BROADCAST NEWS

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IN THIS ISSUE

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BROADCAST NEWS

Edited by
E. JAY QUINBY

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WEST PORTAL, RCA HALL
IN THE ELECTRICAL BUILDING AT THE "CENTURY OF PROGRESS" EXHIBITION, CHICAGO
THE TALKING VICTOR DOG HAS BECOME A VERY POPULAR FEATURE OF THE SHOW.

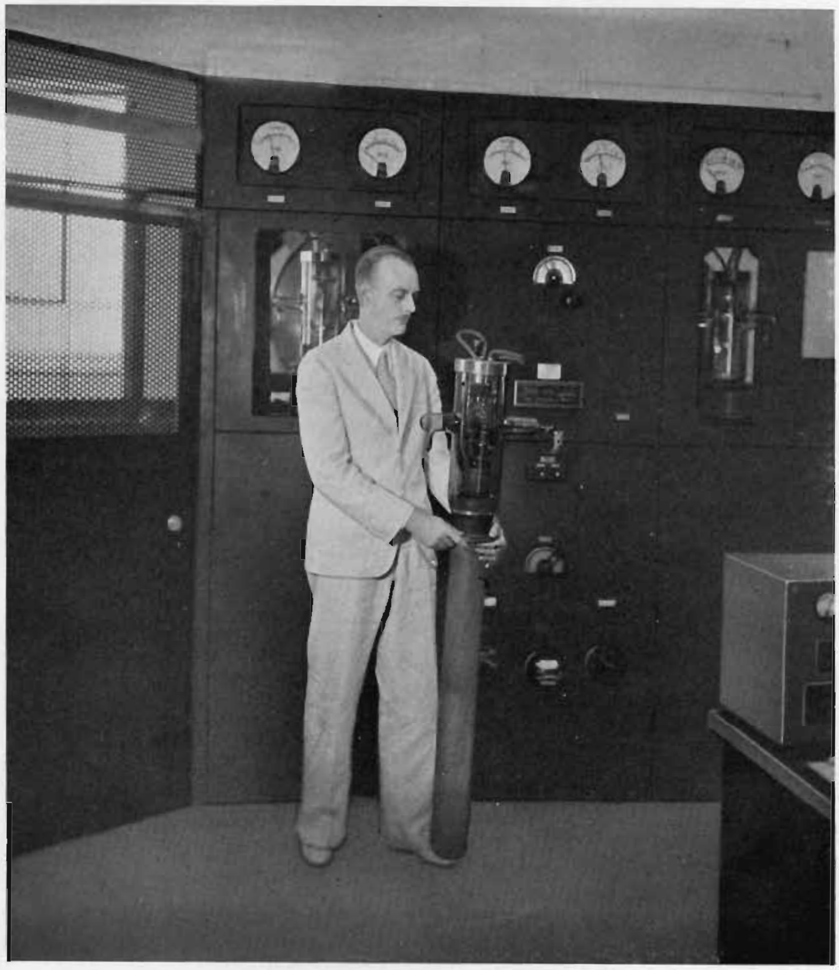
Increased Power for WOC—WHO

By P. A. LOYET, Technical Director, Central Broadcasting Co.

APRIL 22nd, 1933, marked the inaugural of another giant of the ether, the fifty kilowatt station of WOC-WHO, Des Moines, Iowa. The two old and well known 5,000 watt stations of the middle west went off the air to make way for the new RCA 50,000 watt transmitter located at Mitchelville, Iowa, fifteen miles airline east of Des Moines.

In the middle of a short dedicatory address by Col. B. J. Palmer, Managing Director of the Central Broadcasting Company, the two synchronized 5,000 watt stations in Davenport and Des Moines were shut down and the new fifty kilowatt station made its debut.

Three days later, on April 25th, a formal opening program was presented the station by the National Broadcasting Company, which was carried by the Red network. For three-quarters of an hour a wonderful array of talent was presented from Washington, New York and Chicago, after which the program was fed directly from the WOC-WHO studios in Des Moines and Davenport. Outstanding on this part of the program was the excellent congratulatory talk by Governor Clyde E. Herring of the state of Iowa.



P. A. LOYET, TECHNICAL DIRECTOR OF THE CENTRAL BROADCASTING COMPANY, HOLDING ONE OF THE HUNDRED KILOWATT RADIOTRONS BEFORE THE MAIN TRANSMITTER OF **WOC-WHO**

MAIN TRANSMITTER ROOM OF THE NEW RCA 50 K. W. STATION FOR **WOC-WHO**, DES MOINES

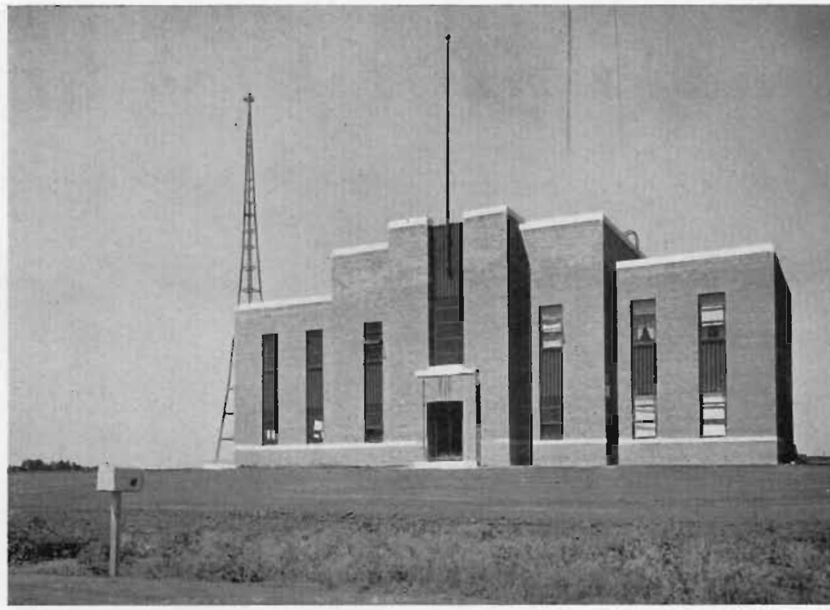
The opening of the new fifty kilowatt plant occurred almost to a day on the first anniversary of the dedication of the new WOC-WHO studios in Des Moines.

Location of Transmitter

As far as radio aspects are concerned, Iowa with its corn land presents one of the best prospects in the United States. After extensive field strength measurements the conductivity of the soil was found to be 180 x 10-15 EMU, which is probably the best inland conductivity ever measured. In actual measurement this transmitter lays down a

1,460 mv/m signal in a park in Davenport, 143 miles away, which is greatly in excess of that calculated. The whole of the 23 acres used for this installation has a 3½ foot black loam topsoil underlaid with blue clay, which bears water at three gallons per minute, the static head standing only 5½ feet below the surface. Truly, this is the ideal site for a wonderful buried ground system.

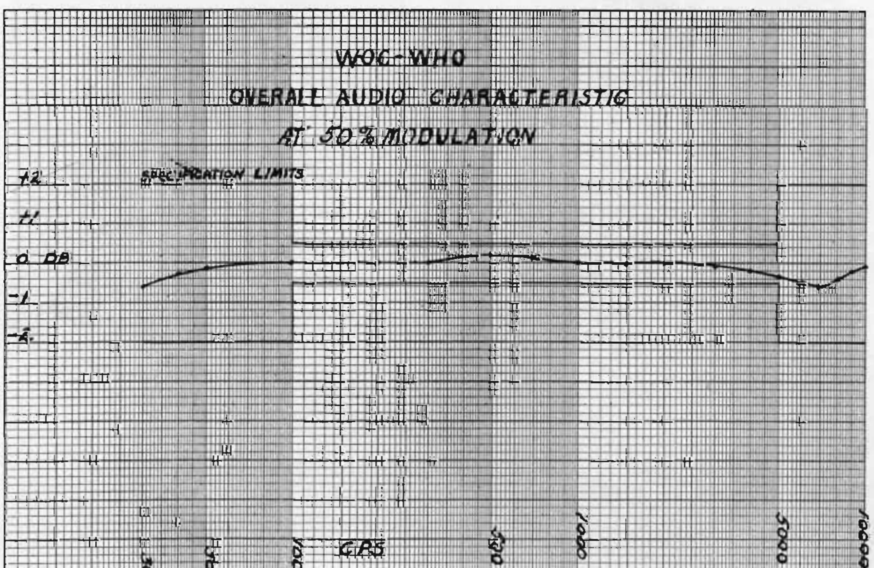
The site is located fifteen miles airline east of Des Moines, and one half mile south of National Highway No. 6, which is most desirable from a publicity and accessibility standpoint.



THE TRANSMITTER BUILDING OF **WOC-WHO**, DES MOINES, IOWA. HERE THE **RCA** 50 KILOWATT TRANSMITTER AND AUXILIARY EQUIPMENT IS INSTALLED. THE BUILDING IS ATTRACTIVELY FINISHED IN WHITE ENAMEL, EXCEPT FOR THE VERTICAL PANELS OF DIAGONALLY SET BRICK, WHICH ARE GREEN. ONE OF THE 300 FOOT STEEL TOWERS MAY BE SEEN IN THE BACKGROUND

Power and Telephone Facilities

Two substations feed the transmitter and are both situated at opposite ends of the property, each



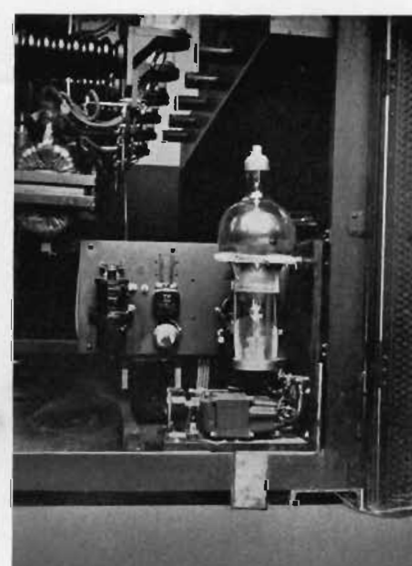
900 feet away from the transmitter building. The 2,300 volt supply from both substations is fed the whole 900 feet underground. The regular supply is from a 44,000 volt line and emergency from 6,[illegible] line. Manual switching in the transmitter building is used for changeover.

A ten pair telephone cable, buried three feet underground for a distance of 3,000 feet away from the transmitter building, brings broadcast loops and telephone line to the building. Both regular and emergency broadcast lines are equalized within 1.8 DB from 30 to 14,000 cycles, giving the station two of the finest transmitter feeds in the country. The telephone at the transmitter is a long line adjunct of the studio PAX system through the control room, and can be used to call and talk to any station in the broadcasting system, as well as dial any number on the Des Moines exchange.

Housing

The transmitter building is a completely fireproofed brick structure of two stories above ground and a large basement for water pumping and heating apparatus exclusively.

The building is rather unique in that completely conditioned air is used throughout. All air enters the building through a set of cleaning sacs and is forced by blower through a monstrous set of radiators, constructed much the same as an automobile radiator, except for size. In the winter the oil burning boiler supplies hot water to this large radiator and the air is preheated

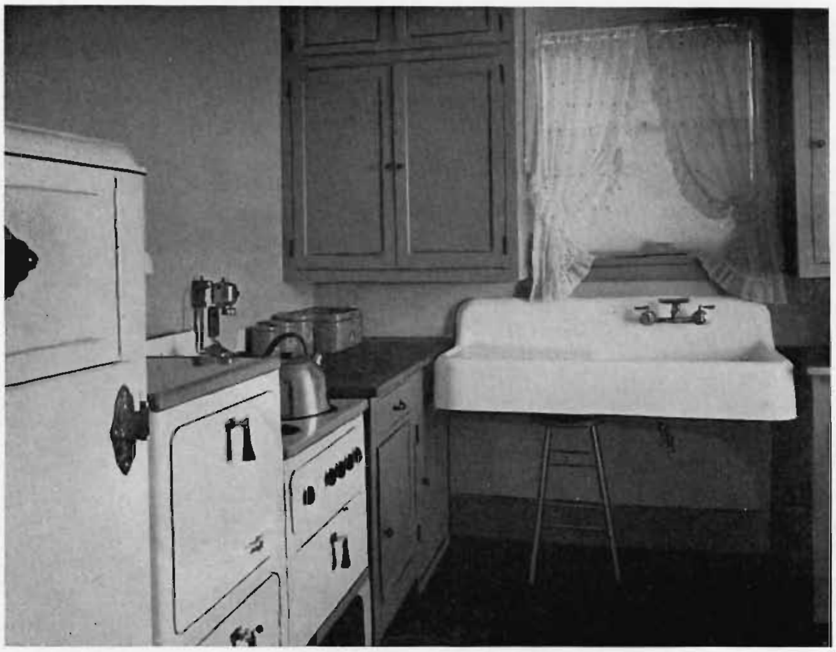


VIEW IN BACK OF MAIN RECTIFIER AT **WOC-WHO**, SHOWING STAND-BY UV-857 HEATER PANEL.

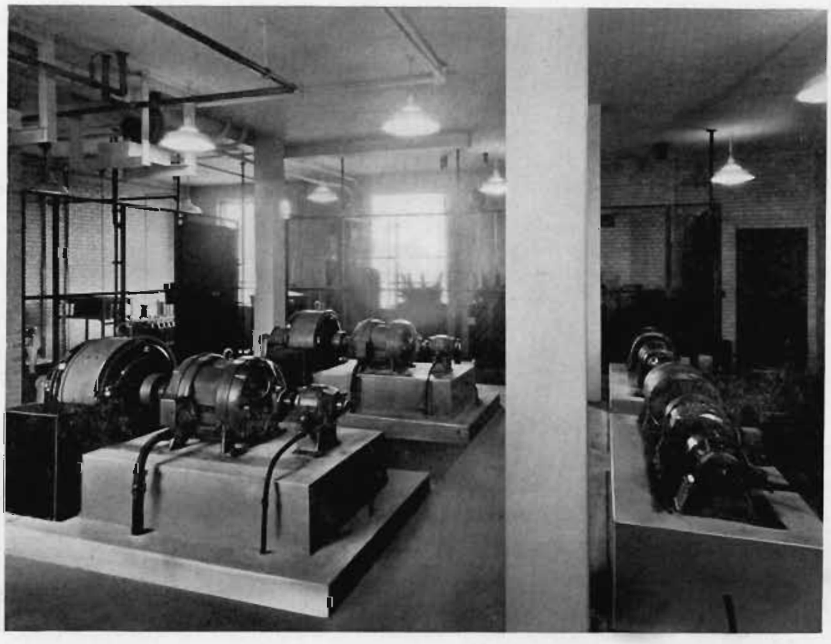
before entering the heating tunnels. The air is automatically humidified by spraying water controlled by a solenoid valve actuated in turn by a humidistat in the transmitter room.

In the summer, the boiler is shut down and fifteen gallons of water per minute is pumped from a deep well through the heating coils of the blower unit, cooling the air before entering the tunnels. This method of cooling seems to be superior to other spray types in this geographical location, due to the dehumidifying effect gained by passing the warm air over cold coils, extracting water from the air in the form of sweat on the coils. This water is drained off the unit and on very humid days considerable water seems to flow.

In spite of a relatively large surface supply, not near enough water was encountered to supply the building cooling needs. The building under full water drain needs 25 g. p. m., and to supply this demand the well had to be drilled to a depth of 1,150 feet. The static level is 150 feet with a draw down of some 150 additional feet at 25 g. p. m., making it necessary to set the pump cylinder at a depth of 330 feet. This setting requires a real man-sized pumping unit.



A GLIMPSE INTO ONE OF THE APARTMENTS PROVIDED FOR THE OPERATING STAFF IN THE TRANSMITTER BUILDING OF **WOC-WHO**



POWER ROOM ON THE GROUND FLOOR OF THE TRANSMITTER BUILDING, AT **WOC-WHO**

After the water is passed through the cooling coils it is either wasted in a large tile drain field or used from the sill cocks to water the shrubbery and lawn, and supply a fountain in a small pool. All of the latter landscaping is yet to be completed.

All water and heating equipment occupies the large basement under the front half of the building. This construction simplifies the air conditioning problem in that the heating tunnels are run the whole length of the building and risers from the tunnels are carried in the walls to the two floors above.

A bird's-eye view of the building would show a large cross, the vertical leg or main structure house ing the radio equipment and large entrance. The two horizontal legs would represent the two wings of the building.

A spacious three car garage occupies the first floor of the left wing. A large office, a shop and a tube storage room, form the upper floor of this wing. The right wing is reserved exclusively for personnel, with private entrance and separate stairway. This wing can be completely isolated from the transmitter section for privacy. The single men's apartment, comprised of bedroom, bath and kitchen, occupies the first floor, and the plant supervisor's apartment, consisting of living room, bedroom, kitchen and bath, complete the wing's second floor.

