVED JOB INSTALLING 3 STATION APARTMENT HOOKUP FOR 52
APARTMENT JOB THANKS TO YOUR COURSE PLEASE SEND ME ALL DOPE ON
LATEST INSTALLATIONS AND COMPANYS MFG SUCH APPARATUS 105 N41 -
OTTO E HOLZ

The telegram telling of Student Holz's new job.

RADIO-TRICIAN SERVICE SHEET

COMPILED SOLELY FOR STUDENTS & GRADUATES

REG. U. S. PAT. OFF.

NEW VACUUM TUBES

Types —30, —31 and —32 and New Power Pentode

New Dry Battery Tubes.—Three new dry battery tubes have been designed to fill the long felt need for a series of tubes to replace the present —99, —20 and —22. These may be used in place of the old series with very slight change affecting only the filament voltages. The major advantages of these new tubes are as follows:

1. A dull emitter filament replaces the thoriated filament and thereby reduces burn-outs which have been so common in —99's and —20's.
2. The microphonic noise which was extremely troublesome in previous types has been eliminated.
3. The mechanical construction is such that the tubes will withstand more severe shocks.
4. The mutual conductance of the new tubes is higher than corresponding tubes of the older series, hence the amplification will be materially increased.

Type —30 General Purpose

This tube can be used in practically every place to replace the —99 type providing the filament voltage is reduced from 3.3 to 2.0 volts. The complete characteristics are given below:

Filament Voltage.....2.0 Volts
Filament Current.....0.06 Amperes
Plate Voltage (Maximum).....90 Volts
Grid Voltage (C-Bias).....—4.5 Volts
Plate Current.....2.0 Milliamperes
Plate Resistance.....12500 Ohms
Amplification Factor.....8.8
Mutual Conductance.....700 Micromhos

Approximate Direct Inter-Electrode Capacitances:

Grid to Plate.....6 Mmf.
Grid to Filament.....3.5 Mmf.
Plate to Filament.....2 Mmf.

Maximum Over-all Dimensions:

Length ..... 4¼"
Diameter ..... 1⅛"
Base ..... Small "UX"
Sockets ..... UX

Type —31 Power Outfit

The —31 is designed to replace the —20 providing the filament voltage is reduced to 2.0 volts. The characteristics are:

Filament Voltage.....2.0 Volts
Filament Current.....0.150 Amperes
Plate Voltage (Maximum and Recommended) .....135 Volts
Grid Voltage (C-Bias).....—22.5 Volts
Plate Current.....8 Milliamperes
Plate Resistance.....4000 Ohms
Amplification Factor.....3.5
Mutual Conductance 875 Micromhos
Undistorted Power Output 170 Milliwatts

Approximate Direct Inter-Electrode Capacitances:

Grid to Plate.6 Mmf.
Grid to Filament 3.5 Mmf.
Plate to Filament. 2 Mmf.

Maximum Over-all Dimensions:

Length ..... 4¼"
Diameter ..... 1⅛"
Base ..... Small "UX"
Socket ..... UX

Type —32 Screen Grid

This new screen grid tube has a mutual conductance of 550 as compared with 350 for the —22 type. This makes possible a 50% increase in amplification per stage providing 67½ volts are provided for the screen and 2 volts for the filament. The —32 characteristics are given below:

Filament Voltage.....2.0 Volts
Filament Current.....0.06 Amperes