BROADCAST NEWS

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BROADCAST NEWS

Edited by
E. JAY QUINBY

NUMBER 3 APRIL, 1932

'ROUND THE WORLD ON ELECTRIC WAVES

—JACKET DESIGN EXECUTED BY HELEN R. SCHMIDT, A YOUNG ART STUDENT IN NEW YORK, FOR THE NEW CATALOGUE OF "RADIOTRONS FOR TRANSMITTING" BEING ISSUED BY THE RCA VICTOR COMPANY, INC.

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CAMDEN, N. J., U. S. A.

Pioneer NBC Stations Modernized

By RAYMOND GUY

Radio Engineer, National Broadcasting Co.

THOROUGHLY up to the minute new RCA 50-B broadcast transmitters replace the old sets so familiar to the audiences of WEAF and WJZ, the key stations of the NBC Red and Blue Networks. The old high power transmitter at WJZ was installed in 1925 and the old high power transmitter at WEAF was installed in 1927. Improvements in the art since that time have been so rapid that the newest and latest type of equipment was installed at both stations.

At each of these stations the old transmitters have been remodeled somewhat and are retained as spare transmitters. In addition to the advanced design of the new transmitters which includes 100% modulation, precise crystal control, simplicity of design, improved suppression of spurious harmonics, and uniform frequency response, there has been a number of special features introduced by the Engineering Department of the National Broadcasting Company to meet the high performance standards and rigid operating schedules of NBC.

SOMETHING DIFFERENT IN INTERIOR DECORATIONS FOR BROADCAST STATIONS. THIS IS THE VISITOR'S ENTRANCE TO STATION WEAF. NOTE THE INTERESTING MURALS

To provide for the heat dissipation of the two transmitters at WEAF and the three transmitters at WJZ (WJZ No. 1, WJZ No. 2, and W3XAL, W3XL) cooling ponds approximately 50 feet square and 4 feet deep have been provided at each station. The ponds are divided into two parts with duplicate spray heads and interconnecting valves so that either or both transmitters may operate through either or both of the sections. Automatic check valves isolate the two cooling systems from each other so that the systems are entirely automatic. Each cooling system consists of two water circuits, one distilled water system which includes the water jackets of the tubes, and the pond water system. Heat is transferred from the distilled water circuit to the pond water through a brass heat transfer unit so that the distilled water system is an independent closed circuit. Circulation of pond water is automatically controlled to keep the temperature of the distilled water within predetermined limits. The pond water is sprayed ten feet in the air when the valves are wide open. It is seldom necessary to operate in this manner, three feet being sufficient. Brass pipe and copper storage tanks are used throughout the distilled water system. The standard cooling towers are retained as auxiliary cooling systems to be used in the event that the heat transfer units are being

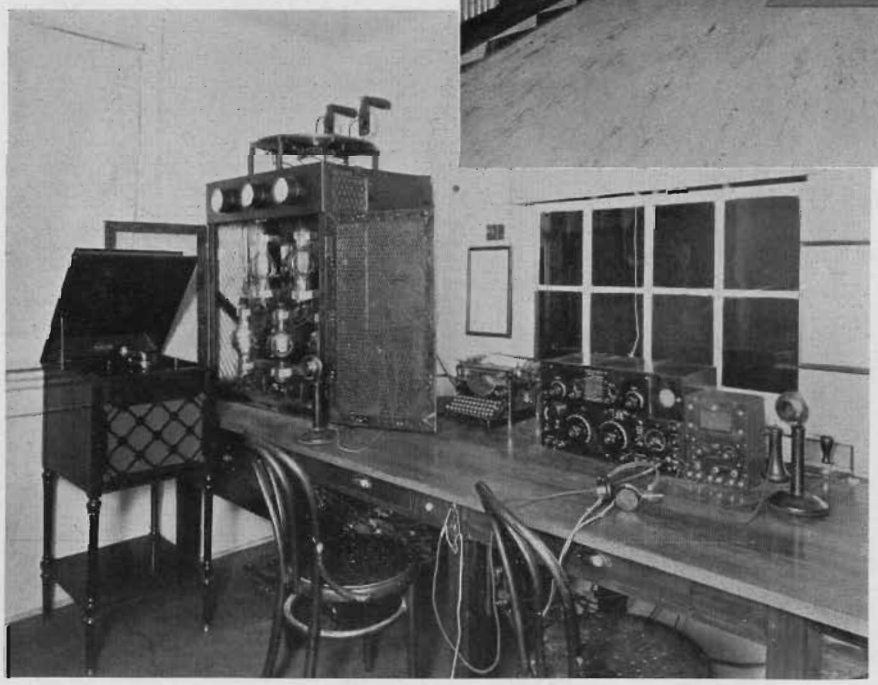
EXTERIOR VIEW OF STATION WJZ, AT BOUND BROOK, N. J. THERE ARE TWO TOWERS LIKE THE ONE SHOWN IN THIS VIEW, AND THE ANTENNA IS MAINTAINED AT CONSTANT TENSION BY A 4000 LB. CONCRETE COUNTERWEIGHT

cleaned or are otherwise out of service. The capacity of the cooling ponds is about 50,000 gallons. With this system either one or all transmitters may be operated at full power with very little change in water temperature regardless of the ambient temperature.

Standby Equipment Maintained

The old transmitters are retained as spare equipment and to facilitate a quick transfer from one to the other there have been provided motor operated switches which are controlled by push buttons located on the operators control box. These switches operate practically instantaneously and are electrically and mechanically interlocked so that either transmitter may be connected to either the regular or the dummy antenna, but so that both transmitters cannot be connected to one antenna or one transmitter be connected to both antennas. Signal lights indicate to each operator the condition of the

MAIN TRANSMITTER ROOM OF THE NEW WJZ INSTALLATION RECENTLY COMPLETED AT A COST OF $300,000. THE MANNER IN WHICH THE DECORATIONS HAVE BEEN CARRIED OUT REFLECTS THE DEPARTURE OF NBC TRANSMITTER INSTALLATIONS FROM THE CONVENTIONAL POWER HOUSE ATMOSPHERE



THE ORIGINAL 500 WATT TRANSMITTER OF OLD WJZ, AT NEWARK, N. J., AS IT LOOKED IN 1921

circuits of both transmitters and the changeover switches.

Both of these transmitters are at times synchronized with other stations, WJZ with WBAL and WEAF with WTIC. Facilities are provided to permit instantaneous transfer from crystal to synchronous excitation by means of push buttons. Through a special coupling circuit the grid of the UV-860 amplifier may be connected to either the output of the crystal control unit or the synchronized exciting apparatus.

Casual visitors, of which there have been many, have been impressed by the simplicity and fine appearance of these stations and have commented upon the departure from the ordinary mechanical appearance of most power plants. The decorations and the manner in which the transmitters are installed surpass all previous transmitter installations in beauty of appearance. Aluminum decorations in the transmitter room contain figures symbolic of radio broadcasting and augment a large placque with the NBC insignia opposite the visitors entrance. The transmitter is actually built into one end of the transmitter room and the rear of the equipment is surrounded by glass observation windows so that visitors may not only see the front of the transmitter but may inspect the rear in detail without danger.

To guard against prolonged outages caused by power failures, duplicate power lines are provided over separate routes to separate sources of power. These lines terminate in power vaults in the basements of the transmitter buildings. To guard against outages caused by a collapse of the antenna system or damage to the tuning house, an emergency antenna is provided for each station which may be coupled into the spare transmitter without the use of the transmission line or tuning house.

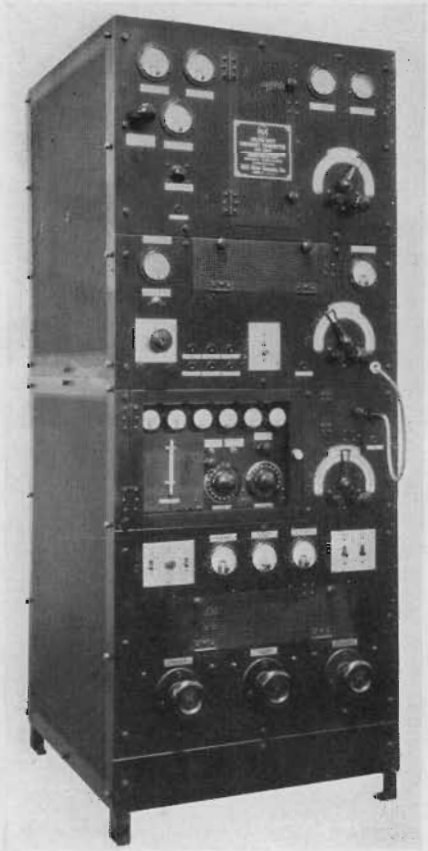
(Continued on page 28)

J. GULLENS ON DUTY BEFORE NO. 2 CONTROL ROOM APPARATUS AT REBUILT WJZ, OF THE NATIONAL BROADCASTING COMPANY AT BOUND BROOK, NEW JERSEY. THE OSCILLOGRAPH, ON THE RIGHT CENTER, IS USED TO MONITOR THE STATION OUTPUT. A MOTION PICTURE OF THE MUSIC OR SPEECH IS PROJECTED ON A REVOLVING MIRROR SHOWING ALL IMPORTANT DETAILS OF THE PERFORMANCE

RCA Victor 100/250 Watt Broadcast Transmitter

By W. L. LYNDON
Transmitter Engineer, RCA Victor Co.

THE RCA Victor Company, Incorporated, have recently announced to the broadcast field their new 100/250 watt broadcast transmitter which has incorporated in it all of the essential high quality features that are found in their higher powered type of broadcast transmitter. The transmitter was designed to fulfill the requirements of stations having a licensed power output of



250 watts or for stations having authority to operate on the power of 250 watts daytime and 100 watts at night. The change from one power to another is effective without interruption to the program by manually operating a switch which is conveniently located on the front of the transmitter panel.

One of the outstanding features

incorporated in this transmitter is its system of modulation. The modulator capacity of the transmitter is sufficient to properly modulate either carrier power output at 100 percent. The most recent contribution in the advance of transmitter design is operating the modulator tubes in a class B audio circuit rather than using the well known class A system. A UV-203-A Radiotron operating in a class A circuit under normal conditions has an undistorted output in the order of 10 watts whereas when two of them are operated in a push pull class B audio circuit, it is possible to obtain an undistorted output in the order of 200 to 250 watts of audio power with a surprisingly low percentage of harmonics when properly excited.

The possibility of being able to obtain such an output from low power tubes materially assists in reducing the maintenance cost of the modulator tubes. It makes it possible to use the popular inexpensive type of tubes in place of the large expensive types as required in a class A modulator delivering the same amount of power output.

The modulator in this transmitter employs two UV-203-A Radiotrons being excited by two UX-210 Radiotrons. In the satisfactory design of class B amplifiers used in audio circuits, advantage is taken of the fact that the output, when applied to an untuned load, is essentially sinusoidal for sinusoidal input during one half of a cycle, and by the use of two tubes in a push pull class B audio circuit, it is possible to obtain an undistorted output power greater than could be obtained by the same tube complement operating class A. The modulator tubes are biased so that on no signal, plate current drawn by the tubes is practically zero and increases with increase in applied audio signal, being limited only by plate dissipation or emission on peak signals, thus presenting a considerable saving in power consumption.

The radio frequency circuits, audio circuits, and two mercury vapor rectifiers are housed within one frame. Adequate metering facilities are provided as a means of checking all important circuits. This feature furnished valuable service in indicating readily the operating condition of their respective circuits.

A self contained completely shielded crystal unit is employed which is calibrated at the factory as a complete unit. The unit contains a temperature controlled crystal compartment, a UX-210 Radiotron, oscillator, and two UX-865 Radiotrons, operating as buffer amplifier stages. The use of these tubes eliminates the necessity of neutralizing circuits as well as reducing the possibility of the higher powered amplifier stages from reacting back on the crystal thus interfering with its precision control. By the use of this unit a frequency stability well within a limit of plus or minus 50 degrees is obtained.

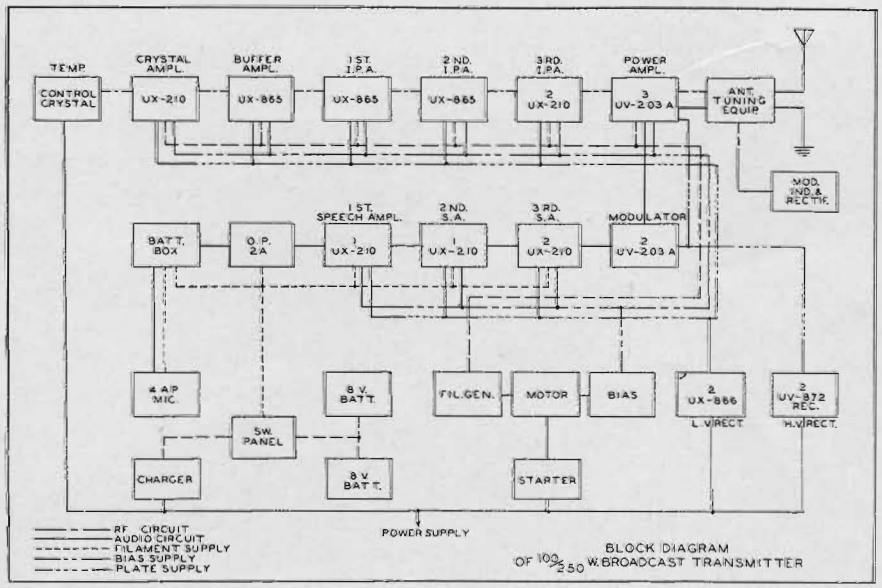
Mercury vapor Radiotrons are employed in the two plate voltage rectifiers, one rectifier utilizing two UX-866 Radiotrons which supply voltage for the low power tubes and the other two UV-872 Radiotrons which provide proper plate voltage for the modulator and power amplifier.