On each side of the spacious entrance, first floor, is a large storeroom for spare equipment with a small store-room off the garage for building and ground equipment such as hose, sprinklers, mowers, etc.

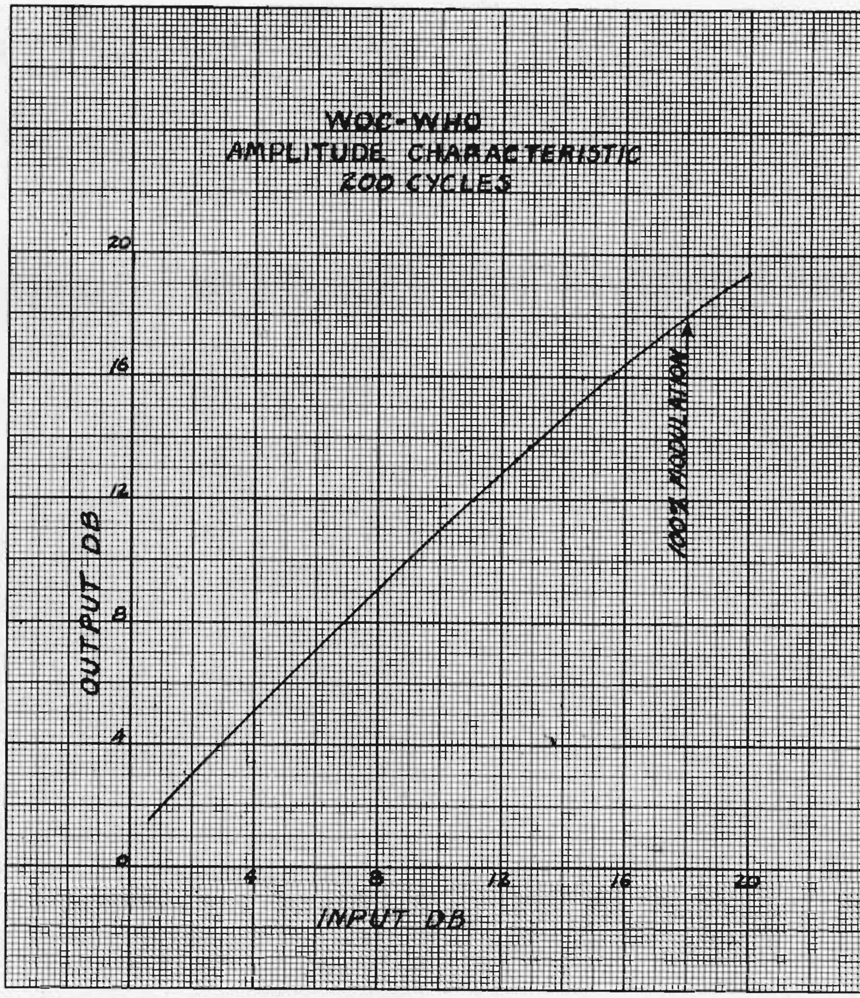
The large room immediately confronting the spectator entering the first floor entrance, houses the rotating machinery and power transformers. The continuity of the grill work around the high voltage transformers is not broken in the rear of the room, but is carried out by the wall closing off the water and pump room. The still and spare storage tank are also included in this room.

To the rear of the pump room is the one-story high cooling room and supply switching vault.

Upon entering the second floor entrance from the stair well, one faces the U-shaped conformation of panels making up the transmitter, with the 50 KW amplifier and control panel forming the center of the U. The transmitter is completely enclosed by grill work, leaving enough space for maintainance inside the cage and a four foot isle all around the outside for visitors inspection of the rear of all units.

It is interesting to note that there are no insulators or tubing fastened to the ceiling. All tubing is carried by the frames of the units or the grill work itself. The lower half of this grill is solid sheet to within six inches of the floor. This latter space is left to facilitate cleaning the floor.

Immediately to the front of the transmitter and to the left of the stair well is found the control room. It is a room 10 feet x 14 feet and double shielded. The outer or grounded shield is common copper fly screen and the inner floating shield No. 16 copper three mesh to the inch. The two are separated by tile walls and floor. The control room is as acoustically correct as a studio. It has a reverberation time of 0.5 second and the material is well distributed over the wall and ceiling areas above a four foot wainscot.



WOC-WHO AMPLITUDE CHARACTERISTIC

Three seven foot speech racks carry the speech input equipment which is entirely operated by A. C. The hum level is well below 90 DB in spite of the flat 30–10,000 cycle response of the speech input equipment, and the proximation of eliminator units. The monitor is mounted in the center bay of the speech rack assembly, providing an extremely rigid and large sized baffle, which together with the acoustic balance of the room provides the best of monitoring facilities.

RADIOTRON STORAGE ROOM AT **WOC-WHO**—HERE THE "SPARES" ARE KEPT IN CONVENIENT AND ORDERLY FASHION

The Antenna and Feeders

A 400 meter antenna is used, operating at 75% of the fundamental and slung between two 300 foot insulated towers spaced 750 feet apart. The towers are operated grounded following many tests of detuning.

The antenna tuning equipment is fed by means of a three wire feeder system, rather than the conventional two wire design. The center wire is grounded at both ends, serving as a metallic connector between the antenna ground and the transmitter ground systems.

The Iconoscope

A Modern Version of the Electric Eye

By V. K. ZWORYKIN, E. E., Ph. D., RCA Victor Company, Inc.

THIS paper gives a preliminary outline of work with a device which is truly an electric eye, the Iconoscope, as a means of viewing a scene for television transmission and similar applications. It required ten years to bring the original idea to its present state of perfection.

The Iconoscope is a vacuum device with a photo-sensitive surface of a unique type. This photo-sensitive surface is scanned by a cathode ray beam which serves as a type of inertialess commutator. A new principle of operation permits very high output from the device.

The sensitivity of the Iconoscope, at present, is approximately equal to that of photographic film operating at the speed of a motion picture camera. The resolution of the Iconoscope is high, fully adequate for television.

The paper describes the theory of the device, its characteristics and mode of operation.

In its application to television the Iconoscope replaces mechanical scanning equipment and several stages of amplification. The whole system is entirely electrical without a single mechanically moving part.

The reception of the image is accomplished by a kinescope or cathode ray receiving tube described in an earlier paper.

The tube opens wide possibilities for applications in many fields as an electric eye, which is sensitive not only to the visible spectrum but also to the infra-red and ultra-violet region.

The idea of being able to observe far-away events is a fascinating one. A device which will enable a person to do so has been for centuries the dream of inventors and for decades the goal of earnest scientific workers.

The goal of television is to make this dream a reality. The problem, however, is a difficult one and requires for its solution a great many component elements, most of them unknown up to quite recent years.

As an indication of what RCA Victor engineers are doing in the direction of television development, we invite your attention to this paper by Dr. V. K. Zworykin, which he has prepared for the I. R. E. Proceedings. Through the courtesy of that publication, we are reproducing Dr. Zworykin's paper herewith, including his illustrations, as we believe that many of our readers may not have the good fortune to see the issue of I. R. E. Proceedings in which this work will appear.
—Editor.

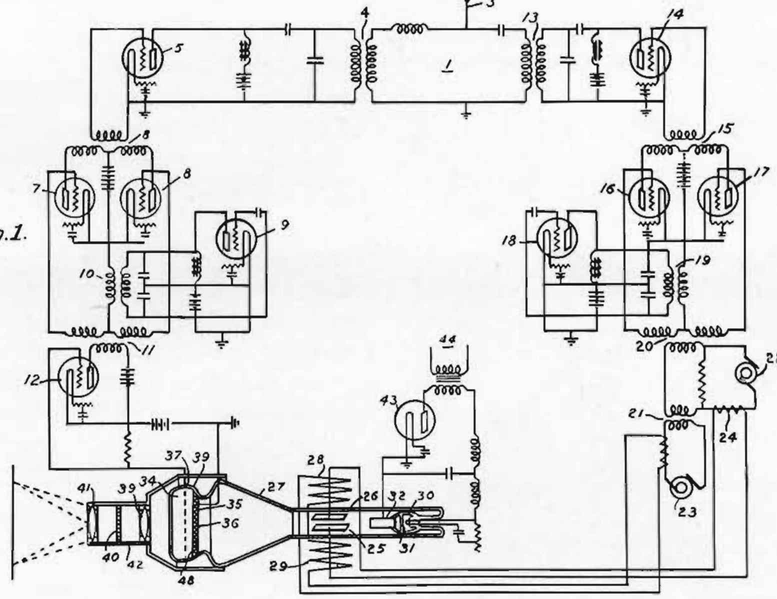
The meaning of seeing over a great distance can be interpreted as sending instantaneously a picture through this distance. This requires means of communication extremely rapid and free from inertia. The discovery of electricity and the development of electrical communication, therefore, laid the foundations for the future realization of television.

The first step which enabled the conversion of the picture into electrical energy was taken by May in 1873 through the discovery of the photo-resistive property of selenium. Further advance came from Hertz fifteen years later by the discovery of the photoelectric effect. The succeeding years witnessed rapid progress in this line from the study of the effect by Hallwachs, Elster and Geitel and others.

How eagerly the experimenters were taking advantage of these new tools placed at their disposal is illustrated by the fact that the first proposal of a solution of the television problem by means of the selenium cell was made by Carey in 1875, or only 2 years after its discovery. Carey proposed to imitate the human eye by a mosaic consisting of great numbers of minute selenium cells. The second attempt to construct a mosaic of this kind with a small number of elements was made by Ayrton and Perry in 1877. Later in 1906 Rignoux and Fournier used a mosaic of this type to transmit simple patterns and letters. Their transmitter consisted of a checkerboard of sixty-four selenium cells. Each cell was connected by two wires to a corresponding shutter in a similar checkerboard comprising a receiver. The picture was projected on selenium cells, creating in them electric currents which, in turn, operated the shutters. The light from behind the shutters reproduced the picture.

The idea of separating the picture into small elements, converting the illumination of each element into electrical current, and sending each through a separate wire is a good one, but leads to a very elaborate system. To transmit a picture of good quality, a great many pairs of separate wires would be required, which, of course, is impractical. To simplify the problem, Nipkow in 1884 proposed that instead of sending all the elements of the picture at

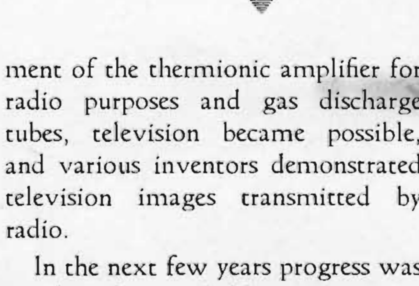
Fig.1.



once to transmit the picture point by point, or to scan the picture. This proposal simplified the problem considerably, since it enabled the transmission of the picture over a single wire or over a single communication channel.

The means by which this simplification was achieved was the scanning disc. The introduction of the scanning disc alone, however, did not bring the solution of the problem, due to the lack of some more essential elements. Almost forty years later, through the develop-

FIG. #2



ment of the thermionic amplifier for radio purposes and gas discharge tubes, television became possible, and various inventors demonstrated television images transmitted by radio.

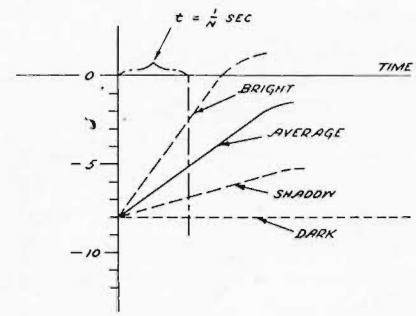
In the next few years progress was rapid and remarkable results were obtained, considering the difficulties encountered during this period of development. Practically all the work was done with mechanical methods of scanning, using either Nipkow discs, polygonal mirrors, mirrored screws, etc. This involved purely mechanical complications in construction of sufficiently precise scanners, difficulties in increasing the number of picture elements and particularly in obtaining sufficient light. This last limitation actually introduced a stone wall which prevented the increase of the resolution of the transmitted picture to obtain the necessary quality and practically excluded all hope of transmitting an outdoor picture—the real goal of television.

In order fully to understand the reasons for this difficulty we should remember that the picture in all conventional systems of television is scanned point by point and therefore the photosensitive element is affected by the light from a given point only for a very short interval of time corresponding to the time of illumination of one picture element. Assume for a picture of good quality, we desire 70,000 picture elements. For twenty repetitions per second, this means that the time of transmission of one picture element is 1/1,400,000 of a second. On the other hand, the output of the photocell, which goes into the amplifier is proportional to the intensity of the light and time during which the light is acting on the photocell. A brief computation shows how microscopic will be the output of the photocell for this number of picture elements. If we take an average photographic camera with a lens F-4.5, the total light flux falling on the plate from a bright outdoor picture is of the order of 1/10th of a lumen. Substituting a scanning disc for the plate suitable for 70,000 picture elements and placing a photocell of 10 microamperes/lumen sensitivity, we will have a photo current from a single picture element

$$I_e = \frac{1 \times 10^{-5}}{1 \times 70{,}000} = 1.43 \times 10^{-11} \text{amp.}$$

The charge resulting from this cur-

FIG #3



rent in the time of one picture element is

$$Q = I \times t = \frac{1.43 \times 10^{-11}}{1.4 \times 10^{6}} = 1 \times 10^{-17}$$

coulombs

comparing that with a charge of one electron, $e = 1.59 - 10^{-19}$ coulombs, we see that only 63 electrons are collected during the scanning of one element. The amplification of such small amounts of energy involves practically insurmountable difficulties. If we now compare this condition with that of a photographic plate during exposure, we will see that the latter operates under much more favorable conditions since all its points are affected by the light during the whole time of exposure. This time for studio exposure is several seconds, and of the order of one hundredth of a second for outdoor exposures, or many thousands times greater than in the case of the scanned televised picture. The human eye, which we regard as an ideal of sensitivity, operates also under the same favorable condition.

If a television system could be devised which would operate on the same principle as the eye, all the points of the picture would affect the photo-sensitive element all the time. Then in our example of a picture with 70,000 elements the photoelectric output for each point would be 70,000 times greater than in the conventional system. Since scanning is still necessary in order to use only one communication channel, we should have some means for storing of the energy of the picture between two successive scannings of each point.

FIG. #5

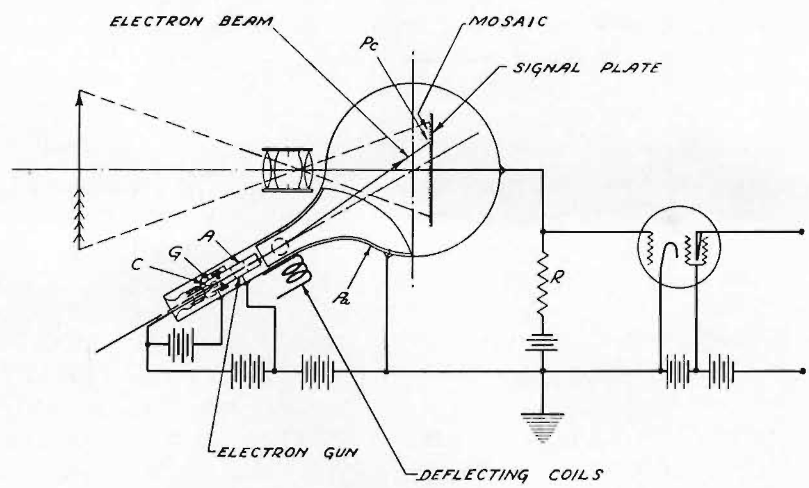
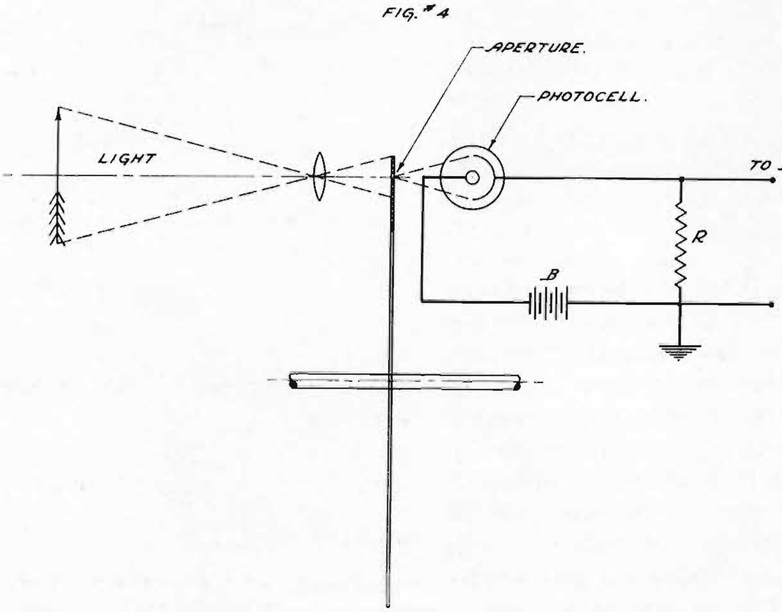


FIG. #4



One of the first receptions of a picture with a cathode ray tube was achieved in 1929, using a mechanical galvanometer for transmitter.** This was reported at the Rochester meeting of the I. R. E. in November, 1929. The next year the work was moved to the laboratories of RCA Victor Company, Inc., in Camden, where development of the cathode ray receiving system was continued, the pickup being obtained with a scanning disc. This has been described in a series of papers in the Proceedings of the I. R. E.