In order to utilize the full advantages of high percentage of modulation, a vacuum tube indicator is employed and in its output circuit there is located a meter which is calibrated directly in percentage of modulation. This visual indicator removes any uncertainty on the part of the operating personnel as to the degree of carrier modulation.

The filament and bias voltages for the high level audio and all radio frequency circuits are obtained from a three unit motor generator supply. The low level audio stages obtain their filament supply from a small storage battery. This feature insures the transmitter of having an extremely low carrier noise level.

access doors on the transmitter were provided with interlocks which remove the high voltage from the transmitter when any of these compartments are entered.

A front view of this transmitter is shown in Fig. 1. Three controls, located at the bottom of the transmitter panel regulate bias, transmitter filament voltage, and rectifier filament voltage. The door located immediately above these controls provides access to the two rectifier stages. Located in the center of the transmitter directly above the crystal unit is a power switch which allows the transmitter to be placed in operation by means of pressing only one control. The various radio frequency stage tuning dials which are shown on the front panel may be clamped in place when the circuit has been properly resonated. The knob which is located in the upper left hand corner of the transmitter panel is used for changing from one power output to the other. Means are provided on the top of the transmitter



BLOCK DIAGRAM OF 100/250 W. BROADCAST TRANSMITTER

The overall frequency characteristic is substantially flat between the limits of 30 and 10,000 cycles and a calibrated volume control is located across the secondary of the input transformer of the speech amplifier.

In the design of the transmitter consideration is given to the protection of the operating personnel and all

for making connections to the antenna.

A block diagram of the tube complement is indicated in Fig. 2. This diagram includes a standard RCA condenser microphone together with a battery box and special outside pickup amplifier. This equipment has been satisfactorily used in a large

number of the smaller installations but a more elaborate line up of speech input panels may be substituted for this equipment where the broadcast requirements demand greater facilities.

SUCCESS

"To what do you attribute your successful retirement at the age of forty, with a fortune of $100,000. safely tucked away in gilt edged securities?" inquired the cub reporter of the Affluent Gentleman, as he rocked to and fro in a comfortable chair on the clubhouse veranda.

After clearing his throat and lighting a Corona-Corona, the A. G. replied as follows:

"It all began when I was a radio operator at sea. Ten years of loyal attention to duty, together with fearless application of the old rule of the Sea during emergencies,—diligent studies in a correspondence course to improve my mind, followed by ambitious effort in a subsequent assignment at a shore station, after which by clever strategy, I managed to get into the newer Radio Broadcasting industry, and keep abreast with the times. Then by consistently saving all the money I could spare, outside of the absolute necessities required for living and keeping up appearances, I managed to bring to the attention of the comptroller of the company my ability for practicing economies, not only in business but in my personal affairs, and I eventually became Managing Director. Thereafter, by shrewd manipulation of the affairs of the company, I obtained a controlling interest, and by constantly catering to the requirements of the sponsers of my programs, as well as complying with the wishes of each and every broadcast listener who sent in criticisms and suggestions, I managed to further expand the business of my broadcasting company and to build up my profits.

"This, coupled with the fact that my wife's father recently passed away, leaving me the sole heir to his fortune of $99,900. is probably responsible for my success."

Mercury Vapor Rectifier Radiotrons

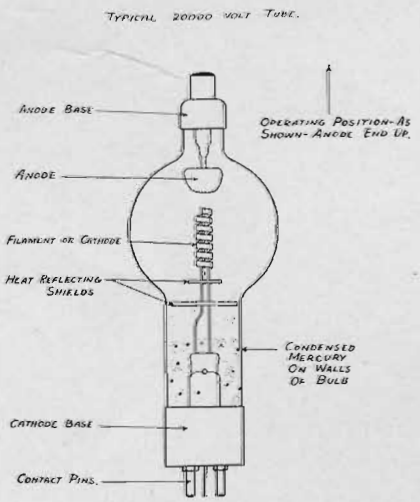
By A. H. CASTOR, Transmitting Radiotron Sales Manager and W. G. MORAN, Design Engineer, Transmitting Radiotrons (RCA Victor Co.)

MERCURY vapor tubes have been known to the electrical industry for many years but their use has been limited to moderately low voltage applications. The possibilities and advantages of a high voltage *oxide-coated hot-cathode* mercury-vapor tube were published by Hull in 1928. (1) As a result of intensive development, these mercury vapor tubes have largely supplanted the vacuum tube rectifier wherever a high-power, reliable and efficient source of high voltage direct-current is required. In this article some of the very interesting phenomena occurring in the tubes are discussed.

An ideal rectifier would be a perfect check-valve of infinite capacity. It should offer no hindrance to current passing in the forward or current-carrying direction. It should also offer infinite resistance to the passage of current in the backward or inverse direction. It should last as long or longer than equivalent apparatus of other types. It should be simple in construction, reliable in operation and reasonable in price. Within its rating limits, each of the hot-cathode mercury-vapor rectifier tubes represents a remarkably close approximation to this ideal.

The outline diagrams in Fig. I indicate the shapes and general construction of the various sizes now available.

The most important characteristic of a cathode is its ability to "emit" great quantities of tiny "electrons" from its heated surface. These electrons are negatively charged and are pulled toward the plate (or anode) by the plate voltage. The negative charges which these electrons deposit on the anode constitute the plate current through the tube. For a plate current of one ampere, something like 10,000,000,000,000,000,000 of these tiny charges must be deposited on the anode every second.



The cathodes of the mercury-vapor tubes are coated with a particular mixture of alkaline-earth oxides. This coating has the unique property of giving off electrons at approximately one-third of the temperature of an equivalent pure tungsten cathode. (A layer of thoria on tungsten has the same property but to a less degree).

If no current is to be permitted to pass in the backward direction when

there may be as much as 20,000 volts impressed on the tube, the anode must be a poor emitter of electrons. The anode must remain cool, and preferably be made of carbon or carbon-coated material. There must be no impurities such as sodium, potassium, etc. on the surface. The anode must be designed so that there are no ragged edges or sharp corners.

All electrons have a negative charge and repel each other. In a vacuum tube rectifier, an electron starting out from the cathode is confronted with millions of other electrons going toward the same goal and repelling each other. The result is a first rate traffic jam. This phenomena is known as "space charge effect." It means that to pull double the number of electrons all the way across to the anode, much more than double the anode voltage is necessary.

When the electrons reach the anode, many are moving very fast and hit the anode so hard that the metal may become red hot. This is what happens in every vacuum type tube. It is the function of the vapor in the mercury vapor tubes to overcome this condition.

The tubes are pumped to a high degree of vacuum and all the parts are treated at a high temperature to remove as much as possible of the absorbed gases. At some stage during this exhaust process, a small quantity of pure mercury is introduced. The pressure of the mercury vapor depends upon the temperature of the condensed mercury in the coolest part of the bulb. The vapor given off by this mercury plays an important part in the operation of this tube. There always must be some liquid mercury in the tube. The mercury temperature, in turn, depends upon the current carried, room temperature, air circulation around the tube, etc. This is the reason for specifying operating temperature limits.

Mercury vapor is composed of tiny atoms of mercury moving about in all directions inside the tube. The number of atoms present determines the vapor pressure. Compared with the atoms of other gases such as hydrogen, oxygen, nitrogen, etc., the mercury atom is several times as heavy. The atoms resemble miniature solar systems and are made up of definite combinations of particles carrying either positive or negative electric charges. When one of these atoms is struck with sufficient force, one of the particles making up the outer part of the atom is knocked off by the impact. The particle knocked off is an "electron." It is the same sort of particle as the electrons which are given off by a hot filament. The loss of the electron with its negative charge spoils the neutral condition by leaving one positive charge without a neutralizing partner somewhere in the atom. The atom in this condition is called a "positive ion" of mercury. A mercury "positive ion" is several hundred thousand times as heavy as the electron which it lost. The magnitude of the electric charge on the electron is equal to that of the unneutralized positive charge on the positive ion, but it is opposite in sign, so that they are attracted to each other. If they recombine to form a neutral mercury atom, the electron immediately takes its place in the structure of the atom. It is not necessary that the original electron return to the broken atom. Any electron will do, no matter where it comes from. The electrons from the atoms of every substance are all exactly alike.

When sufficient positive potential is applied to the anode of a mercury vapor tube, the initial electrons start out from the filament toward the anode. Some of them will collide with mercury vapor atoms with sufficient force to knock out electrons from those atoms, causing "ionization." The colliding electron may use up all its energy in this collision and be claimed by the "positive ion" which it produced, or it may have enough energy to continue on its way, making more collisions and perhaps finally reaching the anode. Here it gives up its electric charge which becomes a part of the current flowing through the anode lead wire. Some of the electrons and positive ions which it produced in its passage toward the anode will undoubtedly recombine with each other, but the voltage across the tube will cause some of these electrons to move toward the anode and the positive ions toward the cathode. All the electrons which reach the anode add to the tube current by giving up their electric charges there.

The positive ions are heavy compared with the electrons. They are repelled by the anode potential and move slowly toward the cathode. Some will attract and attach electrons passing by and become neutral atoms again. They may even be hit so hard that a second electron is knocked out and the ion then exists as a doubly charged ion. In any case, some positives ions are in existance at any one moment. The cathode has continued to give off electrons due to the pull of the posi-

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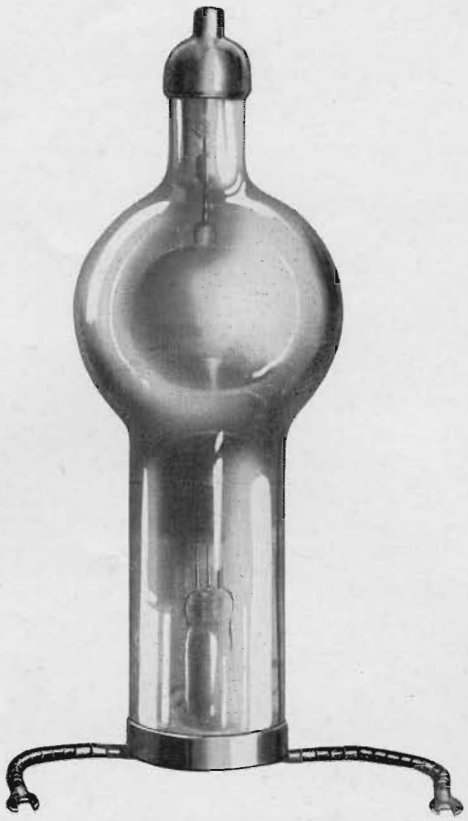


RADIOTRON UV-857

HINTS FOR LONG LIFE

1. Study Instruction Book before placing tube in operation.
2. Make sure applied filament voltage is within 5% of rated voltage at all times.
3. Rated anode current must not be exceeded—even instantaneously.
4. Inverse peak voltage limitations must not be exceeded.
5. Tubes must be properly cooled.
6. Rectifier should be shielded to keep out stray RF fields.

MERCURY VAPOR RECTIFIER

(Continued from previous page)

tive potential on the anode. But instead of each electron being compelled to fight all the other electrons every inch of the way, it now finds that these drifting positive ions neutralize the repelling effect or space charge of the other negatively charged electrons and each one has an easy trip. All that is necessary is that a few of the electrons make enough ionizing collisions with the mercury atoms to maintain the supply of positive ions.

This means that it is almost as easy for enough electrons to pass to the anode to make ten amperes as to make one ampere of current. This is the reason that the loss in voltage as the current passes through the tube is approximately constant for any fraction of the rated current. (See Fig. 2.) As the end of the current carrying half of the cycle is approached and the anode voltage falls to zero, the current and the ionization decrease proportionately.

It normally requires the equivalent of about two volts to separate electrons from the hot cathode surface. It requires a certain voltage, depending upon the condensed mercury temperature, to ionize the mercury vapor. Within the recommended temperature range, this is not more than about 15 volts. The total voltage drop, then is normally less than 18 volts, irrespective of the tube current, up to the limit of the cathode emission. This is a very interesting and useful condition which makes it possible to obtain very high operating efficiencies. (See Fig. 2.)

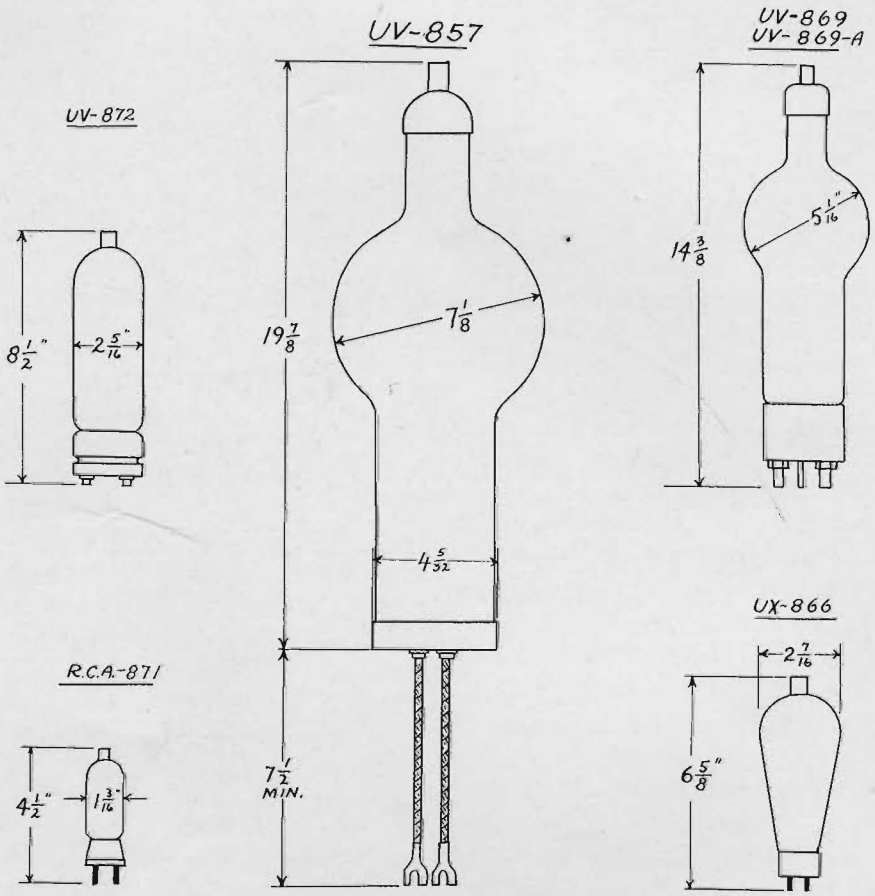
It is easily seen, from the above, that the only current limitation within the tube itself, on the tube current is the total emission from the cathode. The same or an equivalent electron must leave the cathode for every electron reaching the anode. The electrons which were robbed from the mercury atoms by violent impacts, and which added to the tube current when they reached the anode, must be paid back when the "positive ions" arrive at the cathode. Actually, the positive ions collect or pile up in a sheath or cloud around the cathode in their eagerness to get their missing electrons.

The above description will give some idea of what goes on in a mercury vapor tube during the current carrying part of the cycle. But that is only one-half of the problem. A rectifier, to be a good check-valve, must strongly resist any efforts to make it pass current in the backward or inverse direction.

Some of the mercury vapor atoms will be broken up into positive ions and electrons if the voltage stress is great enough. The electrons resulting from this small amount of ionization are pulled toward the positive cathode under the full force of the thousands of volts across the tube. The positive ions are pulled toward the negative anode by the same force. There may be more ions produced by collisions as these ions are on their way. There are two main reasons why nothing serious happens.

The first reason is that the number of ions present is small when the tube is operated within the recommended conditions. The second reason is that the positive ions arriving at the anode cannot get what they need. Each needs one electron, some need two or three, but the anode is not able to supply them. The positive ions pile up in a cloud around the anode so that they exert a really enormous electrostatic stress on the whole anode surface. So long as it refuses to give out electrons, no current can pass through the tube.

Before leaving the discussion of the inverse half of the cycle, the effects of too high inverse voltage should be considered. In this case when the first positive ions crowd around the anode trying to get their required electrons, they repel later arriving ions. These late ions shoot past the anode and come around behind it. Here they impact on the glass with such force that the glass is heated and sometimes boiled. The hot glass will supply the electrons demanded so that a small current is passed through the tube. More



NOTE:- ALL DIMENSIONS ARE MAXIMUM VALUES.

positive ions arriving at the damaged spot extend the injury so that a hole may be drilled through the glass and gas is liberated from the heated glass.

The external circuit resistance should never be low enough to permit the tube current to become more than the cathode can supply by its normal emission. When this happens, the "positive ions" arriving near the cathode cannot easily get enough electrons to complete their atomic structures, and they impact on the cathode surface with more than normal force. The tube voltage drop is increased. The impacts may be so great as to heat up local areas producing "hot spots" where the oxide coating may become hot enough to boil and spatter off the cathode. The temperature at these spots may become high enough to temporarily supply the demanded emission, but the coating of these "hot spot" areas is usually permanently damaged. The heating may even be sufficient to burn out the filament.

At the same time, electrons reaching the anode are moving faster because of the higher tube voltage drop. They may hit hard enough to make the anode red hot. This may not only release a bit of residual gas in the material but also make it possible for the anode to emit electrons and the tube to pass current in the "inverse" direction when the potentials acting on the electrons become reversed during the inverse part of the alternating current cycle.

The effect of gas is to chemically poison the oxide coating. More than the normal 18 volts are then required to get the desired number of electrons off the cathode and to maintain the required degree of ionization of the mercury vapor.

From the discussion of the above topics, it is now reasonable to define the fundamental limitations of the tubes. There are two separate and independent limitations. They may be stated as follows:—

(1) *The maximum rated emission from the filament or cathode must never be exceeded.* To exceed the emission would produce high tube voltage drop, excessive cathode bombardment and all the consequent ills that follow. It would amount to the same thing as trying to operate a "low emission" tube.

The maximum rated peak inverse voltage must never be exceeded. The actual limit is somewhat above the rated limit in order to provide some factor of safety. However, changes may take place during accidental overloads, etc. which may seriously damage the tube if this margin of safety which the designer provided has been encroached upon in regular operation.

RADIOTRON UV-869A

Both of the above limits vary with the condensed mercury temperature. Figures 3 and 4 show the amount of this variation. A glance at these curves will make it evident why the specified temperature limits must be observed.

The "ambient" temperature is the temperature of the cooling air which carries off the heat from the tube. The relation between the "ambient" and the condensed mercury temperatures depends largely upon the amount of air circulation around the tube. They are nearly the same if large enough blowers are used. In the open air of the room, the condensed mercury temperature may be as much as 150°C higher than the "ambient." In a closed box with little or no circulation, the spread is even greater and may make operation impossible.

The electron emission from a given cathode is fixed by its temperature. Unless allowed to come up to full operating temperature before applying the anode voltage, the required emission will not be available. Conservative time delay periods for each type of tube are given in the tube instruction books and should be religiously followed.

Some practical suggestions may be added to the above general outlines. These hints are given to help the user prevent possible troubles and to suggest how existing troubles, if any, may be eliminated.

The filaments should never under any conditions be adjusted to less than the rated voltage. There is sufficient metal in the filaments to last a very long time. Not one tube in thousands ever fails from true burnout simply due to evaporation of the filament metal. *The filament voltage is more important in this line of tubes than in almost any other.* If the required plate current is so very much less than the rated value that reduced filament voltage seems possible, the user should, for true economy, obtain a smaller tube.

Low filament voltage is one of the most common faults, and at the same time one of the most fatal. The supply line should have good regulation. The tolerance given in the published data and instruction books should be strictly observed. The voltage should be checked at the sockets at least every ten days. The contact springs should have good tension and be kept clean and bright.

"Low emission" resulting from long life does not usually show itself suddenly. For weeks before the final failure, the emission will be observed to be coming from less and less of the total cathode surface area. The inactive coating will appear darker than the emitting portions. It is really found to be darker when the tube is broken for inspection. The effect of insufficient emission has

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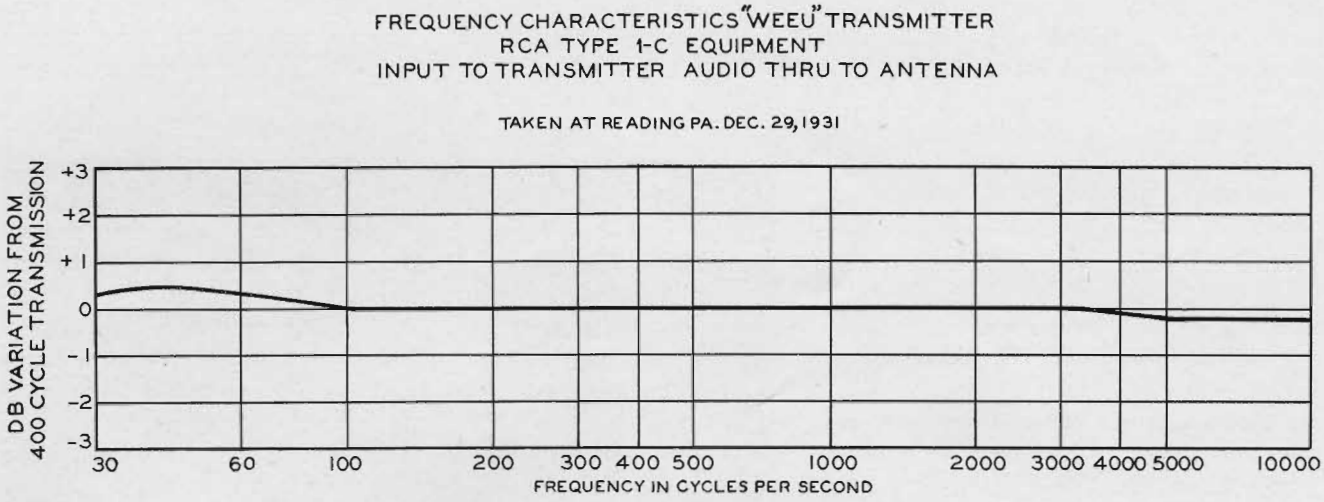

A CURVE THAT WENT STRAIGHT

MERCURY VAPOR RECTIFIER

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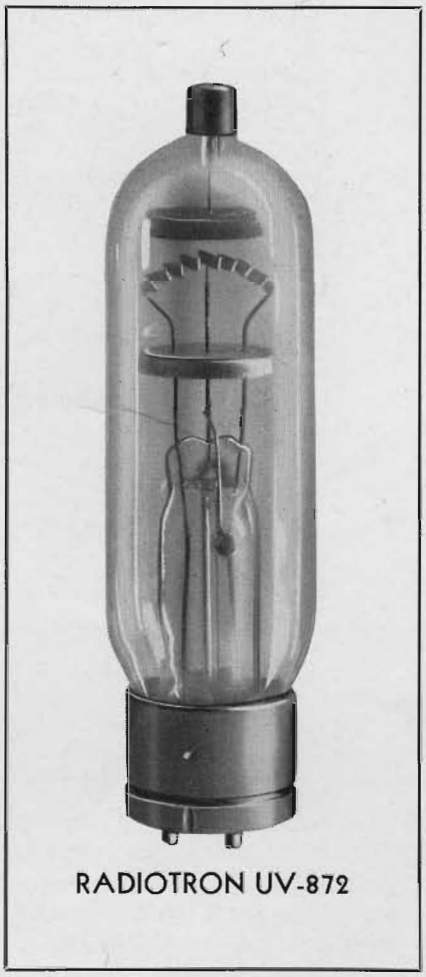
already been discussed. This development of low emission during long life may be aggravated by low filament voltage.

It is essential that mercury vapor rectifiers be completely and effectively shielded to prevent R. F. pick-up, either externally as by coupling of the lines or internally as by feed-back from the oscillating or amplifying tubes. This trouble is not simple to determine or to eliminate. The seriousness of this condition has not been fully appreciated in the past.

The effect of the radio frequency in mercury vapor tubes is to maintain the vapor in a partially ionized state. This continues during the inverse part of the cycle when the tube is intended to withstand high inverse voltage. The ions maintained by the radio frequency are moved at very high velocities by the inverse plate voltage and the coating on the filament is severely bombarded. The actual current passed may be only a few milliamperes but the ions move with such high velocities that the coating is permanently damaged.

As a temporary expedient, when troubles are pressing, it may be possible to continue operation until the fundamental cause can be corrected, by applying artificial cooling of some form. The ideal form of this



RADIOTRON UV-872

auxiliary is, of course, a blower and individual air ducts ending near the cathode arm of the tube. One or more ordinary electric fans may be sufficient to keep the set operating until something better can be arranged. The effect of this cooling is, of course, to maintain the condensed mercury temperature at a point where the voltage necessary to cause "arc-back" is much higher than the voltage which the tube is called upon to withstand in operation.

The procedure outlined in the data book and instruction book for the *initial operation* of these tubes should be conscientiously followed. It is made necessary because the liquid mercury inside the tube becomes widely distributed during shipment. In this condition, a tube could be ruined in a few minutes by increasing the load too rapidly. The voltage is the important factor in this process, rather than the plate current.

A tube which has been damaged and has become subject to "arc-backs" can sometimes be brought back to operating condition by following the procedure outlined for initial operation. A period of as much as four hours may be necessary before some tubes will operate satisfactorily under full load. This procedure will be found useful and profitable in rehabilitating otherwise useless tubes.

It is hoped that these suggestions and discussion of a comparatively new and useful type of rectifier will help the user in obtaining the mutually desired objectives of consistent operation and satisfactory tube life.

REFERENCE: (1) HULL—
"GAS FILLED THERMIONIC TUBE"
Proc. A. I. E. E. 47-753
July 1928.

When A Thinker Speaks

—It Is Well To Listen

MOST of us are thoroughly familiar with the "Golden Hour of the Little Flower," broadcast every Sunday on a special nationwide hookup of stations. This feature has achieved an amazing degree of popularity amongst people of all creeds throughout the length and breadth of this country. Father Coughlin is now consistently reaching an audience which quite probably is as large as that ever reached by anyone.

Whether we all completely agree with Father Coughlin on his views or not is beside the point,—he has a tremendous following, and no one can deny that he is a sincere and a forceful speaker,—that he never fails to provide plenty of food for thought to his listeners. To hear him is to admire him.