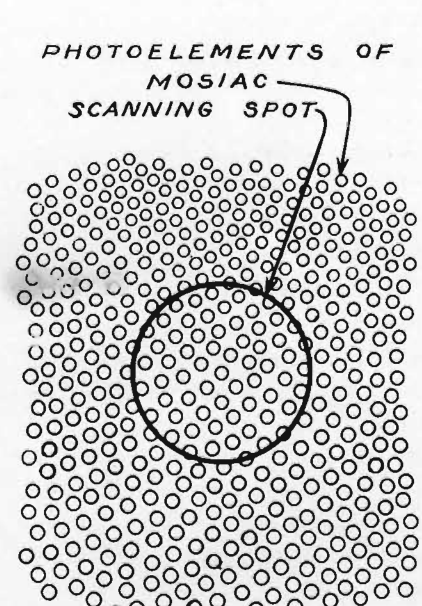
**V. K. Zworykin, Radio Engineering, December, 1929.

The writer began to work on the realization of this idea years ago, and devised various solutions of the problem. One of the solutions of this problem involved the use of a special cathode ray tube with a photosensitive mosaic structure applied on an insulated metallic plate, as shown in Figure 1. This represents a picture from one of the patents already issued upon one form of the development.* Each element of the mosaic is a miniature photoelectric cell. The picture is projected on this mosaic, resulting in continuous emission of photoelectrons according to the distribution of light of the picture. The charge acquired by each element of the mosaic is released by the cathode ray beam once in each repetition of the picture. The resulting impulses were amplified and used to modulate the intensity of the cathode ray beam in the receiving tube, in which the picture was reproduced on a fluorescent screen.

Transmitting tubes of this type were actually built quite a few years ago and proved the soundness of the basic idea. During the succeeding years this development was carried on in the Research Laboratories of the Westinghouse Electric and Manufacturing Company in East Pittsburgh.

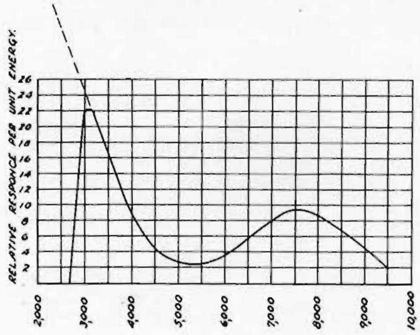
*U. S. Patent No. 1,691,324, Issued November 13, 1928, Filed July 13, 1925.

FIG #6



In the meantime, the development of the pickup tube was pushed and the results obtained from it soon surpassed the results of mechanical scanning and eventually completely replaced it. The tube itself is called the "Iconoscope" from the Greek word "Icon" meaning an image and "scope" signifying observation.

FIG. #7



WAVELENGTH IN ANGSTROMS.

To understand fully the operation of the Iconoscope, it is best to consider the circuit of a single photoelectric element in the mosaic, as shown in Figure 2. Here P represents such an element and C its capacity to a plate common to all elements, which hereafter will be called the "signal plate." The complete electrical circuit can be traced starting from the cathode Bc to C, then to resistance R, source of e.m.f. B and back to the anode P_a. When light from the projected picture falls on the mosaic each element P_c emits electrons, and thus the condenser element C is positively charged by the light. The magnitude of this charge is a function of the light intensity. When the electron beam which scans the mosaic strikes this particular element P_cC that element receives electrons from the beam and may be said to have become discharged.

This discharge current from each element will be proportional to the positive charge upon the element and, hence, the discharge current will be proportional to the light intensity at the particular element under question. The electrical circuit then transforms this discharge current into a voltage signal across the output resistor R.

If we plot the rise of charge of the element P_cC with respect to time, as shown on Figure 3, the potential will continuously increase due to the light of the picture. The slope of this increase or $\frac{dv}{dt}$ will depend only on the brightness of the particular point of the picture shining on this element. This linearity will be preserved until the saturation of the capacity C, which is so chosen as never to be reached at a given frequency N of repetition of the discharge. Since the scanning is constant, the interval of time, t, which is equal to 1–N is also constant and therefore the value of charge depends only on the brightness of this particular point of the picture. With constant intensity of the scanning beam, the impulse through R and consequently the voltage drop V_I across R is also proportional to the brightness of a given point of the picture. This potential V_I is the output of each single photo-element of the Iconoscope, which is applied to an amplifier.

The above explanation is actually somewhat complicated by the fact that this discharging beam not only neutralizes the positive charge of the photo-element, but charges it negatively. The equilibrium potential of the element is defined by the velocity of the beam and the secondary emission from the photo-emitting substance due to bombardment by the electrons of this velocity. This equilibrium condition in the dark, for a normal Iconoscope, is of the order of 5 to 10 volts negative. The light causes the element to gain a positive charge, thus decreasing the normal negative charge, and the scanning beam brings it back again to the equilibrium potential.

Another complication is due to the existence, besides the discharge impulses, of a charging current of the entire mosaic due to light. This current is constant for the stationary picture and varies when the picture, or part of it, begins to move across the mosaic. This variation, however, is very slow and does not affect the amplifier which has a cut-off below 20 cycles.

In order to compare the magnitude of this output with that of the conventional television system, using a perforated disc, under identical conditions, we will write down the value of the output for the Iconoscope and for the usual mechanical method. A typical circuit for mechanical scanning is shown in Figure 4.

The output of the photoelectric cell measured across the resistance, R, from the disc scanner is

$$V_d = R \times \frac{L}{n} \times S$$

L = light flux corresponding to the total image,

S = sensitivity of the photo element,

n = number of picture elements,

R = input resistance.

Considering the time necessary to build up the picture signal, we have to satisfy the condition that the time

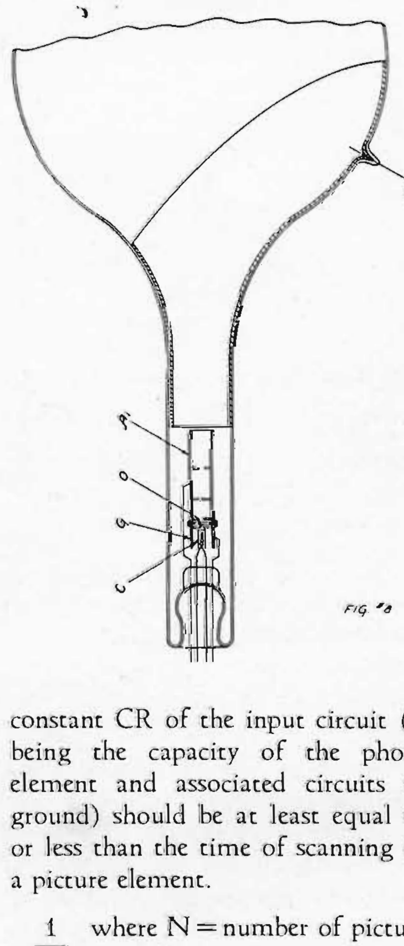


FIG. #8

constant CR of the input circuit (C being the capacity of the photo element and associated circuits to ground) should be at least equal to or less than the time of scanning of a picture element.

$\frac{1}{Nn}$ where N = number of picture frames per second.

or

$$CR = \frac{1}{Nn}$$

from which

$$R = \frac{1}{NnC}$$

Introducing this in the expression of output of the photoelectric cell, we have

$$V_d = \frac{L}{n} \times S \times \frac{1}{NnC}$$

which shows that the output decreases as the square of the number of picture elements.

For the charge on one picture element of the Iconoscope, we can write approximately

$$q = \frac{L}{n} \times S \times t$$

where t is the time during which the light shines on the element and which roughly equals

$$t = \frac{1}{N}$$

The output voltage from the Iconoscope will be

$$V_I = \frac{q}{C_I}$$ where C_I is the total input capacity of Iconoscope and associated circuits to the ground,

or

$$V_I = \frac{L \times S}{n \times N \times C_I}$$

The ratio between outputs from the Iconoscope and disc scanner will be

$$n = \frac{\dfrac{L \times S}{n \times N \times C_I}}{\dfrac{L \times S}{n^2 \times N \times C}} = n\frac{C_I}{C}$$

or for equal output capacity

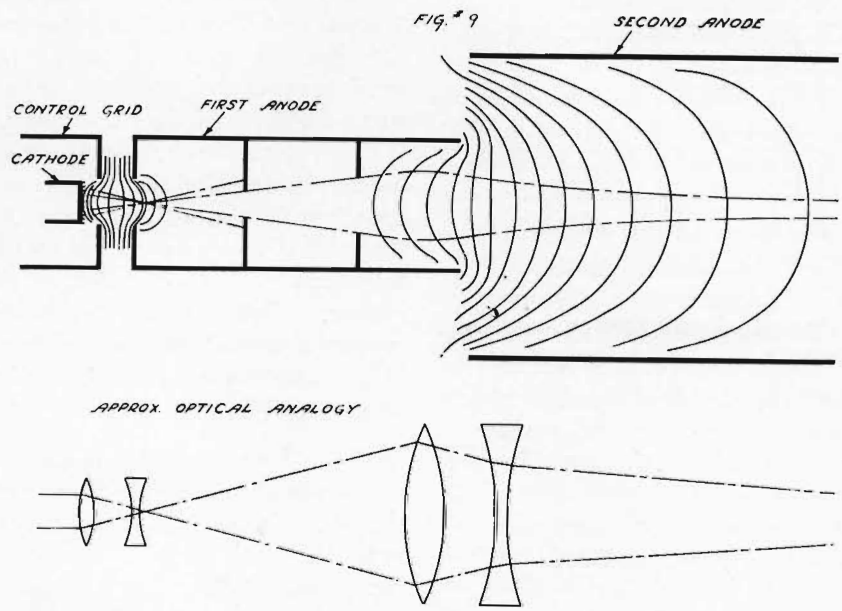
$n = n$ (the number of picture elements)

If we take the previously given number of picture elements $n = 70{,}000$, the net theoretical gain of the mosaic system against the conventional system of television is equal to 70,000 times. It should be noted, however, that 100% efficiency can hardly ever be attained for various reasons, but we have already achieved approximately 10% efficiency which gives us a net gain of several thousand times. These several thousand times increase of picture signal output do not serve to merely decrease the necessary amplification. In the conventional television system, we have already pushed the amplification as far as it is possible from the point of view of permissible noise to picture signal ratio. This gain, therefore, is the only factor whereby real television can be achieved, if we understand by this term not only the transmission of a picture of limited definition under artificial conditions but the actual transmission of a picture of high resolution under reasonable or natural conditions of illumination.

The scanning of an object with the flying spot is not considered in this computation, because it represents an entirely artificial condition and cannot be used for television pictures of distant objects.

The schematic diagram of a complete electrical circuit for the Iconoscope is shown in Figure 5. Here the two parts of the photo element P, shown on Figure 2 are entirely, separated. The cathodes are in the shape of a photo-sensitive mosaic on the surface of the signal plate and isolated from it, the anode is common and consists of a silvered portion on the inside of the glass bulb.

The capacity C of each individual element with respect to the signal plate is determined by the thickness and dielectric constant of the insulating layer between the elements and the signal plate. The discharge of the positive charge of the individual elements is accomplished by an electron beam originating from the electron gun located opposite the mosaic and inclined at 30° to the normal passing through the middle of the mosaic. Both mosaic and electron gun are enclosed in the same highly evacuated glass bulb. The inclined position of the gun is merely a compromise in the construction in order to allow the projection of the picture on the surface of the mosaic.



The resolution of the Iconoscope is determined by both size and number of picture elements in the mosaic and size of the scanning electron beam. In practice, however, the number of individual photo elements in the mosaic is many times greater than the number of picture elements, which is determined entirely by the size of the scanning spot. This is shown diagrammatically on Figure 6. From the initial assumptions formulated in the analysis of the ideal circuit for individual elements, as shown on Figure 2, we find the qualifications which should satisfy the mosaic for the Iconoscope. These assumptions required that all the elements be of equal size and photo-sensitivity and equal capacity in respect to the signal plate. The fact that the exploring spot is much larger than the element modifies and simplifies this requirement so that the average distribution, surface sensitivity and capacity of elements over an area of the mosaic corresponding to the size of the scanning spot should be uniform. This allows considerable tolerance in the dimensions of individual elements.

The requirement of uniformity, which at first glance is quite difficult to accomplish, is solved by the help of natural phenomena. It is known that such a common material as mica can be selected in a thin sheet of practically ideal uniform thickness and it therefore serves as a perfect insulating material for the mosaic. The signal plate is formed by a metallic coating on one side of the mica sheet. The mosaic itself can be produced by a multitude of methods, the simplest of which is a direct evaporation of the photoelectric metal onto the mica in a vacuum. When the evaporated film is very thin it is not continuous but consists of a conglomeration of minute spots or globules quite uniformly distributed and isolated each from the other. Another possible method is that of ruling the mosaic from a continuous metallic film by a ruling machine.

Although the initial method of formation of the photo-sensitive mosaic was the deposition of a thin film of alkali metal directly on an insulating plate, subsequent developments in the photocell art resulted in changes in the methods of formation of the mosaic.

The mosaic which is used at present is composed of a very large number of minute silver globules, each of which is photo-sensitized by caesium through utilization of a special process.

Since the charges are very minute the insulating property and dielectric losses should be as small as possible. Mica of good quality satisfies this requirement admirably. However, other insulators can also be used and thin films made of vitreous enamels have proven to be entirely satisfactory. The insulation is made as thin as it can be made conveniently.

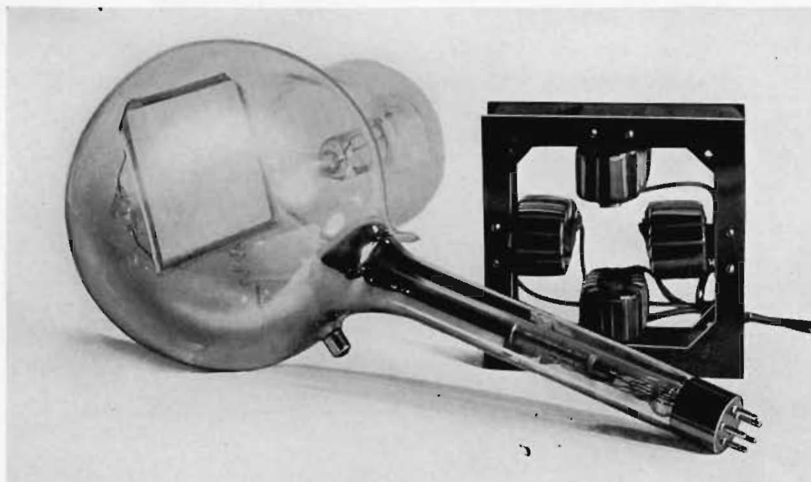
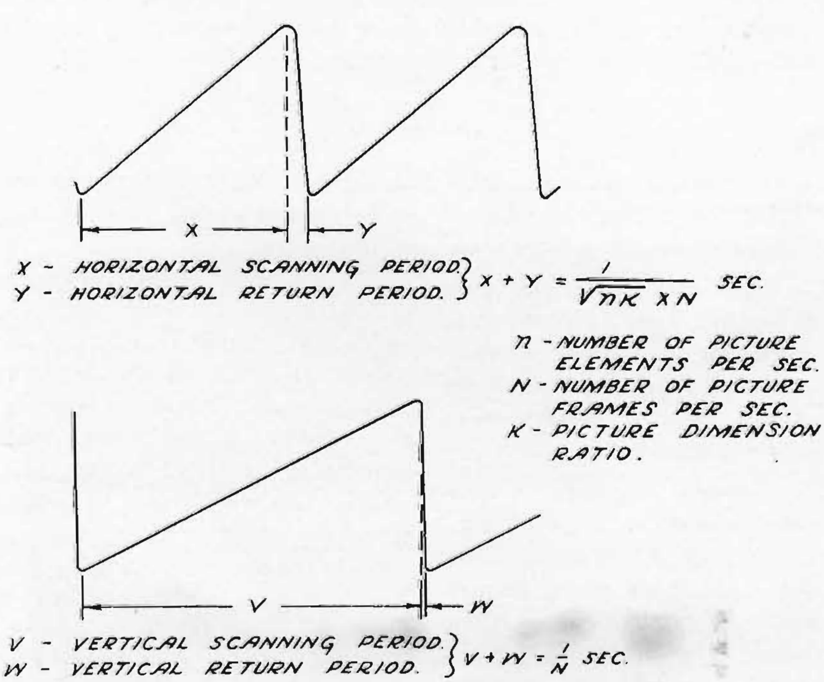


FIGURE 10

FIG. #11



The sensitivity of the mosaic is of the same order as that of corresponding high vacuum caesium oxide photocells. The same is true also of the color response. The spectral characteristic is shown on Figure 7. The cut-off in the blue part of the spectrum is due to the absorption of the glass. The actual color sensitivity of the photo elements themselves is shown as a dotted curve.