We therefore are particularly pleased to have the privilege of quoting Father Coughlin on his views toward the impending situation, which should be of vital interest to all those connected with the Radio Broadcasting industry. Your editor, hearing Father Coughlin's sermon over the radio on February 7th, immediately wired for permission to print the following excerpt therefrom:

FATHER CHARLES E. COUGHLIN
PASTOR OF THE SHRINE OF THE LITTLE FLOWER, ROYAL OAK, MICH

"During the past few years the American people have become the victims of a deluge of filth. The screen and stage have gone as far as they dare. Obscene publications are on sale at news stands and extend far beyond the degree of risqueness. I want to take this brief moment to pay tribute to one form of entertainment which, with the decline of the others, has stood out foremost in cleanliness, education and entertainment. It is radio broadcasting.

"The owners of broadcasting stations, realizing the responsibility placed upon them, have carried their banners high. Not once in the history of my radio work, have I ever heard anything broadcast that should not be listened to by the youngest child in the family. Broadcasters realize that they are the guests in your home and the programs are prepared, not for one individual of the family, but for the family group, which is the keystone of America today.

"And yet, with all this, the radio stations throughout the country are being subjected to a Senatorial investigation, while the commercial filth of other forms is approved by the silence of the same august body.

"Although certain organizations, jealous of the progress of radio, have abetted this investigation, which would not stop at nationalizing a clean, honest industry, they will themselves accept copy that is often times questionable and yet the owners of the broadcasting stations have never once criticized them.

"From my personal experience I am well acquainted with the tremendous cost associated with broadcasting a presentation. And I am well acquainted with the comparative profits made by the owners of the stations.

"Let no propagandist deceive you on this matter.

"These words I freely speak to you in reciprocation for the kindness and cooperation which I have received from the broadcasting stations over which this presentation comes to your homes. At no time have they stooped to commercialize filth. At no time have they shocked you with the horrid details of lust and murder. But at all times they have endeavored to bring you clean entertainment and sane education.

"Although in no wise is this presentation of mine donated by the stations over which I broadcast—because such a donation would be unethical—I am happy to add my voice in protest against those who are seeking to socialize the radio industry and to destroy such expensive and sometimes unprofitable enterprises to realize their own ulterior motives.

"Radio is a modern Aladdin's lamp—one of the greatest achievements of science. I feel I am not going too far in expressing on behalf of the fifty million listeners in the United States this brief tribute to this marvelously clean and well conducted industry."

REV. CHARLES COUGHLIN

LET'S GET ACQUAINTED

F. R. DEAKINS

WHO IS LOCATED AT CAMDEN, N. J., IS MANAGER OF THE VARIOUS SECTIONS OF THE RCA VICTOR COMPANY ENGAGED IN SELLING BROADCAST TRANSMITTERS AND POLICE RADIO EQUIPMENT, TRANSMITTING RADIOTRONS, INDUSTRIAL PRODUCTS, FARADON CONDENSERS, ETC.

HIS EXPERIENCE STARTED WITH THE GENERAL ELECTRIC COMPANY, IN 1915, WHERE HE BEGAN IN THE TESTING DEPARTMENT, LATER ENTERING THE RADIO DEPARTMENT, AND BEFORE TRANSFERRING TO THE RCA VICTOR COMPANY IN 1930, HE WAS SALES MANAGER OF THE GENERAL ELECTRIC RADIO DEPARTMENT.

HAROLD C. VANCE

WHEN THE RCA GROUP DEVELOPED THEIR PRESENT COMPLETE LINE OF BROADCAST TRANSMITTERS MR. VANCE WAS THE GENERAL ELECTRIC COMMERCIAL ENGINEER CHARGED WITH THE DUTY OF COORDINATING THE SALES AND ENGINEERING REQUIREMENTS OF THE VARIOUS EQUIPMENTS IN COOPERATION WITH SIMILAR ENGINEERS OF THE RCA AND WESTINGHOUSE COMPANIES.

FOR THE PAST YEAR AND A HALF HE HAS BEEN LOCATED IN THE CHICAGO OFFICE OF RCA VICTOR IN CHARGE OF THE SALES OF RADIO BROADCAST AND POLICE TRANSMITTERS, SPEECH INPUT EQUIPMENT AND POWER RADIOTRONS.

Broadcasting Personalities

It seems as though all the broadcasters are going amateur. Henry Grossman of CBS is getting a 40 meter transmitter in shape, call W2HM. Ray Guy of NBC has managed to obtain another two letter call, W2AK, and will soon be pounding brass. E. J. Gluck and Paul Rosekrans of WBT are the leaders of the southern amateurs. George Milne of NBC has a well established ham set in northern New Jersey.

Down at the Camden office, A. H. Castor, who ordinarily handles power tube sales, works on his class "B" modulated phone after hours. I. R. Baker, who has been building an amateur set ever since he left Schenectady threatens to have it operating any year now. R. H. Holmes of Government Sales, Charlie Roberts of Export and numerous others seem to

"Ted" Ostman, known the world over as 20M is completing a new 200 watt bottle set.

A. B. Chamberlain and G. S. MacAllister of CBS and Ted Smith of the Eastern District office descended on Charlotte, N. C. recently to confer with the personnel of WBT on the installation of the 50 KW power amplifier there. If nothing else was accomplished "Mac" now knows how to operate a teletype.

A. F. Kleindienst owner of WORC is an amateur movie enthusiast. Needless to say, he has some excellent pictures of the station.

Messrs. Gaul, Landis, and Kraumer of WEEU, at Reading, made a recent trip to New York to see whether the radio stations there could compare with WEEU.

E. W. Dannals, formerly of Wired

WEVD. He is now supervising the installation of a new transmitter and studio equipment.

We are glad to report that Paul Rosekrans, chief engineer of WBT, has gone and done it. On February 29th, he was married. Now he will have to remember the anniversary only once every four years.

What with the broadcasting of news of the Lindbergh case, NBC and CBS field engineers are well represented at Princeton and Trenton.

G. O. Shepherd, manager of WWNC, up in Asheville, N. C., has established an apprentice training course for announcers and field men.

It is rumored that "Jack" Leitch of WCAU is going to have a 50 KW station in Philadelphia which will incorporate some really new ideas in

RCA Victor Personalities

—We Print Only the Circumstantial Evidence

W. M. WITTY

—WHO IS NOW ASSISTANT TO BENJAMIN ADLER IN THE SOUTHERN DISTRICT OFFICE OF THE RCA VICTOR COMPANY, INC., HAVING BEEN TRANSFERRED FROM THE RCA VICTOR SERVICE DIVISION.

A. H. CASTOR, of our Broadcast Transmitter Section, has just returned from an extended trip through the southeastern portion of these United States. The trip was made by Chrysler from Camden to Miami, Florida, across the historic and picturesque Tamiami Trail to Tampa, thence following the old Spanish Trail (and observing the old Spanish customs) to New Orleans, where he engaged in sightseeing, occasionally interrupted by business for a period of about three weeks. He then proceeded northward, across Mississippi and Alabama and on through the Shenandoah Valley, returning to our windswept city. When pressed for details of his journey, Mr. Castor merely stated that he was struck by the abrupt change in climate, and the size of the snow drifts along the latter part of his route, adding that his car looked none the worse for wear after five thousand miles of travel, and did not resent our veiled insinuation that it wasn't so hot when he started. However, we still feel that he is holding out on us.

We are glad to have I. R. Baker back with us again, after a sojourn at Cooper Hospital, at Camden, New Jersey. He had the misfortune to slip on the ice and dislocate his hip, but he says that this was offset by the good fortune of being able to rest up for several days on a comfortable RCA Victor Radio Pillow, and he likes the idea so well that he is having one installed at his home. George Cole, who sponsers the distribution of the Radio Pillows, commented that some people have to be treated rough in order to be convinced of the merits of his wares.

J. P. Taylor is also glad to be back in our midst again, having been confined in the same hospital with his boss a good part of the time,—in order to keep him in contact with his business affairs.

S. W. Goulden is an accomplished organist. He tells us that a large pipe organ is particularly adapted for marches. We have never seen one carried in a parade, but it probably would be a good trick if you could do it.

C. L. Beach, who up until recently was a great Stanley Steamer enthusiast, has more recently been seen driving a gasoline car, and we suspect that he and Goulden are converting his old bus into a calliope, which probably would work out better on the march.

Signs of Spring! J. M. Sawyer has been seen hovering about the sporting goods store windows lately, probably in anticipation of the coming trout season.

When last heard from, T. A. Smith was calling for assistance on his short wave equipment, being snowbound somewhere between Buffalo and Albany.

T. A. tells us that the construction program at the Bound Brook, N. J., NBC stations has included rebuilding W3XL-W3XAL the well known high power shortwave stations, and W3XAK the experimental television transmitter.

W. H. BELTZ

—WHO HAS BEEN APPOINTED ASSISTANT TO T. A. SMITH IN THE NEW YORK DISTRICT OFFICE OF THE RCA VICTOR COMPANY, INC. MR. BELTZ WAS FORMERLY WITH RCA COMMUNICATIONS, INC., AND LATER WITH RCA PHOTOPHONE, INC., AND HAS HAD A GENEROUS PORTION OF EXPERIENCE IN THE RADIO FIELD.

P. A. Anderson says his new log cabin out at Medford Lakes, N. J., has proven itself not only livable but comfortable throughout the winter. Why not? Andy has electric light, oil heater, modern plumbing, gas stove, electric refrigerator, telephone, radio, piano, and,—oh well, these log cabin pioneers just ain't what they used to be in our estimation.

SEND US YOUR NEWS

Offering an issue chuck full of what we hope you enjoy reading. And again reminding you that this is YOUR magazine—for your entertainment and information—so send us publication material that is of interest to you, and hence interesting to your associates—let us hear of your big way progress—send us the boss's picture—or the picture of the up-and-coming protege — introduce us to your personnel—we're Clara-Lou-and-Em about all of your affairs —in the interest of this magazine.

The St. Louis Police Radio

Interesting account of activities as disclosed in interview with Chief Joseph A. Gerk

By HAROLD C. VANCE

A PIONEER station, one of the few to be allowed 500 watts power, the St. Louis, Missouri Police Radio Station KGPC, under the supervision of Chief Joseph A. Gerk, has established an enviable record among the police stations of the country.

Backing up standard radio equipment with thorough maintenance and a systematic administration has paid safety dividends to the City and the surrounding country.

The use of radio has increased the efficiency of police three hundred percent in some cities, according to police chief reports

Needless to say, a great many cities are looking for just such a panacea, what with crime increasing on account of the depression and city budgets decreasing on account of the same depression!

Police radio has participated in the capture of criminals under many interesting conditions. Some of the capture reports read like tales of the old magicians who transported themselves from place to place on magic carpets.

Some of the criminals who have been captured almost before their crimes were completed probably feel there must have been considerable truth in those stories, only the present day magicians ride in squad cars and receive their orders and information via the magic ether waves instead of carpets.

Believing that a short technical description of this station, together with some actual stories of its operation will be of interest to cities not already so equipped, the following descriptions are related through the courtesy of Chief Gerk and his department.

The transmitter is an RCA 1-B, one thousand watt set, operating at half power on 1716 kilocycles. It is crystal controlled, assuring stability of frequency. Broadcast announce

COL. JOSEPH A. GERK
CHIEF OF POLICE, ST. LOUIS, MO.

All motors and generators are in duplicate, as well as other parts of the transmitter, in order to minimize time off the air, in case of breakdown. The motor generators rotate constantly and the station is on the air the instant a switch is thrown. The radio operator who controls this apparatus also keeps a record, accurate to the half minute, of the time each message is transmitted, the nature of the call and the disposition or action taken by police officers after they arrive at the scene. Each fifteen minutes the operator announces the correct time and the call letters KGPC. In this manner the officers riding in radio-equipped cars are informed as to whether or not the receiver in the car is in an operative condition.

RADIO TRANSMITTER ROOM SHOWING FROM LEFT TO RIGHT SPEECH INPUT, RADIO OPERATORS' DESK AND RCA TYPE 1-B TRANSMITTER

type condenser microphones and standard speech input are used. Two control positions are provided, one for the operator in the transmitter room and one for the dispatcher in the switchboard or communication

The radio dispatcher, a police officer, sits at a desk in the switchboard room on the sixth floor. On a table at his side is a large map of St. Louis, divided by many lines into districts and precincts. In each of these precincts, day and night, at

least one radio-equipped automobile is constantly patrolling. On the wall in front of the dispatcher is another large map and installed in this map are many tiny lights, which represent

CLOSEUP OF RADIO DISPATCHER'S DESK WITH CONDENSER MICROPHONE AND RADIO TRANSMITTER CONTROL BOX

every radio-equipped car in the police department doing regular patrol duty. One hundred and five switches installed on the dispatcher's desk are connected with these lights. When a radio-equipped car leaves its precinct, the dispatcher closes the switch bearing its radio number. This switch lights the lamp in the precinct outlined in the map in which the car cruises. Thus the dispatcher has available at all times the exact location of the territory from which the car was removed. When the car is returned to service the dispatcher is informed and opens the switch.

In the garage adjoining police headquarters building a twenty-four hour radio repair service is maintained. Here radio service men keep in repair the hundred and twelve radios which are installed in the cars. Extra radio receivers are kept on hand to replace defective receivers, as well as radio-equipped cars and a supply of tubes and batteries and replacement parts sufficient to keep the maximum number of cars on the streets at all times.

A few incidents in the radio history of KGPC are related to show how efficient radio is in police work.