The electron gun producing the beam is quite an important factor in the performance of the Iconoscope. Since the resolution is defined by the size of the spot, the gun should be designed to supply exactly the size of spot corresponding to the number of picture elements for which the Iconoscope is designed. For the given example of 70,000 picture elements and a mosaic plate about 4" high, the distance between two successive lines is about 0.016" and the diameter of the cathode ray spot approximately half of this size. This imposes quite a serious problem in gun design.

The electron gun used for this purpose is quite similar to the one used for the cathode ray tube for television reception or the kinescope, which has already been described in several papers.* The components of the gun are shown in Figure 8. It consists of an indirectly heated cathode, C, with the emitting area located at the tip of the cathode sleeve. The cathode is mounted in front of the aperture O of the controlling element G. The anode A_L consists of a long cylinder with three apertures aligned on the same axis with cathode and control element. The gun is mounted in the long narrow glass neck attached to the spherical bulb housing the mosaic screen. The inner surface of the neck as well as the part of the sphere is metallized and serves as the second anode for the gun and also as collector for photo electrons from the mosaic. The first anode usually operates at a fraction of the voltage applied to the second anode. which is approximately 1,000 volts.

The focusing of the electron beam is accomplished by the electrostatic field between elements of the gun and between the gun itself and the second anode. The distribution of equi-potential lines of the electrostatic field is shown on Figure 9. The theory of electrostatic focusing for this type of gun has already been published by the writer.** Briefly summarized, it amounts to the fact that a properly shaped electrostatic field acts on moving electrons in the manner as a lens on a beam of light. The action of the field in the Iconoscope gun is roughly equivalent to a composite lens consisting of four glasses, two positive and two negative. The optical analogy is shown on the same figure. The actual appearance of the Iconoscope is shown on Figure 10. Its overall length on this particular model is 18″ and diameter of the sphere 8″.

The deflection of the electron beam for scanning the mosaic is accomplished by a magnetic field. The deflection coils are arranged in a yoke which slips over the neck of the Iconoscope. The assembled deflecting unit is shown besides that of the tube. The scanning is linear in both vertical and horizontal directions and is caused by saw-tooth shaped electrical impulses passing through the deflecting coils and generated by special tube generators. The resultant ... of the scanning

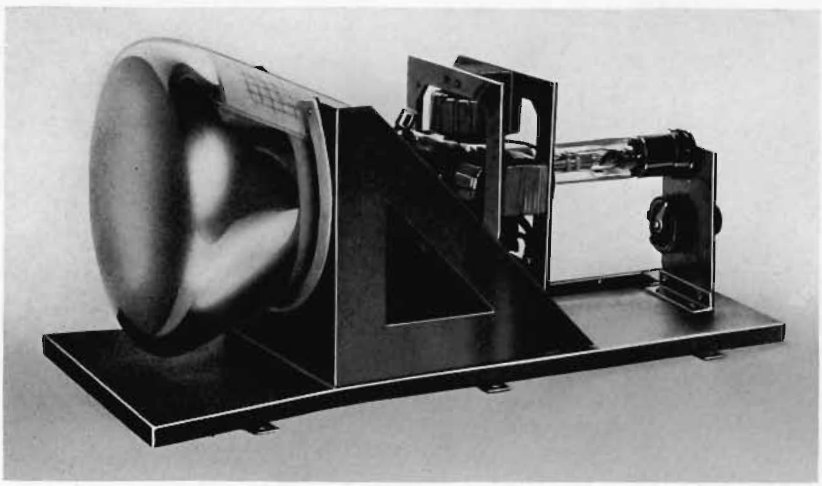


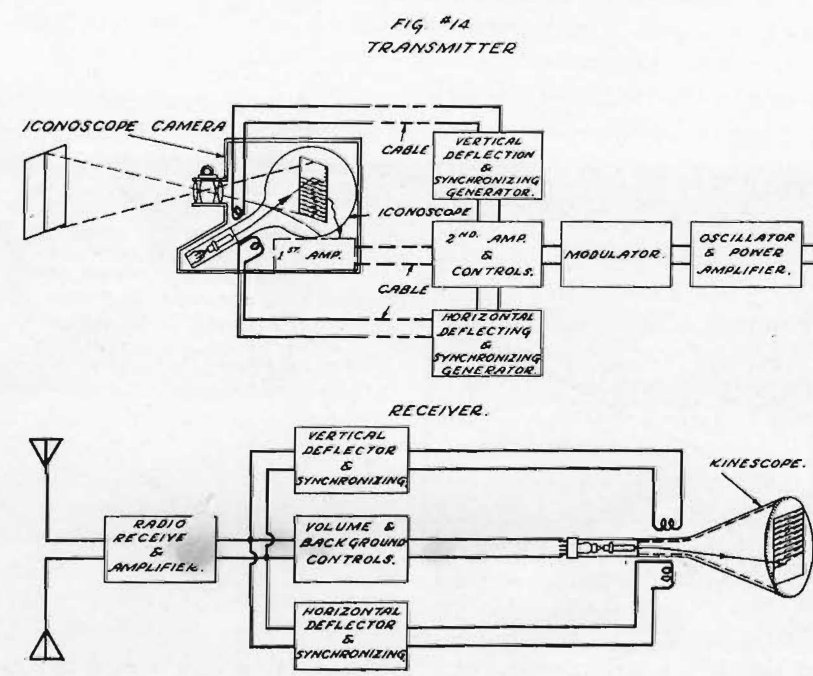
FIGURE 13

cathode ray spot plotted with respect to time is shown on Figure 11. The circuits for these generators as well as methods of synchronizing were given in a previous series of papers in these Proceedings.*

Since the Iconoscope is practically a self-contained pickup unit, it is possible to design a very compact camera containing the Iconoscope and a pair of amplifier stages connected with the main amplifier and deflecting units by means of a long cable. Since the camera is portable, it can be taken to any point of interest for the transmission of a television picture. The photograph of such a unit is shown on Figure 12.

The reception of images transmitted by the Iconoscope is accomplished by means of the cathode ray receiving tube or kinescope. This tube was described in the writer's earlier paper (see previous citation). The picture of the tube is shown on Figure 13.

The complete block diagram of the circuit associated with the transmitting and receiving ends of the whole system is shown on Figure 14.



The main feature of this scheme, as seen from this diagram, is that in the whole system there are no mechanically moving parts and the transmission of the picture is accomplished entirely by electrical means.

*V. K. Zworykin, previous citation
**V. K. Zworykin, Journal of Franklin Institute

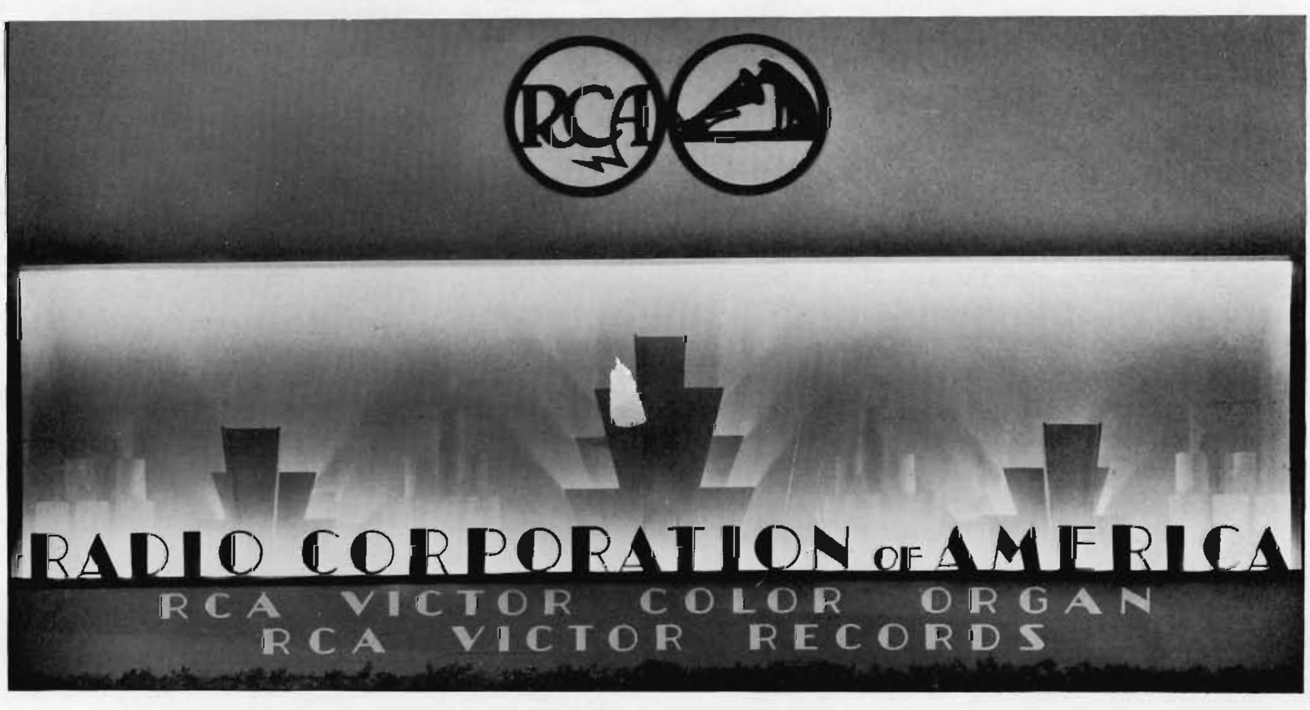
FIGURE 12

From the color response curve shown on Figure 7, it is clear that the Iconoscope can be used not only for transmission of pictures in visual light but also pictures invisible to the eye in which the illumination is either by ultra-violet or infra-red light.

The present sensitivity of the Iconoscope is approximately equal to that of a photographic film operating at the speed of a motion picture camera, with the same optical system. The inherent resolution of the device is higher than required for 70,000 picture element transmission. Some of the actually constructed tubes are good up to 500 lines with a good margin forf uture improvement.

With the advent of an instrument of these capabilities, new prospects are opened for high-grade television transmission. In addition, wide possibilities appear in the application of such tubes in many fields as a substitute for the human eye, or for the observation of phenomena at present completely hidden from the eye, as in the case of the ultra-violet microscope.

The writer wishes gratefully to acknowledge the untiring and conscientious assistance of Messrs. G. N. Ogloblinsky, S. F. Essig, H. Iams and L. E. Flory, who carried on much of the theoretical and experimental work connected with the development which has been described in the foregoing, and whose ability was the major factor in the successful solution of the many problems arising in the course of this work.



THE RCA VICTOR COLOR ORGAN

AT THE "CENTURY OF PROGRESS" EXHIBITION, CHICAGO—A DELIGHTFUL AND FASCINATING SYNCHRONIZATION OF MUSIC AND COLORFUL LIGHT RAYS WHICH CAST THEIR MAGIC SPELL OVER THOSE APPROACHING THE NORTH PORTAL OF RCA HALL.

The RCA–850 Radiotron

By H. F. DART, Tube Development Engineer

THE RCA-850 Radiotron has been designed to meet certain requirements that are fairly definite; namely, the ability to operate efficiently at a moderate plate potential and the requirement of a minimum of space or volume. There are many transmitter installations where a plate potential of the order of 1,000 to 1,250 volts is already available or can be obtained at reasonable cost. This is feasible in many cases where a moderate amount of power is required and where it is desired to use this tube in conjunction with some of the so-called 50–100 watt tubes for modulators which operate in this approximate plate potential range. In addition to resulting in economical tube outlay, the auxiliary equipment need not be insulated for such high voltages and will therefore be less expensive.

In other cases, the space taken by the radio transmitter and even that required by the individual tubes is very valuable and makes the space reserved and used by each tube of considerable importance. This is especially true of aircraft installations in which a great deal of effort is expended in an attempt to keep the volume of all equipment at a minimum.

The RCA-850 Radiotron is a screen grid or 4-electrode tube designed chiefly for radio frequency amplifier service. The whole design has been so arranged that the elements are rigidly supported as a single assembly unit. The tube may thus be used in practically any type of service, although shock-absorbing mountings should be used if the tube is subjected to vibration or shock. Also, the operating characteristics will be more stable if the tube is properly mounted.

Figure 1 is a photograph of the RCA-850 Radiotron. The tube weighs approximately 8 ounces and the gross shipping weight of the tube, carton and packing material averages 2 pounds. The tube has

the standard four-pin base as used on the line of 50–100 watt tubes and fits into the RCA Victor socket No. UT-541. The screen grid connects with the usual control grid pin in the base, the other lead connections being standard. In order to separate the leads as much as possible and further reduce any tendency for plate to grid coupling externally, the control grid lead is taken through the top of the bulb and is provided with a suitable attaching cap.

The screen grid acts as an electrostatic shield between the plate and control grid as is usual in other four electrode transmitting Radiotrons. The potential of the screen grid is held constant in certain types of service with the result that variations in the potential of the plate have practically no effect on the control grid. Since there is very little coupling through the tube from the plate circuit, the necessity for neutralization to prevent feed back and self-oscillation is reduced.

The outline shown in Figure 2 gives detailed information on the overall and other dimensions which will be of value in installing this tube. As the bulb becomes very hot during operation, some additional clearance should be provided for cooling and to prevent damage to nearby materials as well as for electrical protection.

The plate supply potential may be conveniently obtained from a rectifier using suitable Radiotrons together with the usual filter equipment. It is desirable to use an ammeter in the plate circuit to indicate that the plate current is neither excessive nor above the maximum rating. The grid bias may be obtained from a grid leak of approximately 5,000 ohms for most types of service or from a negative potential drop from the plate supply or even from a separate source. The peak power in the grid circuit of a class B amplifier may be relatively large and such that the usual filter system cannot maintain an absolutely constant grid bias. It is, therefore, generally advisable to use a generator or storage battery in this type of service to prevent the introduction of objectionable distortion.

The screen grid potential may be obtained from a separate source or through a series resistance from the plate supply and so designed and adjusted in either case as to give approximately one-sixth of the plate potential. Since with the resistance method of obtaining screen grid potential, opening of the filament circuit would place the full plate voltage on the screen grid, the filament should not be opened without first removing the plate potential. With a potentiometer or a separate source of voltage, the screen grid potential should not be applied without the plate circuit also being closed.

The resistance method is, in general, more desirable as it automatically maintains a proper screen grid potential. The best value of series resistance varies with the screen grid supply potential, load and excitation. Also, the impedance between the screen grid and filament must be kept as low as possible by the use of by-pass condensers.

If this tube is to be plate modulated, the best results can be usually obtained by modulating the screen grid potential simultaneously with the plate potential so that the percentage changes in both voltages are approximately equal. High modulation can also be obtained if the series resistance method for supplying screen grid potential is used. The best value of series resistance,

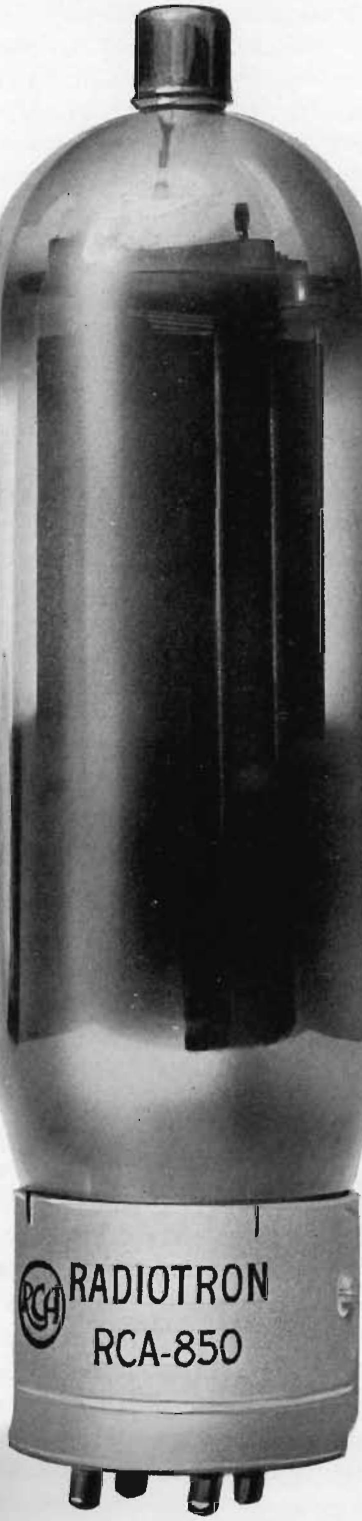


FIGURE 1—RADIOTRON RCA-850

TABLE I

RADIOTRON RCA-850
TECHNICAL INFORMATION SHEET

GENERAL:

Main Use	R. F. Power Amplifier and Oscillator
Number of Electrodes	4
Filament Potential	10 Volts
Current	3.25 Amperes
Type	Thoriated Tungsten

Average Characteristic Values Calculated at:
$E_b = 1{,}000$, $E_d = 200$, $I_b = 0.0195$ A., $E_f = 10$ V. D-c.