Two men in an automobile snatched five purses in rapid succession in north St. Louis one afternoon. In each case the descriptions were practically the same. While a police car was hurrying to the scene of the fourth purse snatching, the officers saw the car they were after being driven in an opposite direction. There was a short chase, capture of the quarry, and then started the trip to the station, the suspects protesting innocence. When they heard the message come in describing the fifth purse snatching, however, they "came in" with all of the thefts and in one case identified one of the victims who failed to identify them.

A police officer walked into a home brew joint on his beat and saw a young man seated. While questioning him, he turned to find another man holding two pistols on him. The gangsters took the officer's gun and bound him with adhesive tape and rope. While this was going on, a Negress in a rear room left. So did the proprietor. A few minutes later the two men got into a Chevrolet sedan and drove away. The Negress returned and released the officer. A description of the car, which bore a Colorado license, was flashed on the air and twenty minutes later the two men were captured after a chase by police cars. Three guns were found in the gangsters' car.

It was 1:00 A. M., February 3, 1932. A citizen telephoned the dispatcher that three men were acting suspiciously in an automobile in an alley in the rear of a certain address. Police cars answering the radio call found three men seated in a car and they carried a revolver, a black jack and a shotgun. Arrests were made and probably several crimes prevented.

TYPICAL RADIO-EQUIPPED SCOUT CAR

(Continued on page 17)

List of Licensed State and Municipal Police and Emergency Fire Radio Stations—Alphabetically by States

As Compiled by the Federal Radio Commission, Washington, D. C.

[1]Harbor Police
[2]State Police
[3]Emergency Fire

Call Letters	Name	Transmitter Location	Frequency Kilocycles Feb. 1, 1932
	CALIFORNIA		
KGPD	City of San Francisco	San Francisco	[3] 1558, 2470
KSW	City of Berkeley	Berkeley	2422
KGPG	City of Vallejo	Vallejo	2422
KGJX	City of Pasadena	Pasadena	1712
KGPL	City of Los Angeles	Los Angeles	1712
WPDA	City of Tulare	Tulare	2414
	DISTRICT OF COLUMBIA		
WPDW	Metropolitan Police Dept.	Washington	2422
	GEORGIA		
WPDY	City of Atlanta	Atlanta	2414
	ILLINOIS		
WPDC	City of Chicago Police Dept.	Chicago	1712
WPDD	City of Chicago Police Dept.	Chicago	1712
WPDB	City of Chicago Police Dept.	Chicago	1712
	INDIANA		
WPDT	City of Kokomo	Kokomo	2470
WPDH	City of Richmond	Richmond	2442
WMDZ	City of Indianapolis	Indianapolis	2442
	IOWA		
KGOZ	City of Cedar Rapids	Cedar Rapids	2470
KGPN	City of Davenport	Davenport	2470
KGPK	City of Sioux City	Sioux City	2470
	KENTUCKY		
WPDE	City of Louisville	Louisville	2442
	MASSACHUSETTS		
WEY	Boston Fire Dept.	Boston	[3] 1558
WMP	Commonwealth of Mass., Dept. of Public Safety Div. of State Police	Framingham	[2] 1574
	MICHIGAN		
WPDL	City of Lansing	Lansing	2442
WPEB	City of Grand Rapids	Grand Rapids	2442
WMO	City of Highland Park	Highland Park	2414
WCK	Detroit Police Dept.	Belle Isle	2414
WPDX	Detroit Police Dept.	Detroit	2414
WKDT	Detroit Fire Dept.	Detroit	[3] 1558
WPDF	City of Flint	Flint	2442
WPDR	Township of Grosse Point	Grosse Point	2414
WRDS	State of Michigan	Ingham Township	[2] 1574
	MINNESOTA		
WPDS	City of St. Paul, Dept. of Public Safety	St. Paul	2430
KGPB	City of Minneapolis Police Dept.	Minneapolis	2430
	MISSOURI		
KGPC	City of St. Louis	St. Louis	1712
KGPE	City of Kansas City	Kansas City	2422
	NEBRASKA		
KGPI	City of Omaha	Omaha	2470
	NEW YORK		
WMJ	City of Buffalo	Buffalo	2422
WPY	City of New York Police Dept.	New York City	[1] 438, [1] 500
WRDU	City of New York Fire Dept.	Brooklyn	[3] 1558
WCF	City of New York Fire Dept.	New York City	[3] 1558
WPDR	City of Rochester	Rochester	2458
WPDV	City of Charlotte	Charlotte	2458
	OHIO		
WPDO	City of Akron	Akron	2458
WKDU	City of Cincinnati	Cincinnati	2430
WRBH	City of Cleveland	Cleveland	2458
WPDG	City of Youngstown	Youngstown	2458
WPDI	Franklin County Board of County Commissioners	Columbus	2430
WRDQ	City of Toledo	Toledo	2470
	OKLAHOMA		
KGPH	County of Oklahoma	Oklahoma City	2450
	OREGON		
KGPP	City of Portland	Portland	2442
	PENNSYLVANIA		
WBA	Penn State Police	Harrisburg	[2] 257
WBR	Penn State Police	Butler	[2] 257
WDX	Penn State Police	Wyoming	[2] 257
WJL	Penn State Police	Greensburg	[2] 257
WMB	Penn State Police	West Reading	[2] 257
WPDP	City of Philadelphia	Philadelphia	2470
WPDU	City of Pittsburgh	Pittsburgh	1712
	TEXAS		
KGPJ	City of Beaumont	Beaumont	1712
KVP	City of Dallas Police and Fire Signal Dept.	Dallas	1712
	TENNESSEE		
WPEC	City of Memphis	Memphis	2450
	WASHINGTON		
KGPA	Seattle Police Dept. and Fire Dept.	Seattle	2414
	WISCONSIN		
WPDK	City of Milwaukee	Milwaukee	2450

CONSTRUCTION PERMITS ISSUED

	CALIFORNIA		
KGPM	City of San Jose	San Jose	2470
KGPS	City of Bakersfield	Bakersfield	2414
	INDIANA		
WPDZ	City of Fort Wayne	Fort Wayne	2470
	IOWA		
KGPV	State of Iowa	Des Moines	[2] 2506
	NEW YORK		
WPEA	City of Syracuse	Syracuse	2458
WPDN	Auburn, City of	Auburn	2458
	OKLAHOMA		
KGPO	City of Tulsa	Tulsa	2450
	OHIO		
WPDM	City of Dayton	Dayton	2430
	TEXAS		
KGPR	City of Ft. Worth	Ft. Worth	1712
	TERRITORY OF HAWAII		
KGPQ	City and County of Honolulu	Honolulu	2450
	UTAH		
KGPW	City and County of Salt Lake	Salt Lake City	2470

ST. LOUIS POLICE RADIO

(Continued from page 11)

An attendant at an oil-filling station had just been held up by two young men, one with a revolver. He telephoned descriptions which the dispatcher put on the air immediately. Officers enroute to the holdup ran into the bandits and arrested them.

The dispatcher received information that three men riding in an automobile without license plates were wanted for a holdup in Roxana, Illinois. A police car caught the outfit as it was being driven across the Chain of Rocks bridge into St. Louis. The men were returned to Roxana and identified.

Although listening in to police broadcasts by the public is not encouraged, sometimes good results occur from a stray pickup. A Negro had held up a loan office and escaped on foot. He had a good start. As his description and other information were shot into the air, a woman called with the information that she had the robber in view. The line she was using was kept open and her messages were relayed via air to radio cars, the outcome being that the fugitive was chased into a park and captured after he had dived into a lagoon.

The following, taken from a radio log of July 17 last, is typical of the manner in which calls are actually placed on the air:

10:01 A. M. "Scout car one, district four, a shooting at 1003 Selby place."

10:26 A. M. "Arrest a brown skinned negro, about 40 years old, five feet, seven or eight, one hundred and sixty, riding in a Studebaker touring car, bearing Tennessee state license 340-495, or 314-495. He may be bound for Crystal City, Missouri, on the Lemay Ferry road. He is wanted for murder at 1003 Selby place."

10:44 A. M. "The negro wanted for murder at 1003 Selby place has been arrested in the Second District."

Here is the story: Arriving at the scene of a shooting, Fourth District officers found a young Negress dying from several revolver shots which had been fired at close range. While a futile attempt was being made to save her life, she told officers that John Robert Lee, whom she described vaguely, had become infuriated when she refused to accompany him to a suburban town and had shot her. She told the officers he was riding in a touring car bearing a Tennessee license, the numbers of which she did not know.

The officers who accompanied her to the hospital passed this meager information on to the dispatcher. This was supplemented soon by a report from another source that a Negro had been seen leaving the vicinity in a Studebaker touring car. This time a license number was available. The highways were covered and eighteen minutes after the crime was broadcast the Negro was locked up at the Second District station and the message announcing his arrest had been transmitted.

The St. Louis Police Radio installation stands out as a fine example.

GRAND RAPIDS POLICE RADIO DIVISION COOPERATES WITH MICHIGAN STATE POLICE

RCA VICTOR TRANSMITTER KEPT BUSY, ACCORDING TO LETTER OF MARCH 11TH

From all indications, things are going to remain quiet now that we have Police Radio installed here in Grand Rapids. Besides finding this Police Radio a much needed weapon in this department, we have found it useful for a great number of other things, and we can foresee its increased usefulness in cooperating with other departments.

Last night we had a burglar alarm about midnight, and through the medium of the radio system, we had several officers on the scene in one minute's time. Without the radio, it would have taken about four minutes to accomplish the same results. It goes to show how we are prepared to handle such situations quickly, when the time comes.

We are handling from two thousand to twenty-five hundred messages per month now, with prospects of doing more as time goes on. We keep one receiver tuned to the Michigan State Police transmitter continuously, intercepting all messages that pertain to this section of the state, and we re-broadcast to our own cars the warnings which effect our district. Working in this way, we have several times furnished valuable cooperation to the State Police, and have picked up cars and persons wanted by them from time to time.

We have just received a letter from Los Angeles, California, that our transmitter was logged there with loudspeaker volume on a Pilot Wasp receiver. That sounds good to us.

A. A. KIRCHNER
Chief Engineer, WPEB
Grand Rapids, Michigan

Chicago NBC Studios

By HAROLD C. VANCE
Sales Engineer, Central District, RCA Victor Co.

MODERN equipment is essential to efficient radio broadcasting. Much depends on the reliability of apparatus, and both transmission and receiving equipment must be of the highest calibre. The National Broadcasting Company installs new apparatus as it proves itself worthy and feasible.

When NBC took over the operation of WENR, the company acquired a broadcasting plant, which, although a few years old, had been kept thoroughly modernized and up-to-date in every respect.

Early in 1930, a new RCA 50 k.w. amplifier (see figure 1) and a new rectifier (see figure 2) was installed. The new amplifier contained two 100 k.w. tubes, operating in a push-pull circuit. The new rectifier employs six hot cathode mercury vapor tubes, and was necessary to provide the higher voltage required by the 100 k.w. tubes.

FIGURE 6—LEFT, RCA PORTABLE TRANSMITTER, SHORT-WAVE, **O. B. KEELER**, GOLF AUTHORITY, HOLDS MICROPHONE, WHILE **DEWEY STURGILL**, NBC ENGINEER, HOLDS SHORT-WAVE RECEIVER AT LEFT

FIGURE 5—LOOKING INTO STUDIO A, CHICAGO DIVISION OF NBC, ARMOUR PROGRAM REHEARSAL. **E. C. HORTSMAN**, NBC ENGINEER, AT CONTROL PANEL IN FOREGROUND

In addition to the broadcast transmitter, there is a 5 k.w. transmitter (see figure 1, left end) operating on 6020 k.c. and known as W9XF, an experimental international relay broadcast station.

Comments on signals from this station have been had from all over the civilized world. The transmission is especially good to Japan, Australia and New Zealand. The New Zealand Broadcasting Company has had remarkably good results in receiving signals from this station.

At the Chicago NBC studios, located in the Merchandise Mart, the largest building in the world, perhaps the most interesting feature for visitors who are conducted on tours through the spacious layout is the control room (see figure 3). In the background, near the ceiling and protected by a guard rail, is the power distribution board. On the floor, parallel bays of equipment racks may be seen. Contained in the bay at the left are the studio amplifiers, interlocking relays and terminating jack strips, while those on the right contain incoming and outgoing repeaters and associated equipment for the distribution of programs to local stations and to the network through which the broadcasts may be going.

At the back, looking like a row of big bay windows, are the "nemo" booths, used for monitoring both outside pickups and network programs. They are equipped with control circuits, and in actuality are miniature studios.

Seen in the foreground is the master control desk (see figure 4 for greater detail) located in an advantageous position so that the engineer can see what is taking place throughout the room. It is the electric nerve center of the whole system. The bays, or rows of lights, correspond to the studio channels, while the individual lights indicate the line amplifier which is set up on any particular studio for distribution to various stations associated with an NBC network.

The engineer at this desk has before him a picture in lights which indicates the continuity of any or every program circuit and studio that might be in operation. He has available at his finger tips means of correcting any discrepancy which may crop up for some untoward reason.

Loudspeaker or headset monitoring gives him an accurate check on every program, and from the board he is able to check several vital

points at which trouble might develop. Through a telephone arrangement direct and private means of communication with New York, also each studio. New York may be had at any time through a 24 hour leased telephone line. Should there be an emergency, he may switch to any one of three auxiliary circuits.