Grid Bias	0 Volts
Amplification Factor	550
Plate Resistance	200,000 Ohms
Grid-Plate Transconductance	2,750 Micromhos

Approximate Direct Interelectrode Capacitances:

Plate to Grid (Filament and Screen Grounded)	0.25 mmf. Maximum
Grid to Filament and Screen	17 mmf. Average
Plate to Filament and Screen	25 mmf. Average

Maximum Overall Dimensions:

Length	8½ Inches
Diameter	2⁵⁄₁₆ Inches
Base Type Numbers	1839 and 3903
Type of Cooling	Air

MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

R-F POWER AMPLIFIER—CLASS B—TELEPHONY

(Carrier conditions to which a modulation factor up to 1.0 can be applied)

Maximum Operating Plate Potential	1,250 Volts
Maximum Unmodulated D-c. Plate Current	0.150 Ampere
Maximum Plate Dissipation	100 Watts
Maximum Screen Dissipation	10 Watts
Maximum R-f Grid Current	5 Amperes

Typical Operation:
E_b 1,000, $E_c = -8$, $E_d = 175$ approximate, $E_f = 10$ V.

Unmodulated D-c. Plate Current	0.10 Ampere
Peak Output	120 Watts
Carrier Output—Modulation Factor 1.0	30 Watts

OSCILLATOR AND R-F POWER AMPLIFIER—CLASS C—TELEGRAPHY

(Key Down Conditions)

Maximum Operating D-c. Plate Potential	1,250 Volts
Maximum D-c. Plate Current	0.175 Ampere
Maximum D-c. Grid Current	0.040 Ampere
Maximum Plate Dissipation	100 Watts
Maximum Screen Dissipation	10 Watts
Maximum R-f. Grid Current	7.5 Amperes

Typical Operation at:
$E_b = 1{,}000$, $E_c = -150$ approximate, $E_d = 175$ approximate, $E_f = 10$ V.

Output	100 Watts

PLATE MODULATED OSCILLATOR AND R-F POWER AMPLIFIER—CLASS C—TELEPHONY

(Carrier conditions to which a modulation factor of up to 1.0 can be applied)

Maximum Screen Dissipation	7 Watts
Maximum Operating D-c. Plate Potential	1,000 Volts
Maximum D-c. Plate Current	0.150 Ampere
Maximum R-f. Grid Current	5 Amperes
Maximum Plate Dissipation	70 Watts

Typical Operation:
$E_b = 750$, $E_d = 125$ approximate, $E_c = -100$ approximate, $E_f = 10$

Output	50 Watts

May 22, 1933 K-7000070

by-pass condenser, and general operating adjustments finally adopted will depend upon the general transmitter design, including the frequency or wavelength to be used and the required fidelity of output signal. In some cases where 100% modulation is not desired, satisfactory results can be obtained by the use of a fixed screen grid potential.

The filament may be operated from alternating current unless direct current is necessary from the standpoint of hum. It is desirable to install a filament voltmeter with its leads connected directly across the filament terminals of the socket. In this manner, the filament can be maintained at the correct rated operating value which will insure maximum tube life. As the filament is of the thoriated tungsten type and depends for its emission on a surface layer of active material, it should be operated at the rated potential. Less than this value may in time result in loss of emission caused by too low a rate of diffusion of the active material on the surface of the filament while more than rated potential will also cause loss of emission due to a too rapid evaporation of the active material.

Another characteristic of the thoriated filament Radiotron is that the activity of the filament may usually be restored even though the electron emission has been decreased by a severe overload or temporary overheating of the tube. This reactivation process may be accomplished by operating at rated filament potential for 10 minutes or more with the plate voltage off. This process may be accelerated by raising the filament potential to 12 volts for a few minutes.

Electrical Ratings

Radiotrons are rated with certain operating values given as maximum limits, that is, values beyond which it is unsafe to operate from the standpoint of life and performance. The Technical Information Sheet gives the maximum operating plate potential and the amount of plate potential fluctuation due to load and line voltage changes, as well as manufacturing variations in the operating apparatus must be determined or estimated. An average value of plate voltage must then be decided upon so that under the usual operating variations the maximum rated plate potential will never be exceeded.

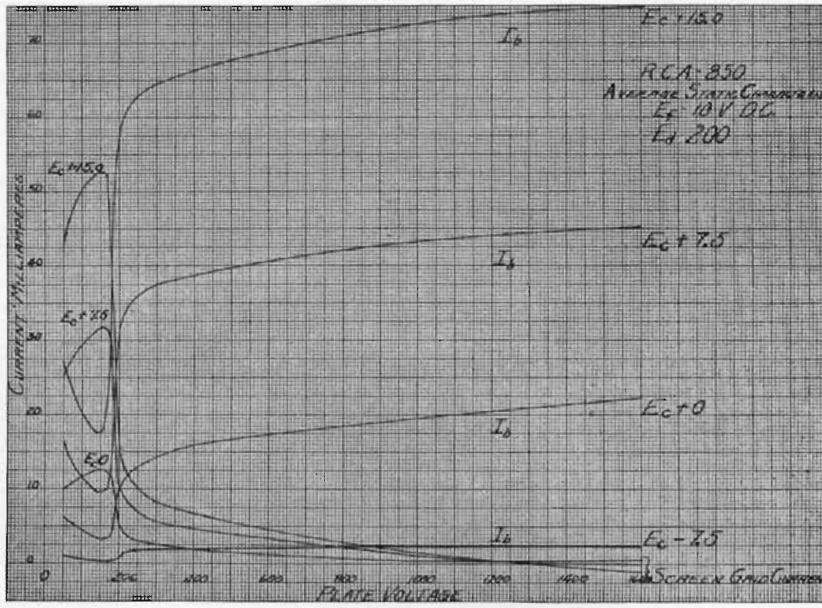


FIGURE 5—RADIOTRON RCA-850—AVERAGE STATIC CHARACTERISTICS

Still other values are given as typical operating conditions which, however, must not be considered as ratings since the tube can be used under any combination of suitable ratings to secure the desired operating characteristics. The output values given in the Table are approximate tube outputs, that is, the tube plate input minus plate loss. Circuit losses must be subtracted from the tube output in calculating the output in any particular part of the circuit and the output figures must be considered as approximate values obtainable under certain typical operating conditions rather than as output ratings.

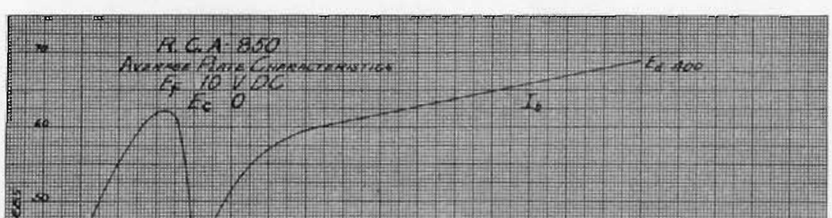


FIGURE 3—RADIOTRON RCA-850—AVERAGE PLATE CHARACTERISTICS

The general average characteristics and operating ratings and limits for the RCA-850 Radiotron are given in Table I. The maximum ratings apply only when the tube is used for frequencies below approximately 13 megacycles or for wavelengths above 23.5 meters. When the tube is used at still higher frequencies, the radio frequency currents and dielectric losses greatly increase the consequent heating effects. Although the tube was not designed for operation at the higher frequencies and other Radiotrons are recommended for operation under these conditions, satisfactory operation with reduced output has been obtained in experimental circuits at frequencies as high as 30 megacycles when proper precautions were taken.

In operating this tube at the higher frequencies, care must be taken to reduce the plate potential with proportional reduction in plate current and dissipation, so that at 30 megacycles the plate potential, current and dissipation and D-c. grid current will never exceed 50% of the maximum ratings. Of course, the useful output under these latter conditions will be not more than 25% of that which can be obtained over the frequency range where the full maximum ratings apply.

In any case, the maximum radio frequency grid current must not be exceeded. Furthermore, since operation at the higher frequencies results in higher heat losses, special attention must be given to proper ventilation and the maintenance of normal ambient temperatures.

In radio frequency power amplifier—class B telephony service, the plate potential is D-c. unmodulated and the grid excitation is radio frequency modulated at audio frequency in one of the earlier stages. Table II gives typical operating conditions for two different plate potentials and a tube output efficiency of approximately 30% can usually be obtained in this type of service. This is defined as the ratio of carrier output to plare input. In this service, the screen grid supply potential, for best results, must be supplied from a separate source such as a generator or battery and not from a resistance in series with the plate supply. The values given are for conditions such that a modulation factor of 1.0 can be used. The values themselves are taken with no applied modulation, the output being pure carrier.

TABLE II

D-c. Plate Voltage	Typical Peak Output Watts	Approximate Grid-Bias Voltage	Approximate Screen-Grid Voltage	Typical Tube Carrier Watts	Typical Plate Current Amperes	Typical Plate Loss Watts
1,000	120	−8	175	30	0.100	70
1,250	160	−8	175	40	0.110	98

TABLE III

Plate Voltage	Approximate Screen-Grid Voltage	Approximate Grid-Bias Voltage	Plate Current Amperes	Typical Carrier Output Watts
750	125	−100	0.140	50
1,000	140	−100	0.125	65

TABLE IV

Plate Voltage	Output Watts	Plate Current Amperes	Approximate Screen-Grid Voltage	Approximate Grid-Bias Voltage
750	55	0.160	175	−150
1,000	100	0.160	175	−150
1,250	130	0.160	175	−150

The plate modulated oscillator and radio frequency power amplifier ratings for Class C Telephony service apply when the plate supply voltage is modulated so that the tube produces a modulated radio frequency power output. Table III gives typical operating conditions chosen so that a modulation factor of 1.0 can be used. The values, except for peak output, are those taken when no modulation is applied, the output being pure carrier. These values should be used as a guide in adjusting a circuit using tubes of this type, and, regardless of the actual value of input and output, the efficiency should always be sufficient to limit the plate dissipation to the rated value. As is indicated elsewhere, conservative operation will result in increased tube life and improved operation.

The ratings and typical operating conditions for radio frequency power amplifier operation in Class C Telegraphy service are given on the Technical Information Sheet and in Table IV.

In this class of service the plate input power to the tube is keyed or alternately on and off as in telegraph keying service. During the periods when the key is down or plate power is on, the tube functions as an unmodulated radio frequency power amplifier and the tabulated data were taken under these conditions. The output and other values

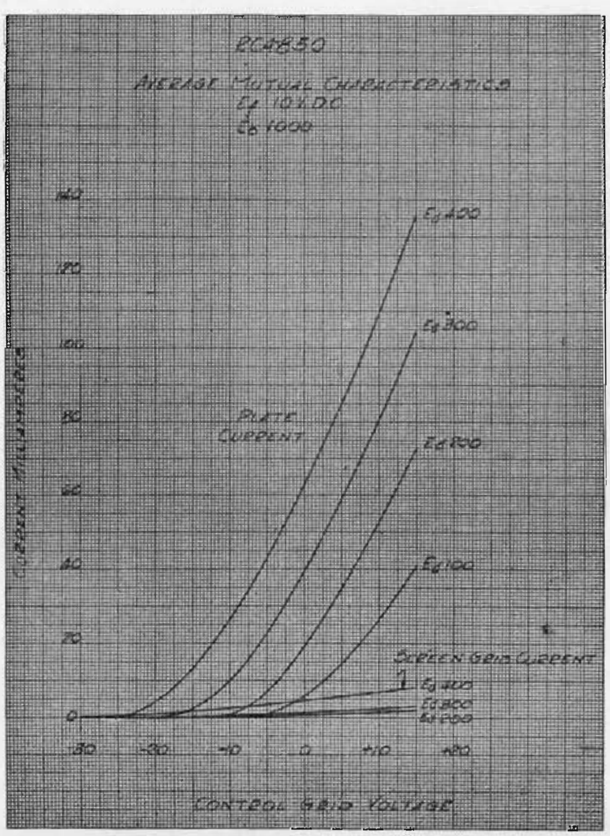


FIGURE 4. RADIOTRON RCA 850—AVERA[illegible]

indicated in the table are typical and will vary with individual tubes and circuits.

Characteristic Curves

The characteristic curves for Radiotron RCA-850 show certain data which are useful in designing the circuits and auxiliary apparatus to be used with the tube. These characteristic curves are plotted from data obtained on a number of tubes and represent the average of such data. Individual tubes may vary somewhat from these averages but never enough so as to seriously affect interchangeability and replacement. As this tube is used mainly in radio frequency power amplifier circuits and occasionally as an oscillator for special reasons, the control grid and plate voltage swings are very large and plate current is passed by the tube only over a small part of the cycle. These facts should be kept in mind when using the static characteristics because the curves indicate the action of the tube over only a limited range.

The values of plate and screen grid current have been plotted against plate voltage in Figure 3 for three screen grid potentials and at zero grid voltage. At the lower plate potentials, the plate current becomes relatively low due to secondary emission from the plate. The screen grid then draws electrons from both the plate and filament resulting in a screen grid current peak. As the plate potential increases (with constant grid potential), the plate current rises rapidly to its normal value, while the screen grid current drops to a very low value due to secondary emission from the screen grid.

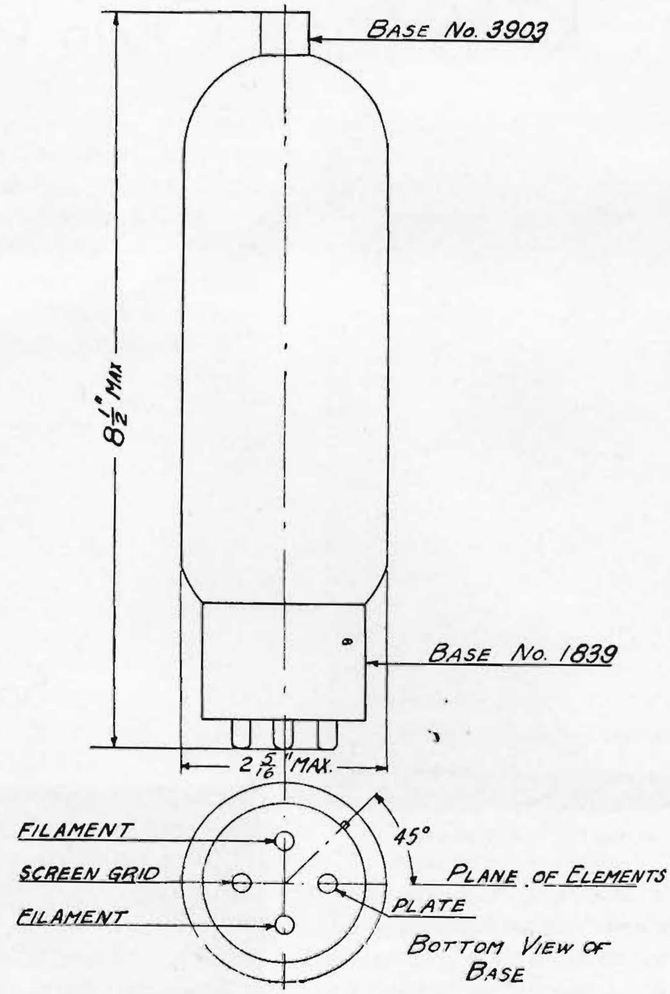


FIGURE 2—OUTLINE OF RADIOTRON RCA-850

Figure 4 gives the plate and screen grid current plotted against the control grid potential for various values of screen grid voltage and at the normal plate potential. From these curves, the grid plate trans-conductance may be calculated and operating conditions ascertained.

In Figure 5 curves of plate and screen grid current for a screen grid potential of 200 volts have been plotted against plate voltage for several values of control grid potential. Values are chosen to cover the most common operating range.

New Transcription Turntables Win Recommendations

In a recent letter to Scott Howe Bowen, Inc., National Representatives for Broadcasting Stations, Mr. Jack Byers, President of the Byers Recording Laboratory, has some very complimentary remarks to make concerning the new RCA Victor Transcription Turntables.