FIGURE 1—RCA 50 K. W. AMPLIFIER, FAR END OF ROOM. 5 K. W. TRANSMITTER AT LEFT END

The walls of the control room are finished in a silver tone, the woodwork being of black satin finish which affords a striking contrast to the Alleghany metal trim which dresses up the racks. The block panels noted at the top of the picture outlined in black, are treated acoustically.

Framed by the control room window (see figure 5) is an orchestra in rehearsal for an Armour program. Three thicknesses of glass may be plainly seen, this having been found to insure complete sound proofing. The engineer sitting before the control panel, with which he mixes the output of the various condenser microphones, used exclusively by NBC for broadcasting, keeps an eagle eye on the volume indicator, the "absolute," as far as he is concerned, and also is able to glance at the artists occasionally. On the table may be seen a carbon mike, used only for cummunication by the program director during rehearsals with the artists in the studio, while on the sill is the huge second clock with which all programs are accurately timed.

A new portable short-wave transmitter and receiver, which was used for the first time in connection with the American Open Golf Championship held in July of 1931, is shown in figure 6. O. B. Keeler, famous as a sports announcer and writer, is seen holding the microphone, while on the left of the picture may be seen the short-wave transmitter with the loop antenna. Keeler, in this picture, is shown listening to his own voice, as it is picked up by the cue monitor receiver, held at the right of the picture by Dewey Sturgill, NBC engineer. This instrument carried its own antenna in the pole which supports it, and when in operation, is located at some central spot during the actual broadcast, picking up the signal from the portable short-wave transmitter on the field.

This system proved eminently successful in broadcasting the golf matches, on which many interesting comments were received, and again it was used at the National Corn Husking Contest held in Grundy Center, Iowa, in November of 1931. Similar equipment was used in this case, with the exception that the receiver was housed in a tower. The reason for this was the limited amount of space needed to hold the contest.

H. C. Luttgens, Chicago division engineer in charge of NBC's plant operation and engineering department in the midwest, has been connected with broadcasting for the

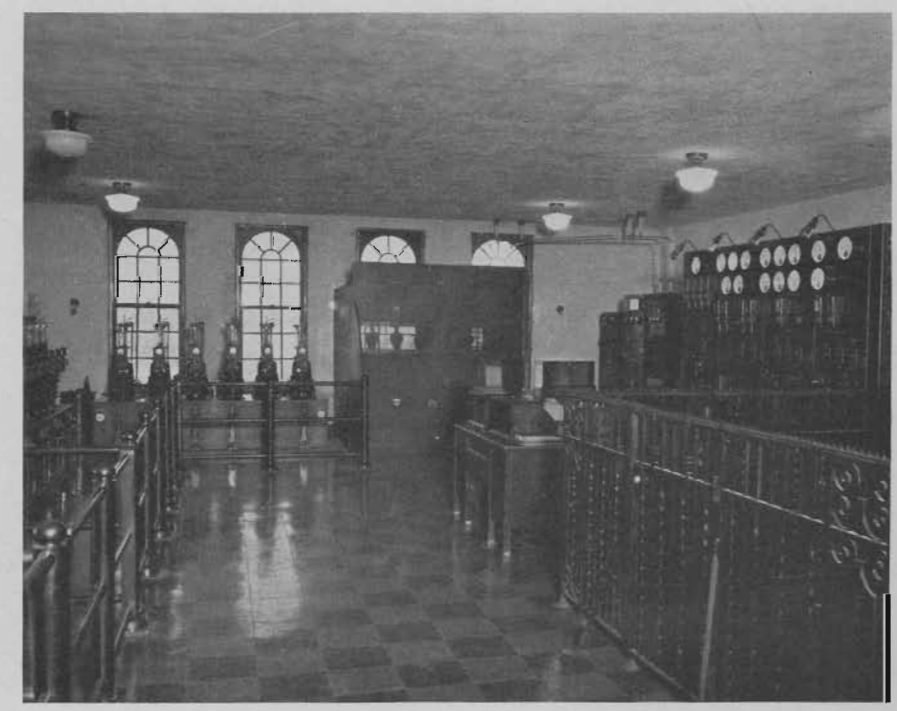


FIGURE 2—NEW RCA RECTIFIER, CENTER PANEL

(Continued on page 23)

PIPE ORGAN PICKUP

By HENRY GROSSMAN
Division Engineer, Columbia Broadcasting System, Inc.

THE problems involved in the pickup of organ music for broadcast purposes are a combination of the general problems of pickup and the special problems peculiar to that instrument. These problems have aroused much controversy over solutions and these controversies have allowed no standard method to come into general use. The methods in use for organ pickup at Columbia have been the result of a slow and painstaking evolution.

If we examine the nature of the organ itself, we are at once struck with its complexity. Essentially, it is a wind instrument. Sound issuing from this instrument is the result of the vibratory motion of a column of air in a pipe. In our incursions inro textbooks on elementary physical theory, pictures of various forms of such pipes are common. But such pictures tell but a fraction of the story of the events which transpire behind the shutters.

Frequency Range Extreme

The fundamental tones which the organ is capable of producing ranges from 32 cycles per second up to 5600 cycles per second. Each of these fundamental tones are produced by a pipe whose length increases as the frequency decreases—the longest pipes being as high as 16 ft. For simulating the tone colors of the various orchestral instruments, these pipes are varied in shape, in material of construction, in lip action, and in end pipe constriction. It is thus possible to imitate any orchestral instrument by depressing the stop which permits air to flow to any of the pipes of the particular set having the tone quality required. The average organ contains a number of stops which have no counter part in the orchestra —the most familiar being the "vox humana" or human voice.

Since some organists are able to play two key boards with each hand

and another with the foot pedals, and since any number of stops may be controlled with each note of the key board, an immense amount of very complex sound may be generated at any instant. The volume of this sound is controlled by the opening and closing of shutters in front of the "swell chambers" in which the pipes are located. As a general rule, at least two and often more "swell chambers" are provided and if the bass note pipes of all stops are in one chamber, and the treble note pipes in the other, it is possible to control the volume of the bass or treble section individually, allowing the organist control of a greater range of tone color.

Microphone technique in broadcasting this instrument, is entirely dependent on the nature of the organ. Carbon microphones which were originally used on our organ broadcasts, suffer from hiss noises with even medium amplification. In order to increase the music to hiss ratio it is of decided importance to place the microphone as close as possible to the source of sound. With the organ, this procedure offers difficulties. The sound source is not a single point source but a wide sweep of pipes, very often running completely around the studio. If we placed our carbon microphones close to any particular section of these sounding pipes, that section would have a greater sound level than the remaining sections and balance would be lost.

This difficulty was overcome to some extent with electrical balancing. A number of microphones were placed at intervals and their sound level balanced and mixed for proper reproduction of each section. New difficulties arose. If all microphones were left open at one time the sound issuing from any section of pipe would arrive out of phase at the various microphones and even balance out certain frequencies in the electrical circuit. Rapid mixing on the part of the engineer became the order of the day and even under the most competent hands, this mixing was far from giving the desired result.

Best Microphones Used

The improvement in the condenser microphone with its lack of hiss, led to its immediate adoption. The absence of hiss allowed higher amplification and this in turn allowed the microphone to be placed at a greater distance from the sound source and allow greater perspective in reproduction. This increase in distance obliterated the problems of electrical balance and brought back the use of a single microphone. The condenser microphone and associate amplifiers having better frequency characteristics, also improved the quality and due to the inability of overloading, did away with another source of distortion.

However, the condenser microphone had its disadvantages in that cavity resonance prevailed and an increased peak as much as 8 db. at 3500 cycles effected the quality, making it sound high pitched.

Another difficulty arose when working the microphone at a distance from the sound source. The acoustics

from the studio or auditorium in which the organ was located began to have their effect on the quality. It might be well to point out that while the ear is discriminating, in that it chooses and discards, the microphone is not. Whatever falls upon its diaphragm is registered with democratic gusto. What may sound well to the ear may not be suited to broadcasting in more ways than one. It was necessary to treat either the studio or auditorium acoustically and to make various tests to determine the proper location for the single condenser microphone.

A recent development in microphones has proved to be of great advantage for the organ pickup.

This microphone has several advantages over previous microphones —the main ones being that it is free of cavity resonance having specially good characteristics over a range of 30 to 10,000 cycles. Also, due to the fact that this microphone has no associate amplifying equipment and is small and rugged, it is possible to suspend it in places where the suspension of a condenser microphone is almost out of the question. The desirable pickup of an organ is, of course, to reproduce it with as great volume range as possible and still retain good quality free from echo, due to acoustics in the auditorium or studio, whichever the case may be.

This can only be accomplished by the use of a single microphone, preferably the recent type and suspending it at a good distance from the organ grills—this distance depends upon the location of the organ and is determined by actual tests.

No doubt, it will interest our readers to know that the familiar Paramount Studio Organ heard over the Columbia network is picked up with one of the newer microphones suspended about 14 ft. in the air and 25 ft. from the organ grille.

We hope in the future to publish similar articles covering the pickup technique employed for other special forms of music and broadcast material. We will, of course, be interested in your criticisms, comments, and suggestions.

ANN LEAF, Grand Organ Virtuoso, whose versatile performances have endeared her to a vast radio audience of classical music lovers and popular melody fans alike. It is amazing indeed to see this clever little Artiste in action, fingers flying deftly over hundreds of keys and stops, toes weaving in and out through a maze of pedals and treadles,—a modern marvel of skillful coordination of mind and muscle, resulting in the perfect rendition of dashing marches or soulful ballads, as her moods dictate.

But what a problem for the Radio Engineer, whose ambition it is to pick up, transmit, and faithfully reproduce these concerts for the unseen listeners near and far!

Try Running Over It With a Mack Truck

"It might be interesting to you to know that the RCA Condenser Microphone unit that was in the fire in our studios on January 20th was burned black by the flames, was knocked over by firemen and lay in about two feet of water for a half an hour or more. It was removed then from the amplifier and tried in another amplifier and found to be working perfectly."

—Excerpt from letter from T. A. McClelland, Chief Engineer, W D A F, Kansas City, Missouri.

Incidentally, they are also Hot-Cha proof and reinforced to withstand B-B-B-BAHing.

Precision Control Equipment Wanted

First Towerman to Second Towerman:—

"Now Bill, you've gone and sent the Twentieth Century to Montreal again—try to be a little more careful."

25 YEARS DEVELOPMENT IN MICROPHONES

PHIL COOK
ADDRESSES HIS N. B. C. AUDIENCE THROUGH THE MEDIUM OF THE LATEST TYPE RCA VICTOR CONDENSER MICROPHONE

JANE GRUBE
DEMONSTRATES THE ORIGINAL CARBON GRANULE MICROPHONE USED BY DR. LEE DE FOREST ON HIS FIRST WIRELESS TELEPHONE EXPERIMENTS

Broadcast From Speeding Train

(Sunday, March 27)

IN cooperation with the Baltimore and Ohio Railroad, the Columbia Broadcasting System undertook to pick up and rebroadcast a complete program of entertainment from a temporary studio on a train speeding at a rate of more than a mile a minute between Washington and New York on Sunday, March 27, from 9:00 to 9:30 P. M., EST. The broadcast, the first of its kind ever attempted, presented Belle Baker, Jack Denny, and the regular talent features on the Ever-Ready Radio Gaieties.

The program was picked up by short wave receivers, transmitted by special circuits to the Columbia studios in New York and rebroadcast over the coast-to-coast Columbia network.

Aside from the fact that this feature marked a departure in radio science, historic significance is lent by the fact that 88 years ago over this same stretch of the first railroad, the Baltimore and Ohio, Samuel F. B. Morse made his first successful tests of the telegraph as a means of railroad communication. On May 24, 1844, as a result of the experiments conducted by Professor Morse, the first railroad telegraph line was installed for regular use between Baltimore and Washington.

Since that epoch-making day when Morse haltingly transmitted the news of the results of the Whig National Convention over his crude experimental apparatus, the telegraph has become an all-important factor in railroad communication. Pioneers in that field, the Baltimore and Ohio is now taking the lead in this country in experiments in radio as a possible source of communication between various points on the line.

In preparation for this attempt, preliminary surveys were made to ascertain the feasibility of such a broadcast. After selecting the line between Washington and New York as best suited to such a project, Edwin K. Cohan, Technical Director of the Columbia Broadcasting System, investigated the selected stretch from the broadcasting angle. A large staff of electrical experts, mechanical

(Continued on page 28)

FACTS, FICTION, AND FLATTERY

If you really want to know what a fine magazine BROADCAST NEWS is, you should read some of the comments in the "Outside the Broadcast Band" department of RCA NEWS, by our good friend W. A. Fitzpatrick. He was an editor when we were a pup.

Fitz is an old friend of ours, and we suspect that he has been suspended by his heels from the top of a certain tower in the old country whilst caressing the famous Blarney Stone,—but it's O.K. with us, Fitz old boy,—we love it!

We have always liked Fitz, since the day he assigned us to the U. S. M. S. "SUSQUEHANNA" with Jack O'Connell as assistant, under Captain Dundas. That's where we got our first experience at editing, in four different languages. Our passengers were divided into so many different nationalities that we had to do something like that to stimulate the sales of our sheet. But Jack went us one better in this direction, by moving whole armies back and forth across Europe during his "press" watch. One day the Bolsheviks would take Warsaw, and the next day Field Marshall Jack O'Connell would march the Polish Fusiliers around the end in a masterful flank movement, reversing the victory. The Chief Steerage Steward, being quite a lignuist, did the translating for Jack.