The Byers Recording Laboratory, which has earned a national reputation for the high technical quality of its recordings for broadcasting pur-

Victor Transcription Turntables since they were first introduced, and Mr. Byers' letter is quoted in part, as follows:

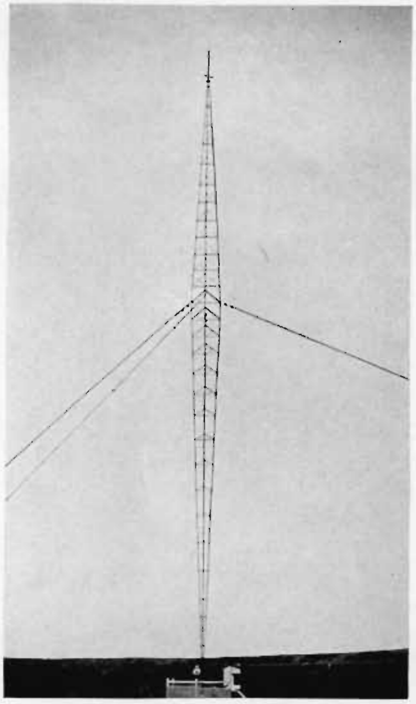
"We have tested your new transcription turntable, and found it to be entirely satisfactory on both 78 and 33⅓ RPM. The frequency range of this new type lateral pickup is indeed gratifying, especially on the high end.

"This laboratory has extended the

up to 8,000 cycles, and has been unable to reproduce the entire range due to the fact that all the various pickups we have tested heretofore, dropped off badly at 4,000 cycles or below.

"Therefore, the Byers Laboratory which is devoted exclusively to the development and production of electrical transcriptions, sincerely recommends this definite improvement in

KTBS Builds Own Vertical Radiator



ALUMINUM TOWER AT **KTBS**

THE accompanying view shows the new Vertical Radiator which was erected this spring at the 1,000 watt station, KTBS of the Tri - State Broadcasting System, Shreveport, Louisiana.

It was designed and constructed by the engineers and staff of the Shreveport station, and was fabricated from raw materials right at its present location and raised intact. The mast is six feet wide at the middle and is triangular in cross section. This tower proved to be quite rigid, easily supporting its own weight of five hundred pounds when suspended horizontally at the ends, before it was raised. Aluminum alloy was used throughout for the construction of this unique mast, and the four guys attached to the middle section are insulated near the tower and are also broken up into short insulated sections. The mast itself is insulated at the base, where a special ball and socket support is employed.

This radiator is of the "quarter wave" design and it performs just as anticipated, considerably increasing the field strength of Station KTBS. It has already withstood some terrific wind and rain storms without damage, and has in every way fulfilled expectations. 100 watt, 32 volt lamps are employed to illuminate the tower at night as a warning to aircraft.

This unique construction job will no doubt interest the staffs of smaller stations throughout the country who are contemplating antenna improvements, and it is certainly a great credit to C. H. Maddox, Chief Engineer of KTBS, who designed this job and superintended its construction.

Radio Telephony on the Sound Movie Lot

BROADCAST STATION FOR FILM DIRECTION. FREDERIC MARCH, FEATURED PLAYER IN **PARAMOUNT'S "THE EAGLE AND THE HAWK,"** FOR THE FIRST TIME USES THE TWENTY-FIVE POUND **RCA VICTOR** SHORT WAVE SET FOR MOTION PICTURE COMMUNICATION AND DIRECTION.

Getting Hot at WLW

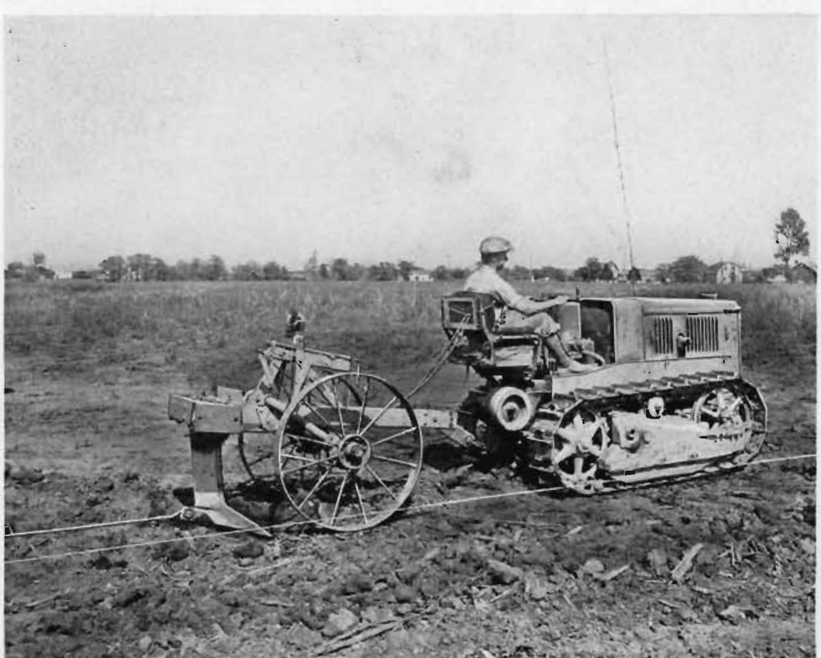
Surprising phenomenon disclosed during construction of new vertical radiator for RCA 500 KW transmitter at W LW

NATURE and science play some weird pranks upon the construction staff at broadcasting stations from time to time, but this story from the job at WLW will probably hold first place for quite a time.

While the vertical radiator tower for the new RCA 500 KW transmitter was in process of construction, a steel cable hoist was employed to raise the fabricated steel to the top of the structure, and day by day the tower grew in stature. Soon this new monument on the horizon began to rival the nearby towers of the short wave station W3XAL and the larger towers of the present WLW station and the WSAI station. In order to avoid the laborous process of climbing up and down the steel lattice work of the new tower structure, the men on the job were in the habit of riding up and down on the end of a steel cable hoist. As the tower grew, the trip to the top became longer and longer.

TOO "HOT" FOR COMFORT. **LEW CROSLEY,** AT THE LEFT, OF THE CROSLEY RADIO CORPORATION, AND **J. A. CHAMBERS,** TECHNICAL SUPERVISOR OF **WLW, WSAI,** AND **W3XAL.** THEY ARE SEEN DEMONSTRATING THE PHENOMENON OF RADIO FREQUENCY PICKUP AT THE WEIGHTED END OF THE CABLE HOIST USED IN CONSTRUCTING THE NEW **WLW** TOWER FOR THE **RCA** 500 KW INSTALLATION.

One fine morning, Pat Gilhooley arrived on the job ready for work, and having comfortably attached himself to the end of the hoisting cable (shown in the illustration herewith), he signalled the engineer to run him up to the top. Up he went, gazing out over the broadening landscape, and as Pat soared aloft he remarked unto himself that it was a fine day—the sun was out, the birds were singing, and the air was *warm* and balmy. In fact, the further up Pat travelled on the hoist, the warmer it seemed to get. That, of course, thought Pat, was because he was getting nearer to the sun and further from the earth which was still cool with its blanket of early morning dew.



A NEW APPLICATION FOR AGRICULTURAL EQUIPMENT. THIS "GROUND WIRE PLOW" IS USED FOR BURYING THE RADIATING GROUND WIRES TWENTY INCHES BELOW THE SURFACE AROUND THE NEW **RCA** 500 KW INSTALLATION AT WLW.

On up towards heaven rode Pat. "Whew," thought Pat, "This day is going to be a scorcher," and he proceeded to shed his coat, clinging to the cable first with one hand and then with the other as he got rid of that garment. Even the hoist cable was getting hot—in fact, Pat felt hot all over, and he wiped his brow on the sleeve of his shirt. Pat wished he had brought up the thermos bottle of ice water, and he began to think of sending a note down to the boys on the ground to shoot it up on the next trip.

Soon Pat began to feel like a broiled lobster. Was his face red? It probably was, but there were none up there to appreciate the fact, and the heat was fast becoming too great for comfort. Another few feet, and Patrick didn't feel so good. The cable was even burning through the callouses of his sturdy hands. This day was going to be too hot to work altogether! So Patrick decided he would ask for the day off as soon as the foreman appeared. In the following few feet, as he progressed upward, Patrick made up his mind that he wouldn't wait for the foreman, but would go down on the next trip.

Then suddenly it dawned on Pat that there was something entirely wrong. It had never been as hot as this before any place in his experience. He could hardly hold on to the metal cable—it was getting that hot. And how would he ever cling to the steel structure of the tower when he arrived at the top? Then he began to signal the hoist engineer to let him down, using the usual signal at first. Pat signaled with his left hand—he signaled with his right hand—he signaled with arms and legs—and then he began to yell. "DOWN," hollered Pat—"HOLY SUFFERING CATFISH LET ME DOWN QUICK." Eventually the hoist engineer perceived that all was not as it should be and reversed his engine, slowly lowering Pat toward the ground with Pat signaling for more speed—downwards.

UNIQUE GATHERING OF RADIO BROADCAST TRANSMITTERS. IN THE FOREGROUND S A SECTIONALIZING INSULATOR IN ONE OF THE GUY WIRES ON THE NEW **WLW** 500 KW TRANSMITTER TOWER. IN THE BACKGROUND AT THE LEFT MAY BE SEEN THE TOWERS OF **WSAI**, IN THE CENTER MAY BE SEEN THE SMALL MAST OF THE SHORT WAVE STATION **W3XAL**, AND AT THE RIGHT MAY BE SEEN THE LARGE STEEL TOWERS OF **WLW**. RADIATION FROM THE TOWERS OF THE STATIONS SHOWN IN THE BACKGROUND OF THIS PICTURE CAUSED SOME SURPRISING RESULTS DURING THE CONSTRUCTION OF THE NEW TOWER IN THE FOREGROUND.

The rest of the story includes a conference on the ground and a hasty investigation by the construction engineer, disclosing the fact that as work on the job progressed and the tower grew in height, more and more radio frequency energy was being picked up from the other stations located nearby. As Pat rode up to work on the cable hoist, the hoist itself was gradually becoming tuned closer and closer to the wave length at which it would pick up a maximum amount of radio frequency energy. This energy evinced itself in the form of heat—too much heat altogether for the comfort and composure of one Patrick Gilhooley. Under certain conditions, one could actually draw a two inch electric flame from the hoist cable!

After that incident, non-metallic lines were substituted for the steel wire cable in the hoist, but it was rather difficult to induce Gilhooley to go aloft again until he had seen some of his fellow workmen try it.

THE TROPICAL TROLLEY THAT "MEETS ALL TRAINS." THE SKIPPER SHOULD CERTAINLY BE PROUD OF THESE DECORATIONS.

NBC BROADCASTS MAMMOTH ORGAN

Playing on one of the largest organs in the world, Paul Carson is now heard over NBC station KPO Sundays from 3:30 to 4:00 p. m., P. S. T., from the Exposition Auditorium in San Francisco.

Visitors from all over the world heard this organ when it was located in the Exposition grounds during the World's Fair in San Francisco in 1915. Since then it has been housed in the city's auditorium where thousands have gathered to hear such famous organists as Lemare, Dupre, Yon Courboin and Lynwood Farnum.

One of the greatest thrills ever experienced by Carson came to him

(Continued on Page 26)

Did You Know?

By W. S. FITZPATRICK

That one hundred years ago the plot on Fifth Avenue, New York, now occupied by Rockefeller Center, was also a showplace? It was a botanical graden popularly known as one of the "wonders of New York."

That 12,000 photo-electric tubes are in operation on railroads, with an average life of 3,000 hours, as compared with the life of 1,000 hours of a 25-watt incandescent lamp, and that the life of photo-electric tubes is longer in their use of controlling and levelling elevators, although in this work the filaments are heated constantly? (O. H. Caldwell in *Electronics*.)

That the RCA executive offices have moved to the fifty-third floor of the new 70-story RCA Building in Radio City, Rockefeller Center, New York; that it took 1,600 men 25,000 eight-hour working days to complete the building; that it has 2,100,000 square feet of floor space and 75 elevators?

Airport at Radio Headquarters (—Drop In)

That the city of Camden, the radio history of which dates back to 1902, has one of the best known airports in the country and an aeronautical history going back a hundred years? A man named Mills made ascensions in October, 1834, on one of which "he soared aloft and when at a great height, he cut loose a parachute containing a rabbit, which reached the earth in safety. Mr. Mills descended ten miles from Camden."

That R.C.A. Institutes instruction is truly far-reaching? In addition to the army of Home Study students around the globe, a tabulation of this year's registration at the New York school of R.C.A. Institutes shows that the resident school students there came from twenty-two different states, from Hawaii, Porto Rico and British West Indies, from

countries of Europe, three countries of South America, and from China, Turkey, Iraq, Siam, India and Egypt.

That the first broadcasting station regularly served by short wave facilities was KGU, Honolulu, added to the NBC chain in 1932, and interconnected with the NBC network through the system of R.C.A. Communications, Inc.?

That Mr. Charles J. Pannill, Executive Vice-President of Radiomarine Corporation, has just received the largest order for radio service and apparatus ever made by an American steamship organization? The order, involving sixty-seven ships, is from the Lykes Brothers steamship interests.

Looking Upward

That about 1,500 more persons are in the employ of E. T. Cunningham, Inc., and RCA Radiotron Company, than was the case a year ago.

That the telegraphic signals preceding the showing of an RKO motion picture, spell out "A Radio Picture" simultaneously with the appearance of each letter of that

That the Italian steamship *Rex*, with six radio operators, has seven radio transmitters for use on any marine wave frequency from 18 to 5,000 meters; that the long-distance superheterodyne receiver has 37 tubes, and that recently while approaching New York, the *Rex* acted as a relay telephone connection between Genoa and the *S. S. Santo Rosso*, tied up at Shanghai, China? (*Radio Engineering*.)

That in the RCA Victor files at Camden are photographs of famous singers and musicians of the past quarter-century, all of whom recorded Victor records and that all the photographs were taken by Harry S. Attmore, who came with Victor following his graduation from the Pennsylvania Academy of Fine Arts? Incidentally, Mr. Attmore's family has been represented by a soldier—himself, son or ancestors—in every war of this country.

RCA Collaborates With Stars

That while Arcturus furnished the light-power which opened the Chicago Fair, it was RCA Radiotron amplifiers that performed the feat?

That the RCA Building is the largest in the world in the point of floor space and that the figure set as estimated daily population when all offices are occupied is 50,000?

That Commander Frank Hawks received radio code instruction at R.C.A. Institutes just prior to his recent non-stop flight across the continent with a robot pilot? An Army Colonel also is among R.C.A. Institutes graduates.

That WBZ was the first licensed broadcasting station in the United States, receiving its original license from Herbert Hoover, then Secretary of Commerce, in 1921?

That a complete unit for manufacturing Cunningham Radio Tubes and RCA Radiotrons is in operation at the Century of Progress Exposi-

That R. C. A. Communications Overseas Program Service is carrying programs of American broadcasters to or from broadcast stations in all countries in Europe and also several countires in South America and the Far East, and that this service is now available for advertising programs to all those countries which permit sponsored programs from their broadcast stations?

That the value of American radio equipment shipped to Spain considerably exceeds one million dollars per year, according to figures in *Radio Engineering.*

"Both of Whom Are Acquainted With Neither"

That two amateur radio stations, one in California, the other in New York, with exactly the same frequency, the same type tubes and antenna, the same call letters (one W6DOO, the other W2DOO), are owned by men named G. Siegel, neither of whom, up to a few weeks ago, had ever heard of the other?

That R.C.A. Institutes has a historic background? At the time its predecessor was founded, there was only one application of radio —that of marine communication. Reliable transoceanic communication, the next developmental step, came eight years, and popular broadcasting eleven years, later.

That there are 50 RCA Victor Velocity Microphones installed in Radio City Music Hall in Rockefeller Center, New York?

That the *S. S. Steel Navigator*, equipped with a 150 watt short wave transmitter and receiver supplied by the Radiomarine Corporation, has maintained direct daily communication with the Radiomarine shore stations at Chatham, Tuckerton and San Francisco during a trip around the world which up to the present writing has taken the ship from New York to Suez, via the Panama Canal, Honolulu, Shanghai, Manila and Singapore?

That a single RCA Radiotron or Cunningham Tube, 2B6 or 6B7, can perform four functions simultaneously: Intermediate or Radio Frequency Amplification, Detection, Automatic Volume Control and Audio Frequency Amplification?

That R.C.A. Communications, Inc., has erected two thousand two hundred wooden poles at its Riverhead receiving station to support antennas and lead-ins?

That a paper on "Telegraphing Without Wires" was delivered before the Institute of Electrical Engineers in 1884?

That in recalling the fact that sixteen, or so, girls have served as sea-going radio operators, it is interesting to read that an air transport line, advertising for thirteen girls as stewardess on airplanes, received 1,500 applications? The girls selected will travel an aggregate of one million miles yearly.

That RCA Victor Sound Systems may be used for 66 purposes?