And in the meantime, our passengers (—mostly those in the steerage),—having read Jack's dramatic accounts of the day's activities, would launch terrific drives against each other, which would be quelled only after the Masters-At-Arms had waded in, brandishing their hickory sticks. However, the Radio Newspaper sales increased by leaps and bounds and how!

When we showed the returns to Fitz at the end of the voyage, we were first congratulated upon our four-language editions, and the cash receipts. — Then someone who could read Polish began to translate one of the copies, whereupon Jack O'Connell remembered an important

CHICAGO NBC STUDIOS

(Continued from page 19)

FIGURE 3—MAIN CONTROL ROOM AT NBC CHICAGO STUDIOS. (SEE TEXT)

past 15 years, coming here from New York after the organization of NBC, of which station WEAF was the original unit. He began his career in the commercial radio field in 1917, having had extensive experience previous to this with the Marconi Wireless Company at Roselle Park, N. J.

All equipment for WENR and also the studio equipment mentioned was furnished by RCA.

FIGURE 4—MASTER CONTROL DESK. AT RIGHT, **O. B. HANSON,** MANAGER OF NBC PLANT OPERATION AND ENGINEERING DEPARTMENT. AT LEFT, **H. C. LUTTGENS,** DIVISION ENGINEER. IN CENTER, **J. C. MILLER,** CONTROL ROOM SUPERVISOR

The next trip we had a new assistant, and our receipts suffered severely. We wonder whose circulation Jack is stimulating now.

THEY'RE TELLING *US!*

Advertisement in "Radio Revue", Organe Officiel du Radio Club de

"*SANS-FILISTES*,

Vous gouterez incomparablement mieux le charme des Radio-Concerts, si en les ecoutant, vous degustez un verre de la celebre

BENEDICTINE DE FECAMP"

So many American radio fans are French in sentiment. It's a good way to listen to any program—French,

News About Your "Frequency Monitor"

By J. P. TAYLOR, Sales Engineer, RCA Victor Co.

WE might start this with . . . How about your frequency monitor, Mr. Broadcaster? But we won't . . . for you would probably shoot it back at us . . . how about *your* frequency monitor, RCA Victor? And with justification—for we've certainly been holding out information on it. We realize it . . . and, we're sorry no other course has been possible. But, we won't alibi . . . you know the story as well as we do. General Order No. 116 dates from last June . . . but it was December before the specifications were clarified and the necessity of Bureau of Standards approval brought out.

Specifications of the Type EX-4180 Equipment

Frequency range	550 to 1500 kilocycles
Frequency stability	± 10 cycles
Frequency indicator	Visual meter
Power supply	110 or 220 volts, 50 or 60 cycles
Mounting	Standard rack
Panel dimensions (r. f. panel)	19"x10 3/32"
Panel dimensions (a. f. panel)	19"x10 3/32"
Tubes required	One UY-227 Radiotron Two UY-224 Radiotrons Two RCA-247 Radiotrons One UX-280 Radiotron

ceived we will be ready to begin shipments.

While we're waiting we imagine you will be interested in a little

FIGURE 4
METER-POWER SUPPLY UNIT. NOTE LARGE EASY-READING FREQUENCY METER

Since that date our engineering department has been working every minute to develop the most convenient and reliable equipment suitable for the purpose. Naturally we were unable—until this equipment assumed its final form—to release information regarding it. However, we are now glad to be able to say that the model unit has been in the hands of the Bureau of Standards for several weeks past and we are momentarily expecting official approval. Meantime, assembly of the production units has gone rapidly forward

further information regarding this equipment, particularly the hundred odd of you, who—despite the meagre information we have been able to give you—have already placed your orders. Incidentally, we appreciate this showing of confidence. Maybe we're wrong but we think it has been inspired by the service we have tried to give you. Anyway, we intend to continue our policy of constantly improving this service. In addition we will very shortly be shipping you a frequency monitor with which we are sure you will be pleasantly

As you have probably guessed, the Type EX-4180 Frequency Monitoring Equipment has been designed by the engineers responsible for the crystal control equipment incorporated in RCA Victor Broadcast Transmitters. These transmitters have, for several years past, been equipped with crystal oscillator units guaranteed to hold the carrier frequency within — 50 cycles (practice has indicated actual stability of — 10 cycles). In fact, more than 95% of the RCA Victor Transmitters in the field will meet the increased requirements effective next June without any modification whatever to the frequency control equipment originally furnished with them. The foresight exercised in the design of this equipment is typical of the engineers who have designed your new frequency monitor. Their experience in developing and building precision frequency control equipment for broadcast transmitters has made it possible for them to design in the short time available a monitor which is not an experiment or a makeshift but a perfected and finished piece of precision equipment.

General Design

The Type EX-4180 Frequency Monitoring Equipment has been designed primarily for standard rack mounting. It is thought that in most control rooms such mounting will utilize the available space in the most economical manner. However, where thought more desirable, it may be placed in a cabinet on the operator's control desk. To facilitate handling the equipment is divided into two units—each completely shielded by an outer case. The panels of these units are finished in dull black to harmonize with standard speech input and transmitter units. Their appearance and construction are indicated in Figures 2, 3, 4 and 5 which show the front and rear of each unit.

The general layout of this equip-

gram. A standard frequency (500 cycles away from the assigned frequency of the station) is generated by a crystal-controlled oscillator of high stability. This frequency is amplified by a buffer stage—which also serves as isolation for the crystal oscillator. The buffer feeds into the grid of a detector tube. A small amount of radio frequency energy, picked up by loose coupling to one of the unmodulated stages of the transmitter, is also fed into this detector. The output of the detector is the difference between these two radio frequencies, an audio beat-note of approximately 500 cycles. This beat-note is intensified by an audio amplifier and the output of the amplifier used to drive a large visual-indicating frequency meter. The meter is so calibrated that when the beat-note is exactly 500 cycles the meter pointer is at zero on the scale. Any deviation from 500 cycles is indicated directly in cycles up to 50 cycles in either direction. Obviously, the 500 cycles is but an intermediary step. The deviation indicated by the meter is the actual difference between the carrier and the standard frequency. The standard holds to better than 10 cycles. Hence, as long as the meter reads less than 40 cycles away from zero the carrier frequency of the station is within plus or minus fifty cycles of assignment.

Precision Frequency Crystal Standard

The standard frequency on which the operation of rhe Type EX-4180 Frequency Monitoring Equipment depends is generated by an UY-227 Oscillator. The frequency of this oscillator is rigidly maintained by a high quality quartz crystal specially selected and carefully ground for this particular use. Calibration is made at the factory in the identical equipment in which the crystal will be used in the field. This insures against the introduction of error due to the small differences of circuit constants which may exist even between equipments which to all appearances are exactly alike.

Two-Stage Temperature Control

The crystal employed is mounted in a heat-insulated chamber. Constant temperature is maintained within this crystal chamber by a heater system which is controlled by an adjustable contact-making thermometer. The control circuit employed is the result of years of experience—it is the most satisfactory and reliable arrangement yet devised. The crystal chamber in turn is enclosed by an outer cabinet—the temperature within which is controlled by an identical but entirely independent heater system. All elements of the oscillator, buffer, and detector circuits are also contained in this outer cabinet. This feature presents two noteworthy advantages. First, by providing a two-stage temperature control the temperature of the crystal is maintained with a high degree of constancy, and second, by controlling the temperature of the crystal-controlled oscillator circuit elements the load on the crystal is stabilized.

NOTE

Copies of Bulletin No. 12 describing the Type EX-4180 Frequency Monitoring Equipment were distributed several weeks ago. This bulletin erroneously states that RCA-236 and RCA-237 Radiotrons are used in this equipment. As stated in the accompanying article, the tubes actually used are UY-224 and UY-227 Radiotrons.

Vernier Frequency Adjustment

In addition to greatly improved stability the crystal-oscillator circuit used possesses a further distinct advantage over formerly used circuits. By means of a vernier tuning capacity in the grid circuit it is possible to vary over a small range the standard frequency. Moreover, this adjustment does not affect the stability for the Type EX-4180 Frequency Monitoring Equipment will hold any frequency within the range in which it can be set with the same high degree of constancy. Normally this vernier control is firmly locked in place. If, however, after the equipment has been in operation for some time checks made by a frequency-measuring station indicate that it has drifted a few cycles the correction can be made by a front of the panel adjustment. Formerly such deviation could only be corrected by changing the crystal temperature—a fatiguing and laborious procedure necessitating resetting of the thermoregulator.

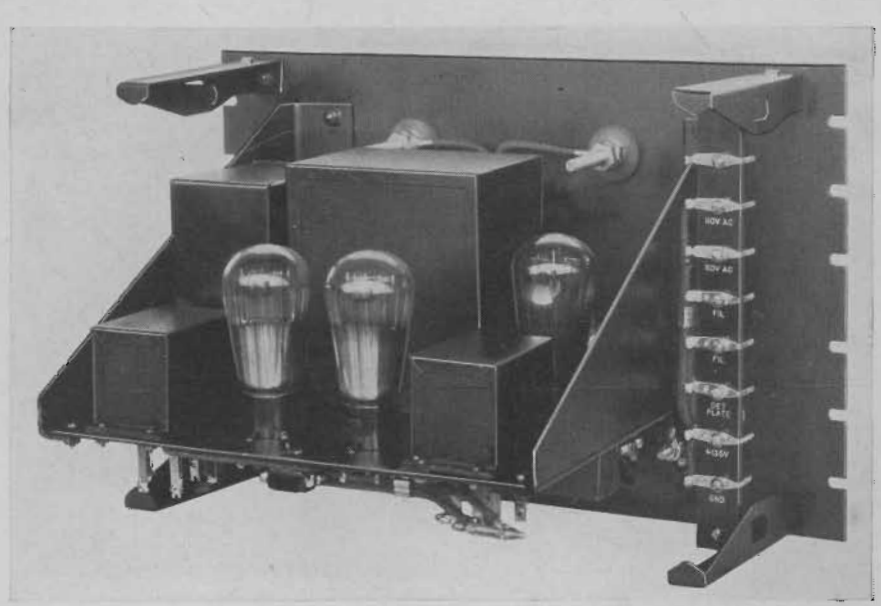


FIGURE 5
REAR OF METER-POWER SUPPLY UNIT. NOTE THAT AN OUTER COVER SLIDES ON OVER THE FOUR SUPPORTS SHOWN.

Radio Frequency Buffer

If a crystal-controlled oscillator is heavily loaded variations in the following stage will likely react upon it and tend to cause frequency changes. To make sure that this will not happen in the Type EX-4180

(Continued on next page)

NEWS ABOUT YOUR "FREQUENCY MONITOR"

(Continued from previous page)

Frequency Monitor a buffer stage has been placed between the crystal-oscillator and the detector. This allows the crystal stage to be very lightly loaded. Shielding and use of a screen-grid UY-224 Radiotron makes neutralization of this buffer stage unnecessary.

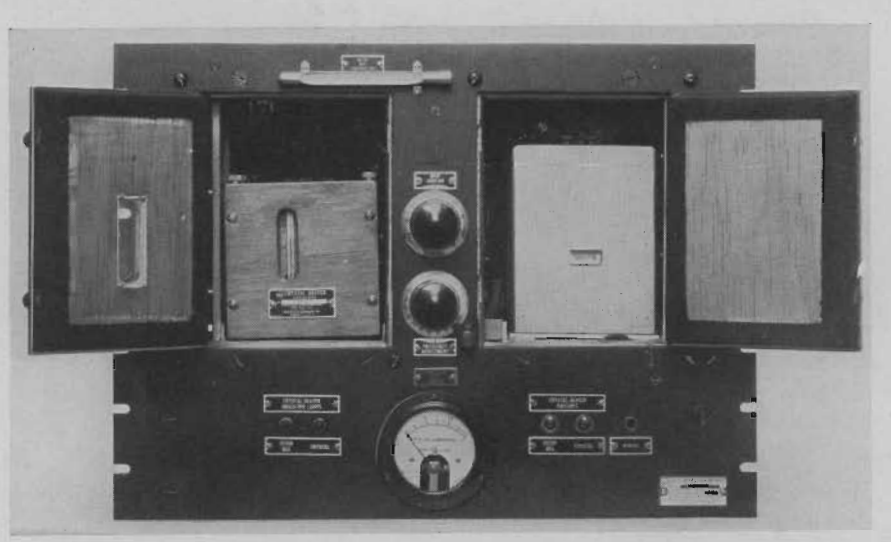


FIGURE 2
OSCILLATOR-SELECTOR UNIT WITH DOORS OPEN TO SHOW CRYSTAL HEATER BOX IN PLACE

Mixing Detector

Another UY-224 Radiotron is utilized as a detector. Two radio frequencies—one, the standard, supplied by the buffer mentioned above, and a second, picked up by very loose coupling to one of the unmodulated stages of the transmitter—are introduced in the grid of this detector. A potentiometer on the panel furnishes a convenient control of the amount of pickup from the transmitter. The output of the detector is an audio beat-note which is the difference between the transmitter carrier frequency and the frequency of the standard.

Audio Frequency Amplifier

Since the detector output would not be sufficient to drive a frequency meter of the desired dimensions an audio amplifier has been provided. This amplifier employs two of the new pentode type RCA-247 Radiotrons in a push-pull circuit. A voltmeter across the output enables correct regulation of the actual power supplied to the meter.

Large-Sized Frequency Meter

The output of the audio amplifier drives a large fan-type frequency meter. The size of this meter and its large and clearly marked scale making reading of it easy even from a considerable distance. This is of considerable practical advantage. It may, for instance, be mounted on a control rack adjacent to the transmitter and yet easily read from the operator's control desk some feet away. When the audio input to this meter is exactly 500 cycles the pointer is at zero. The scale extends 50 cycles either way from the zero point —thus indicating direction as well as magnitude of drift.

Self-Contained Power Supply

All plate voltages required by the Type EX-4180 Frequency Monitoring Equipment are supplied by a self-contained rectifier which utilizes a Type UX-280 Radiotron in a full wave rectifier circuit. The use of heater-cathode tubes in oscillator, buffer, and detector stages and RCA-247 Radiotrons in the power amplifier makes possible the lighting of all filaments from a.c. supply. Thus the equipment is entirely independent in operation and the use of batteries is unnecessary.

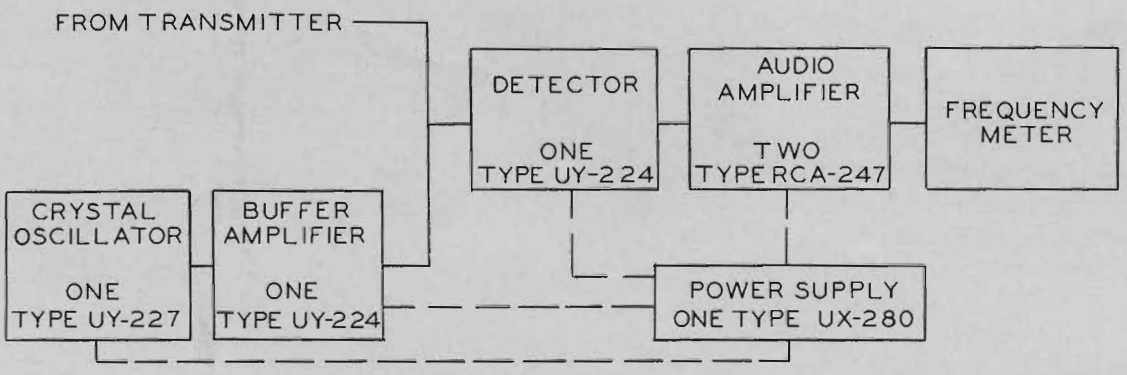


FIG. 1 BLOCK DIAGRAM OF TYPE EX-4180 FREQUENCY MONITORING EQUIPMENT

Continuous Operation

Once installed and correctly adjusted this equipment is practically automatic in operation. It is continuous in reading. The frequency deviation is indicated at all times when the transmitter is on. It is not, therefore, necessary to push a button to obtain a reading. The scale of the

frequency meter extends fifty cycles in each direction. A jack is provided for the insertion of headphones when check of a deviation greater than fifty cycles is necessary.

The salient features of this equipment are:

1. It enables broadcasting stations to conform with G. O. No. 116 in the most satisfactory manner—is furnished with a certificate showing approval of the Bureau of Standards.
2. It is designed to mount in an easily observed position on a standard rack in the transmitter control room—is automatic in operation and continuously indicating.
3. It is furnished with a large projecting fan-type frequency meter reading plus fifty cycles to minus fifty cycles—thus indicating direction as well as amount of drift.
4. It utilizes a newly perfected and particularly stable crystal circuit—incorporates a radio frequency buffer stage which precludes any possibility of reaction on the crystal stage.
5. It is provided with a vernier frequency adjustment which provides for occasional slight correction but which may, in the interim, be firmly locked.
6. It is completely A.C. operated—all voltages being supplied by a self-contained power supply which operates on 110 or 220 volts, 50 or 60 cycle alternating current.

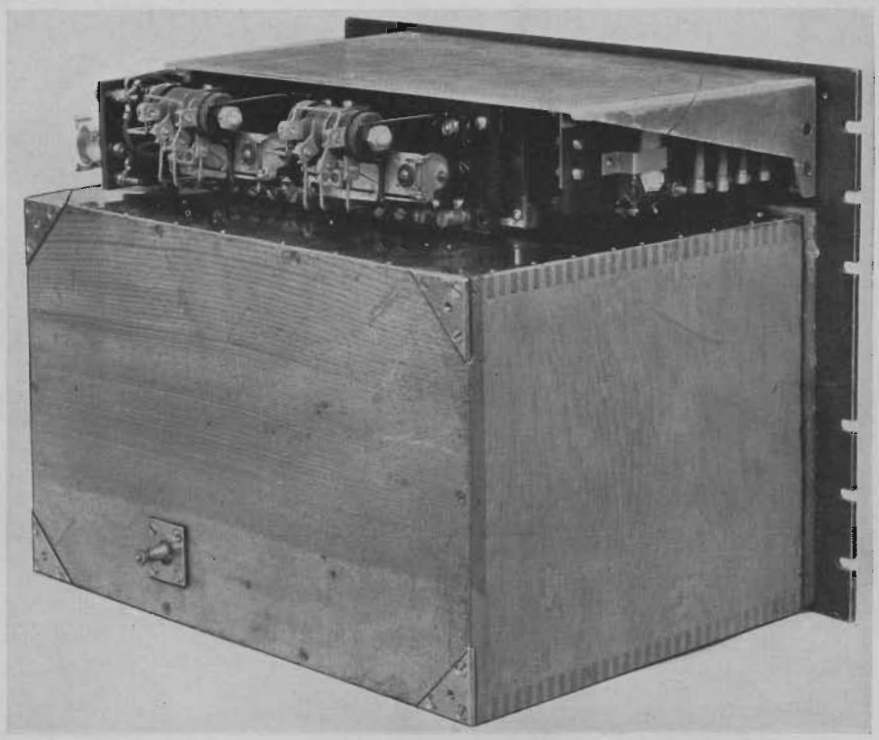


FIGURE 3

REAR OF OSCILLATOR DETECTOR UNIT SHOWING OUTER CABINET AND, AT TOP, HEATER RELAYS
NOTE THAT AN OUTER SHIELD GOES ON OVER THE EQUIPMENT SHOWN

SOMETHING NEW—A TWO STAGE VOLUME INDICATOR.
A PRODUCT OF THE RCA VICTOR COMPANY, INC.

The Type 13-C Volume Indicator is an accurate two-stage visual-indicating meter, specially designed for use as a level Indicator in the studio and remote control rooms of broadcast stations.

FEATURES

1. It is designed to mount on a standard rack,—to present a pleasing appearance harmonizing with that of other standard speech input units.
2. It has a high input impedance,—hence may be "bridged" directly across a program line without reducing either the level on that line or the accuracy of the reading.
3. It indicates on a meter which may be read to .1 db. levels between minus 12 db. and plus 42 db. on any line across which it is "bridged."
4. It provides,—in the coupling system employed between amplifier and rectifier tubes,—means of compensating for the error which would otherwise be introduced by variations in tubes.
5. It measures frequencies in the range of 30 to 10,000 cycles with substantial uniformity,—that is, within ± 1 db. of the 1,000 cycle value.

See Bulletin No. 16

NEW BULLETINS ISSUED

The following new bulletins have just come off the press, and are available to those interested in the subjects upon request to the Transmitter Sales Section, RCA Victor Company, Inc., Camden, New Jersey:

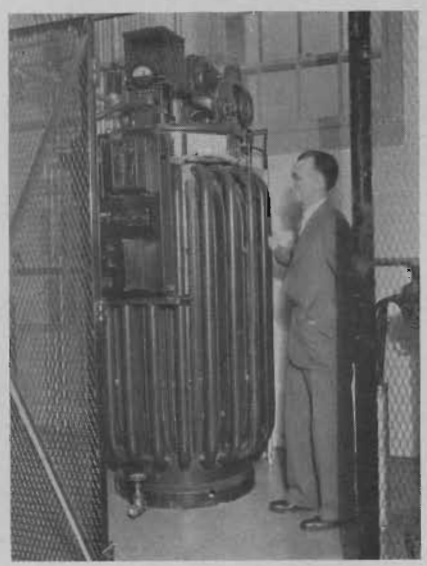
Bulletin No. 10—Precision Frequency Control Equipment, Type EX-4170
Bulletin No. 11—Condenser Microphones,—announcing Type 4AA1, Suspension Type 4AS1, Program Type 4AP1
Bulletin No. 12—Frequency Monitoring Equipment, Type EX-4180
Bulletin No. 13—Field Intensity Meter, Model TMV-21
Bulletin No. 14—Universal Amplifier, Type 24-B
Bulletin No. 15—Monitoring Amplifier, Type 14-B
Bulletin No. 16—Volume Indicator, Type 13-C
Bulletin No. 17—Program Amplifier, Type 12-B

SEND FOR YOUR COPIES

PIONEER NBC STATIONS MODERNIZED

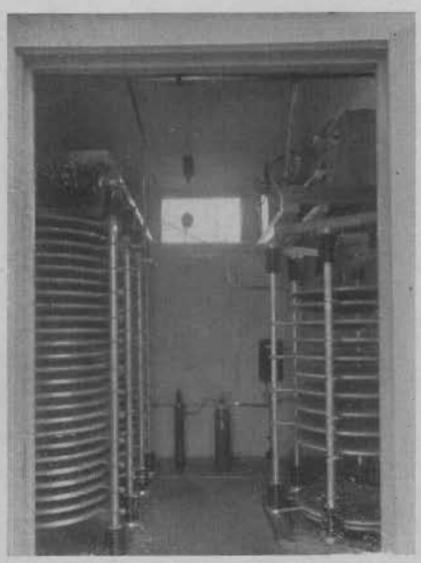
(Continued from page three)

Recent hourly frequency measurements over a complete period beginning at 6:30 AM and ending the next morning at 1:00 AM, showed a drift of only 4 cycles from a mean frequency. On a percentage basis the crystals therefore remained within .00053% of the assignment. Neither of these stations has ever been reported outside of its assigned frequency band.



D. N. STAIR IN CHARGE OF WJZ, INSPECTING THE AUTOMATIC VOLTAGE REGULATOR USED TO MAINTAIN CONSTANT POWER OUTPUT FROM THE RECENTLY INSTALLED RCA 50 B TRANSMITTER.

WEAF has operated with 50 kilowatts since the previous installation in 1927 while WJZ operates with 30 kilowatts.



HUGE AIR SPACED TUNING CONDENSERS USED TO TUNE RADIATING SYSTEM AT THE RECENTLY REMODELED TRANSMITTER OF STATION WJZ OF THE NATIONAL BROADCASTING COMPANY, AT BOUND BROOK, NEW JERSEY. THESE CONDENSERS WILL SUCCESSFULLY HANDLE OVER 150,000 VOLTS OF ELECTRICAL SPEECH ENERGY. THEY ARE OF SPECIAL NBC DESIGN BUILT TO WITHSTAND DIRECT STROKES OF LIGHTNING WITHOUT INTERRUPTING SERVICE.

It is interesting to compare the most recent WJZ transmitter installation with the pioneer 500 watt WJZ located on the Newark, N. J. works of the Westinghouse Company in 1921.

When this picture was taken O. B. Hanson, NBC, Manager of P. O. & E. was with WEAF; C. W. Horn, General Engineer was Supt. of Radio Operations for Westinghouse; the Writer was Enginner Announcer at WJZ, Newark.

BROADCAST FROM TRAIN

(Continued from page 22)

engineers, communications department executives and operations chiefs of the railroad worked with Cohan and A. B. Chamberlain, Chief Engineer of Columbia, on such preliminary tests as were possible. As a result of these surveys, it was decided that the exact zone of broadcasting would start outside of Washington.

One of the regular Colonial type dining cars of the Baltimore and Ohio was used as the broadcasting studio. These cars, the latest models in equipment, have rubber shock absorbers, ball bearings and permanently sealed windows. They are air cooled, and when stripped and fitted up technically—with the control room where the kitchen is normally located—approximate a broadcasting studio. For the actual broadcast, a special crew of mechanics went over the car from end to end to reduce to a minimum vibratory noises and other possible sources of interference.

Preliminary tests indicated that it was desirable to use two short wave pickup stations in order to secure proper reception at all times. One point of pick-up was located at Beltsville, Md., approximately ten miles out of Washington; the other at Laurel, Md., close to twenty miles out of Baltimore. The master control station was located at Laurel, and the Beltsville pick-up was fed by special circuits to Laurel, whence the program was transmitted over the nation-wide Columbia network. Because of the pioneering nature of the broadcast, it was carried also to foreign countries over Columbia's regular short wave stations, W2XE and W3XAU.

Due to the fact that the broadcast was introduced from New York and begun directly from the temporary station at Laurel before switching to the speeding train, two-way communication between the train and Laurel was necessary. For this purpose the special short wave transmitting station, W2XDZ, at Laurel carried instructions to the moving train. The train carried both sending and receiving short wave sets, and special antennae were installed on the roof of the studio car. More than $20,000 worth of special broadcasting equipment was used and the entire expenditure for the experiment probably reached $50,000.

The train from which the broadcast was made was running at speeds varying from 40 to 70 miles an hour in order to determine whether or not the rate of speed would affect reception.

The program broadcast was the Ever-Ready Radio Gaieties.

RADIO

Out of the metal a framework,
Out of the wood heart a box, and the mighty gates of distance
A touch of my hand unlocks.
Out of the emptiness atoms,
Out of electrons their charge, and the motion of the spaces
My casual wish enlarge.
Born of the nothing a rhythm,
Melody I can prolong, comes from the stillness voices,—
Out of the silence a song.

William H. Howard