That the transmitter of KPO, the NBC 50 kw. station at San Francisco, is below sea level, that 37 tubes are utilized and that 100 gallons of distilled water are used a month?

That every RCA Radiotron and Cunningham Radio Tube is subjected to at least 35 perfection tests?

That R.C.A. Communications, Inc., is furnishing a valuable service to the broadcasting stations of the country by periodic measurements of frequency at nominal rates, and that special laboratories at Riverhead, L. I. and Point Reyes, Cal., receiving stations maintain elaborate and accurate equipment for this purpose?

If I Had a Million—

That a number of rich men have taken both resident school and home study courses of R.C.A. Institutes, some as a hobby and others to work radio on private yachts and airplanes?

That from the chronological history of development of the telephone, telegraph, electric applications and radio, running in *Radio Engineering*, it may be seen that electric light dimmers, stock tickers, teletype and simultaneous telegraph - telephone were in operation as early as 1885?

That employees of merchandisers of RCA Victor products, RCA Radiotrons or Cunningham Tubes, receive the same rebates as do RCA employees in taking Home Study or Resident School Courses of R.C.A. Institutes?

That there are few small cities that can boast of as many eight and ten story structures as contained in the RCA Victor group of buildings at Camden?

That thirty pianos are part of the equipment at the New York NBC studios?

That the 50 watt tube transmitters supplied to ships by the Radiomarine Corporation have a range equivalent to that of the 2 kw. spark transmitters of fifteen years ago while the power drawn from the ships' lines is only one-fifth that of the spark set?

That in the Cunningham-Radiotron factory a cathode whose coating varies in weight from the mean by one sixteen-thousandth of an ounce is rejected?

Forgot Something?

That a rigger fell from the 90 foot level of the big Tuckerton radio tower and was back on the job the next day?

That the rim speed of a rotor in an Alexanderson Long Wave Alternator is about 460 miles per hour, and that it clears the stator by only three one-hundredths of an inch?

That the entire transmitting site of R.C.A. Communications at Rocky Point, Long Island, covers nine and one half square miles, or nearly half the area of Manhattan Island?

That at this same Rocky Point plant there are seven different types of short wave, directive antennas, six of which were developed by RCA engineers?

That in a single room in a building of R.C.A. Communications at Riverhead, L. I., there are more than a hundred short wave receivers? And that the receivers require 1,500 amperes at 8 volts to light the filaments, and 26 amperes at 250 volts for plate current?

Didn't You Call Manila? —Excuse It Please

That by means of a radiotelephone circuit operated by R.C.A. Communications at Manila, residents of the Philippines may telephone to any point in the United States or Canada, through San Francisco, or to any point in Europe, through Berlin?

Measuring Antenna Resistance

By L. F. JONES, Transmitter Engineer, RCA Victor Co.

THE measurement of antenna resistance is one of the commonest causes of sleepless nights and headaches to the radio engineer. It is a measurement that is not easy to make accurately due to the many unsuspected sources of error. Yet it is one of the most important steps in adjusting a radio transmitter. Antenna resistance must generally be known before a transmission line can be terminated properly, and it must always be known to ascertain the power output of the station.

Definition

If the impedance between an antenna terminal and ground is measured, at the operating frequency, it will be found to consist of an inductive or capacitive reactance plus a resistive component. The resistive component is known as the antenna resistance and is the value which, when multiplied by the square of the current flowing into the antenna terminal, is the measure of the power supplied to the antenna. Although the antenna resistance consists of several different resistances including radiation resistance, conductor resistance, ground resistance, eddy current resistance, it was specified as being measured between "antenna terminal" (antenna lead) and ground and therefore did not include the resistance of the permanent equipment connected into the antenna circuit for tuning and coupling purposes.

The IRE Standards Committee states that such equipment resistance should be included but the Federal Radio Commission, being interested in only the power actually delivered to the antenna, has stated upon inquiry that the resistance of the coupling and tuning equipment must not be included. Anyway the question is generally of small importance because well designed coupling and tuning equipment usually has less than one ohm resistance at broadcast frequencies.

The power ratings of all RCA transmitters are based on the measurement of power delivered to the antenna terminal, when efficient transmission lines are available. A 1 KW transmitter, for instance, must deliver 1 KW to the antenna over and above any losses in the antenna tuning equipment.

Procedure

There are a number of ways of measuring antenna resistance. The most customary and probably the most convenient way is that shown in Figure 1.

An oscillator is used to induce a voltage in a small pickup coil "L." A variable resistance, a meter and a tuning condenser are connected in series with the antenna. A loading coil may be connected in place of "C" or in series with "C" if one is required to tune the antenna to resonance. A wavemeter is used for adjusting the oscillator to the desired frequencies.

With the oscillator adjusted to the frequency at which a measurement is desired, the resistance should be set at zero and the antenna is tuned to resonance as indicated by the meter "M." The coupling between the oscillator and "L" should be adjusted to give a convenient deflection on the meter. The resistance should then be increased until the current indicated by the meter is exactly half of the former value, whereupon the inserted resistance "R" is equal to the antenna resistance plus the resistance of "L," "M," "C" and the connections thereto. The total resistance of these last items, known as the "equipment resistance," is generally known in advance. It must be subtracted from the value of "R" obtained, the remainder being the desired antenna resistance.

If the equipment resistance is not known it may be determined by disconnecting the antenna from the circuit and by connecting the upper side of "C" to ground through a high quality impedance "Z." The impedance "Z" must be of high quality so that it will not add an appreciable new resistance to the circuit (usually one of the coils or condensers supplied as part of the permanent antenna equipment will suffice), and it should be of approximately the same reactance as offered by the antenna so that the setting of "C" will not have to be appreciably changed. The resistance "R" should then be set at zero and a convenient deflection should again be secured on the meter having first tuned the circuit to resonance by slightly shifting "C." Again the value of "R" should be increased until the current is reduced to half whereupon the value of "R" is equal to the desired "equipment resistance."

Precautions

In making the measurements it is essential that the following precautions be carefully observed.

1. The oscillator should have large reserve power so that only very loose coupling to the antenna is required. If this condition is not met, the adjusting of "R" will appreciably affect the loading of the oscillator and will thereby affect its output. If the meter "M" has a maximum scale of approximately 100 milliamperes it is best to use an oscillator of 50 or 100 watts power.

Smaller oscillators may be used if more sensitive meters are used at "M."

2. Or a small oscillator may be used with tight coupling to the antenna if a radio frequency ammeter is connected in series with the oscillator's output coil. By means of this meter any variations in the oscillator's output can be allowed for, or the output can be held constant by a rheostat in the oscillator's circuit.

3. It is important that the voltage induced in the antenna circuit by the oscillator be induced at one point only, and that this point be adjacent to ground. The oscillator should therefore be so arranged and connected that it will not radiate large amounts of energy which may be picked up by the antenna or by other parts of the test circuit. Every effort should be made to induce a voltage only in the pickup coil "L." It is inadvisable to attempt to use the main transmitter in place of the auxiliary oscillator.

4. Any tank circuits such as the one in the line termination equipment or transmitter should be short circuited or open circuited so as not to affect the measurements.

5. Just before each measurement it should be made certain that the antenna circuit is tuned to exact resonance

6. The resistance must be of a type presenting negligible inductance or capacitance at the frequency being used. A special decade box is made which is suitable for this purpose.

7. The meter "M" must of course be of the thermocouple type and should preferably have a full scale reading between 25 and 125 milliamperes depending on the oscillator power available. Weston thermogalvanometers rated at 115 milliamperes full scale have been found very suitable. They have a current squared scale, so a reduction in current of one half necessitates a reduction in scale reading to one quarter.

8. The use of the electrostatic shield "S" is desirable though not essential.

9. The antenna resistance should be measured not only at the operating frequency but also at four or five frequencies each side so that a curve of antenna resistance versus frequency can be drawn. The slope and smoothness of such a curve are useful in prophesying the accuracy of the measurements.

10. Whenever the resistance measured at the operating frequency seems unreasonable, the resistance at the fundamental frequency should be measured. An antenna's fundamental frequency is its resonant frequency when connected directly to ground. If condenser "C" is removed and if the pickup coil "L" contains only several turns (neglected), the antenna fundamental may be measured without further change in the circuit of Figure 1. In this case the oscillator is of course to be tuned to the antenna's resonant frequency instead of tuning the antenna to the oscillator's frequency. If the resistance at the fundamental is not between 15 and 30 ohms, the design of the antenna and ground systems should be looked upon with suspicion.

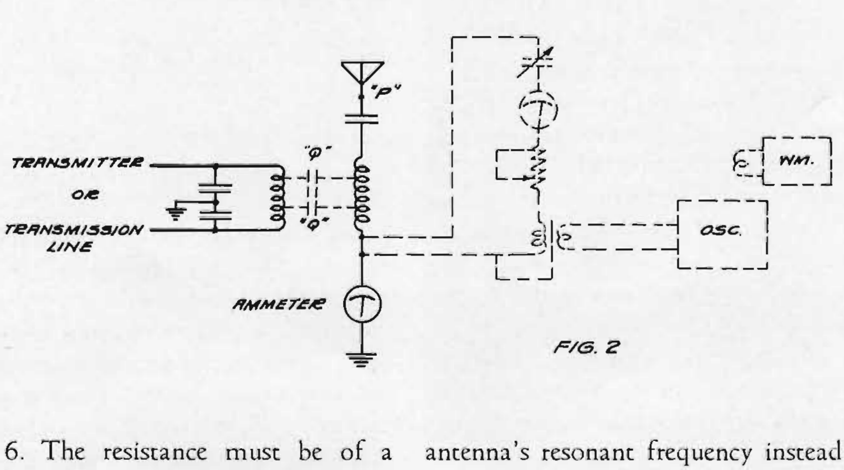


FIG. 2

The method described above is correct for measuring true antenna resistance. The resistance so obtained, when multiplied by the square of the antenna current as measured by a meter in series with the antenna lead, will correctly indicate the power output. However, in practice it is customary to

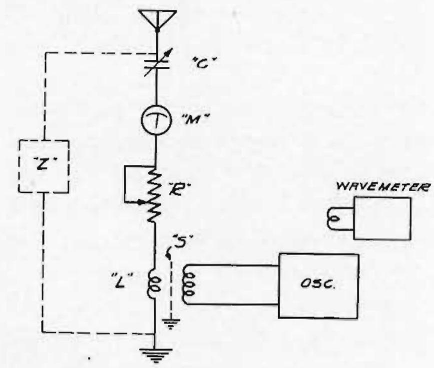


FIG. 1

locate the meter in the ground lead as shown in Figure 2. In this case the by-passing effects of the distributed capacity "Q" and of other miscellaneous capacities will cause the actual current at the meter to differ somewhat from the true antenna current as measured at "P." Therefore an "effective" antenna resistance somewhat different from the true resistance must generally be used when the antenna current is measured in the ground lead. To find this effective resistance two methods may be employed of which the first is to be preferred.

Effective Resistance

(A) The antenna ammeter may first be inserted at "P" and then in series with the ground lead, noting the two currents. Since the watts or I^2R are the same for both points and since the R for the upper point is known, the effective R for the lower or ground lead point can be readily calculated.

(B) The circuit of Figure 1 may be used in the manner depicted by the dotted lines of Figure 2. The tank of Figure 2 should be short circuited but otherwise left the same as in normal operation, the transmission lines if any being connected as usual. Thus the effects of electrostatic capacities are taken into effect. This method is slightly in error because the resistance obtained includes the resistance of the permanent antenna coupling coil and series condenser and also certain other errors enter in, thus method (A) is preferred.

Conclusion

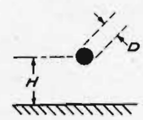
Measurements made in accordance with the procedures outlined above should be consistent and accurate within several percent. Common values of antenna resistance are 20–25 ohms when the antenna is wavelength long (in which case the antenna is operating at its fundamental frequency), 35–70 ohms when ⅜ wavelength long, 250–500 ohms when ½ wavelength long, and 100–150 ohms when ⅝ wavelength long. If the effective length of the antenna in wavelengths is not known it can be found by determining the fundamental frequency (as explained above for finding the resistance at the fundamental). Then multiply ¼ by the ratio of operating frequency to fundamental frequency; the result is the effective length expressed in wavelengths.

Sometimes it is desired to operate a broadcast station at a lower plate efficiency than specified by the Federal Radio Commission. This desire may be based on the lower distortion frequently obtainable at lower efficiencies, particularly in Class B radio amplifiers, or on other considerations. For operation at a lower efficiency the output power is measured by the "direct" method, necessitating the forwarding to the Commission of complete data in affidavit form regarding the antenna resistance. In such case the procedure outlined above for measuring resistance is acceptable and should be used. Report No. 3043 of the Commission should be referred to for information on the required accuracies of the instruments and on the exact form in which the data must be presented.

Transmission Line Formulae

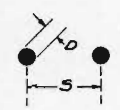
(Also Contributed by L. F. JONES)

For the convenience of those who are so unfortunate as to have to adjust radio frequency transmission lines, the following simple formulae are presented.



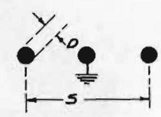
$$Z_0 = 138 \log_{10} \frac{4H}{D}$$

SINGLE WIRE LINE



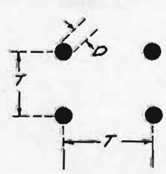
$$Z_0 = 276 \log_{10} \frac{2S}{D}$$

TWO WIRE LINE



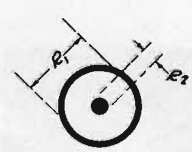
$$Z_0 = 276 \log_{10} \frac{2S}{D}$$

THREE WIRE LINE



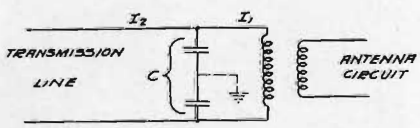
$$Z_0 = \left(138 \log_{10} \frac{2T}{D}\right) - 20.8$$

FOUR WIRE LINE



$$Z_0 = 138 \log_{10} \frac{R_1}{R_2}$$

CONCENTRIC LINE



$$C_1 = \frac{KVA \times 10^3}{KW \times 2\pi f Z_0}$$

$$I_1 = \frac{2\pi f C_2 \sqrt{Z_0} \sqrt{W}}{10^3}$$

$$I_2 = \frac{\sqrt{W}}{\sqrt{Z_0}}$$

$$L_u = \frac{10^6}{(2\pi f)^2 C_2}$$

$$L_L = \frac{10^6 + 10^6 \sqrt{1 - \frac{4 \times 10^6}{(2\pi f)^2 C_2^2 Z_0^2}}}{2 \times (2\pi f)^2 C_2}$$

$$K = 100 \left(\frac{1 - \sqrt{1 - \frac{4 \times 10^6}{(2\pi f)^2 C_2^2 Z_0^2}}}{2} \right)$$

$$R_3 = \frac{Z_0^2}{[illegible]}$$

Z_0—surge impedance, characteristic impedance, in ohms.

H, D, S, T—dimensions as shown in inches.

R_1—inside diameter of outer conductor, in inches.

R_2—outside diameter of inner conductor, in inches.

C_1—capacity required in transmission line tank for given KVA, in mfds.

KW—kilowatts input to antenna.

f—frequency in kilocycles.

I_1—transmission line tank current when adjusted to match the line.

C_2—actual line tank capacity used, mfds.

W—antenna input power in watts.

I_2—current in each line for matched termination adjustment.

L_u—inductance required in line tank for resonance when unloaded (antenna circuit disconnected), in microhenrys.

L_1—inductance required for unity power factor line termination when tank loaded (antenna connected), in microhenrys. Line matched.

K—reduction of L_u required to reach L_1, in percent.

R_3—resistance looking into one end of a line one quarter wavelength long, across the other end of which there is connected a resistance R_4.

NBC BROADCASTS MAMMOTH ORGAN

(Continued from Page 21)

when as a boy he heard this organ for the first time. Sitting alongside of his teacher, John Done, Carson turned the pages of the music while Done played the organ during the World's Fair.

NBC is using the same type of pick-up for this series of broadcasts as utilized by the National Broadcasting Company during the broadcasts of the Metropolitan Opera Company performances in New York. The organ is so centrally placed that a parabolic microphone located in the middle of the auditorium is able to pick up the full range of its many voices.

Broadcasting Personalities

O. B. HANSON, MANAGER OF PLANT OPERATIONS AND ENGINEERING, NATIONAL BROADCASTING COMPANY AT 711 FIFTH AVENUE, N. Y.

E. K. COHAN, TECHNICAL SUPERVISOR, COLUMBIA BROADCASTING SYSTEM, THE PRESIDING GENIUS OF ENGINEERING AND OPERATIONS AT 485 MADISON AVE., N. Y.

P. J. MEYER, OWNER OF STATION **KFYR,** BISMARK, NORTH DAKOTA, IS WELL KNOWN TO ALL BROADCASTERS THROUGHOUT THE COUNTRY. HE RELIGIOUSLY ATTENDS THE N. A. B. MEETINGS, IS AN ARDENT HUNTER, FISHERMAN AND GOLFER. HE MAKES A REGULAR TRIP

MR. ED. CLARK, ENGINEER AT RADIO STATION **WMBC,** DETROIT.

MR. J. I. BELL, ENGINEER (AT RIGHT), OF RADIO STATION **WXYZ,** DETROIT, THE KEY STATION OF THE MICHIGAN BROADCASTING CHAIN.

LET'S GET ACQUAINTED

BEN ADLER, SALES ENGINEER FOR THE TRANSMITTER SECTION OF THE RCA VICTOR COMPANY, INC., WHO COVERS THE SOUTHERN DISTRICT, WITH HEADQUARTERS AT DALLAS, TEXAS

T. W. ENIS, OF THE ENGINEERING PRODUCTS DIVISION, **RCA VICTOR COMPANY, INC.,** WHO ASSISTS IN HANDLING TRANSMITTING RADIOTRONS AND POLICE RADIO EQUIPMENT, AT "RADIO HEADQUARTERS."

Broadcasting Personalities

Ben Adler was born in 1903, in New York City. His history, briefly, includes his preliminary education at the Public School in Queens and the Stuyvesant High School, after which he graduated from the Polytechnic Institute in Brooklyn. Mr. Adler joined the Phillips Petroleum Company where he was engaged in geophysical research, locating oil wells by means of portable sound equipment, until 1927. In that year he entered the research organization of the Radio Corporation of America, at Van Cortlandt Park, in the Technical and Test Department, where he worked on a wide variety of miscellaneous research problems, including broadcast transmission and reception, but more particularly television development. At the end of 1929, the Technical and Test Department was consolidated with the Engineering Department of the RCA Victor Company, Inc., and transferred to Camden, N. J. Mr. Adler joined the Sales Department as Transmitter Sales Engineer, and was assigned to the territory he now covers.

T. W. Enis was born in 1905, at Ennis, Texas. (The town was named before and not after him—also note difference in spelling.)

He emigrated to Mississippi at the early age of two. Here, between raising cotton and stacking lumber, he managed to graduate from high school in 1922.

After spending two years at Southwestern Presbyterian University, Clarksville, Tennessee, he saw that a ministerial career would not coincide with his restless nature.

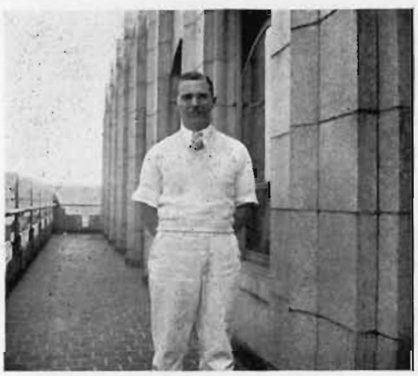
Through the Civil Service Commission, he secured a position in Washington in the War Department, where he helped convert the Soldiers' Bonus Applications into insurance policies. After working there one year, he was appointed to the Naval Academy at Annapolis, by Hon. John E. Runkin of Mississippi. Soon after leaving the Naval Academy, he was employed by the RCA, in January, 1929, as a member of the Production Division.

He was transferred to the Engineering Products Division in 1930, where he has been assisting in handling Transmitting Radiotrons and police radio equipment.

Mr. T. A. J. Hayes, Director of Signal Service, Boston Police Department, en route to Washington, stopped off at the RCA Victor plant for a day recently.

Mr. G. O. Shepherd, director of WWNC in Asheville, N. C., was an official of the annual Rhododendron Festival held in that city June 13th to 15th. Needless to say Mr. Shepherd and the members of the station staff were kept busy, broadcasting the parades, balls, and other events of that celebration.

Mr. H. K. Carpenter, manager of WPTF, Raleigh, attended the NAB meeting in Elkhart, in the latter part of June.



J. L. MIDDLEBROOKS, CHIEF ENGINEER OF **WAPI,** BIRMINGHAM, ALA.

Sergeant Taylor, in charge of the Baltimore Police Radio System, recently inspected the Camden plant.

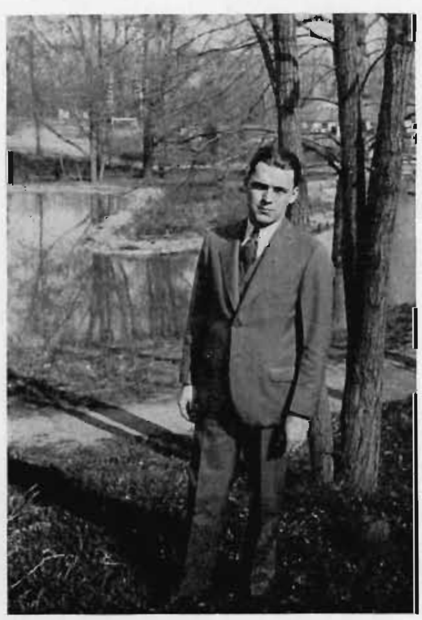
WTAR, Norfolk, Va., opened a new large studio, not long ago. Mr. J. L. Grether, chief engineer, was in charge of technical arrangements. This station also maintains a studio at Virginia Beach, which in our opinion ought to be an ideal place to work.

LEFT TO RIGHT—**FATHER O. L. ABELL, J. D. BLOOM, FRANCIS JACOBS** AND **W. M. WITTY,** OUTSIDE THE TRANSMITTER BUILDING AT **WWL,** NEW ORLEANS, LA.

D. A. BURTON, OWNER AND MANAGER OF **WLBC,** MUNCIE, IND.

Mr. V. J. Gilcher, plant engineer, and Ike Walton, of NBC, reports three fine trout landed in a New Jersey stream, one June weekend.

Mr. G. Wyndham, Chief Engineer of WHN has established a super excellent "ham" station. Call letters, W2WY.



STUART ABCOCK, OWNER AND CHIEF ENGINEER OF **WROL,** KNOXVILLE, TENN.

Mr. B. H. Peace, Jr., Manager of WFBC, Greenville, S. C., tells us that their new station was officially opened in the middle of May. Among the celebraties present were a senator, a mayor, a number of newspaper representatives, and others.

Mr. Paul Girard, of WHOM, and Mr. E. V. Dannals of WEVD, attended the Hudson Division A. R. R. L. Convention in Brooklyn, May 27th.

Mr. Frank Marx, Chief Engineer, WMCA, is busier these days than the proverbial paper-hanger. What

MILTON C. SCOTT, CHIEF ENGINEER OF **WIOD,** MIAMI, FLORIDA

with full time on 570 kc., a growing infant, etc., etc., he also has the responsibility of broadcasting via short wave nightly the doings on a Hudson River pleasure boat.

Eddie Peabody, Safeway program star and most diminutive performer in NBC's San Francisco studios, has the tallest producer on the staff—Donald Cope, six feet, seven inches in height—whom Eddie refers to as: "See Cope—he's my bumper!"

A BLIMP BEING USED BY **JOHN AICKENHEAD,** ENGINEER AT **WADC,** AKRON, OHIO, IN ANTENNA EXPERIMENTS

WCAM—Camden, New Jersey

Typical Up-to-date 500 Watt Station

MARGARET McCULLOUGH, TALENTED YOUNG ORGANIST, WHOSE REQUEST PROGRAMS ARE FEATURED AT STATION WCAM IN CAMDEN.

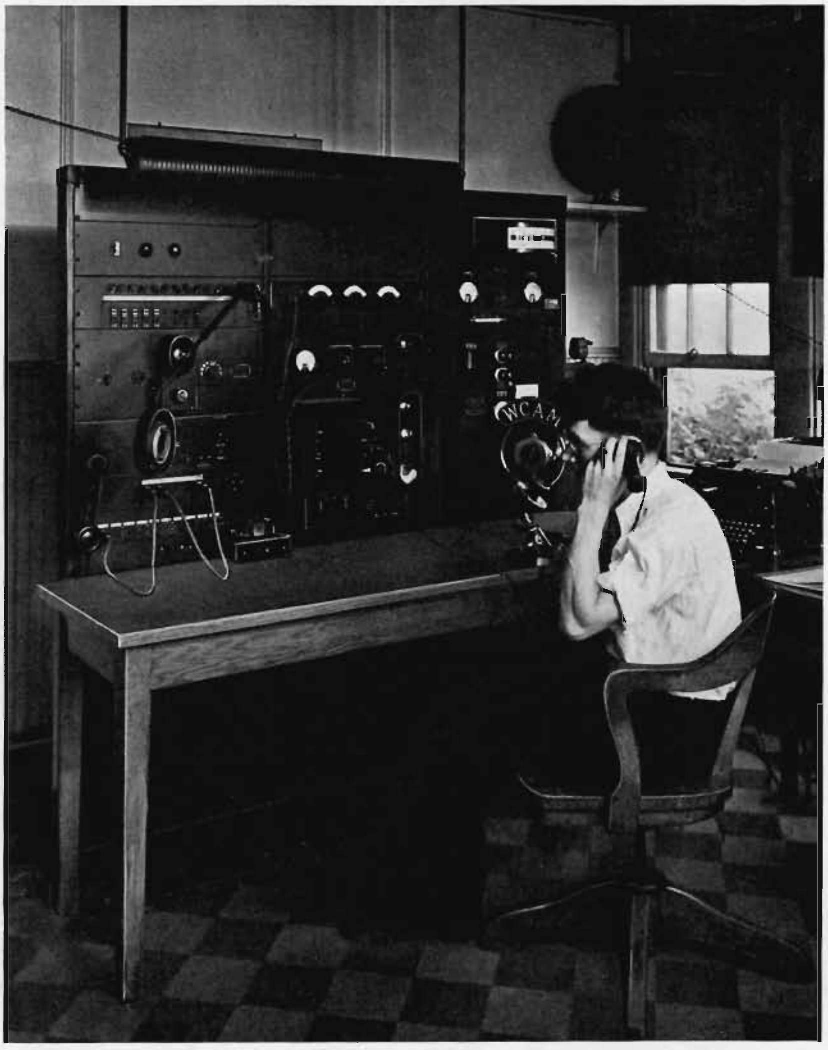
Camden, New Jersey, the home of "Radio Headquarters," is on the direct line of travel between New York and Washington. Notwithstanding the general conception in the radio field however, Camden is not just across the Hudson River from New York City. On the contrary, it is just across the Delaware River from Philadelphia, approximately 88 miles from New York, and occupies a similar position with respect to Philadelphia to that which Brooklyn occupies with respect to New York City. Camden has its own broadcasting station, WCAM, operating on a frequency of 1,280 kilocycles (234.2 meters) and a quite active and progressive station it is.

MARGARET DUFFIELD HENTY, WHOSE PERFORMANCES AT THE CONSOLE OF THE CAMDEN "ELKS" ORGAN ARE VERY POPULAR.

WHILE there are twenty-two 50 kw. broadcasting stations in the United States it must be remembered that the "small station" is in the majority, both in number and in total power output. WCAM, a representative 500 watt station is municipally owned. The program material is furnished by the Broadcast Advertising Company, of which Rud. Preisendanz, Jr., is the President, Edward Preisendanz is the Secretary and Treasurer, and F. S. Caperoon is the Managing Director.

The studios are situated high above the city in the tower of Camden's modern City Hall, which is the tallest structure in Camden. The transmitter and towers are located adjacent to the Municipal Convention Hall, at a distance of approximately one mile from the studios. John Cummings is the Technical Director, and Clarence E. Onens, the Chief Operator.

The WCAM "House Orchestra," under the direction of Edward N. Layman, is a most capable and efficient organization. Each of the six members is proficient in playing two or more types of instruments, and by cleverly "doubling," the impression is conveyed over the air of an orchestra twice its size. In a single number broadcast by these versatile musicians, one may pick out two pianos, accordion, marimba, xylophone, chimes, bass viol, violin, 'cello, saxophones and clarinets. The vocal refrains are usually furnished by Florence Werner and Mary Bibighaus, who have become quite popular



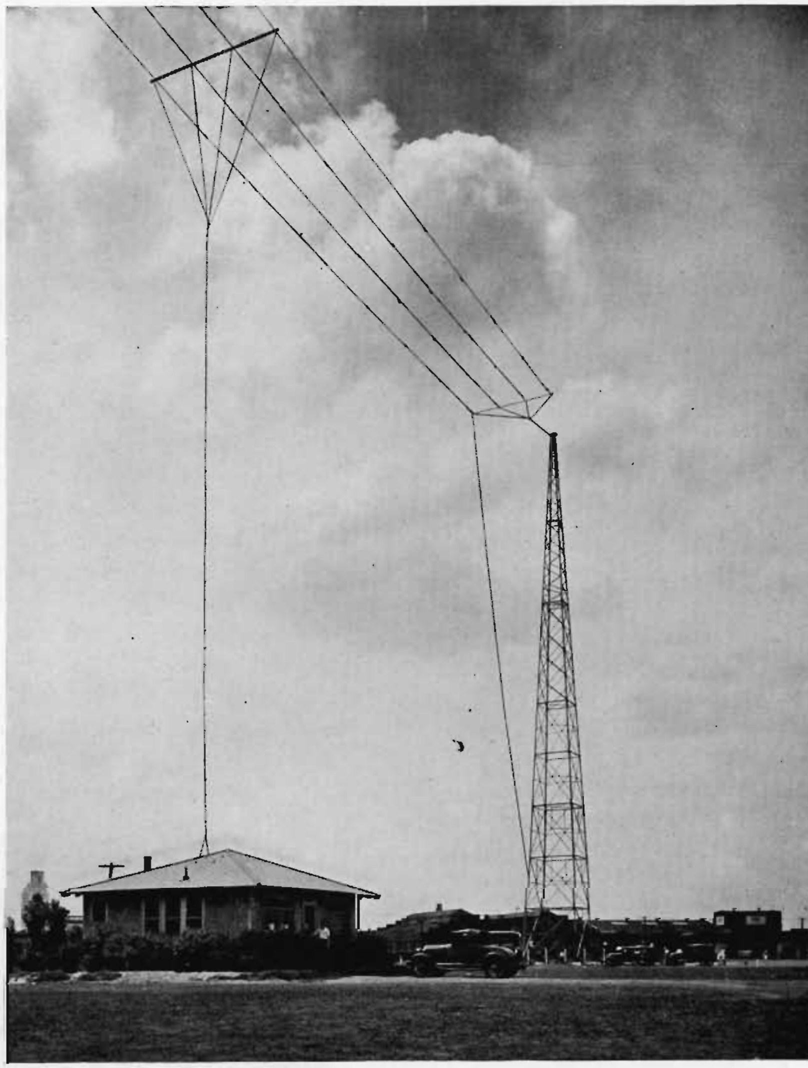
MARVIN SEIMES, WCAM OPERATOR, SEATED AT THE CONTROL BOARD IN THE TRANSMITTER BUILDING. AT THE RIGHT OF THIS BOARD MAY BE SEEN THE RCA FREQUENCY MONITOR.

both for their solo work and their team work in duets before the WCAM microphones.

Margaret McCullough and Margaret Duffield Henty, pupils of Charles L. Bowen, who have had considerable theatre experience thruout South Jersey have both achieved wide popularity among the WCAM listeners for their request organ programs, and Mr. Bowen himself (the "Optimistic Organist"), is a great favorite in the WCAM area. Sometimes these programs originate at the Elks' organ in Camden, sometimes at the municipal auditorium, and occasionally at the organ in Mr. Bowen's residence.

Entertaining and instructive programs are sponsored by the local stores, restaurants and amusement centers. Among the favorite programs so sponsored are "The Morning and Afternoon Shopper," the "Hoffbrau Orchestra," Neil's Melodians, the Walt Whitman Theatre, and the wrestling bouts. On Sundays the South Jersey Children's Hour, Church Services, Biblical Dramas and the Wiley Mission furnish the sustaining features, with the "Vesper Organist" closing the day.

Generally speaking, WCAM is representative of the smaller type of local American broadcast station, enjoying a healthy existence with the enthusiastic support of the business enterprises in the surrounding territory.



NO, THIS IS NOT SWAN ISLAND IN THE GULF OF MEXICO—IT'S **WCAM**, CAMDEN'S OWN RADIO STATION, RIGHT AT RADIO HEADQUARTERS. JUST TO THE LEFT OF THE TRANSMITTER BUILDING IN THE BACKGROUND MAY BE SEEN THE CITY HALL TOWER, IN THE TOP OF WHICH ARE THE STUDIOS.

THE HOUSE ORCHESTRA OF **WCAM**, UNDER THE DIRECTION OF **EDWARD N. LAYMAN**. **FLORENCE WERNER** AND **MARY BIBIGHAUS** FURNISH POPULAR VOCAL DUETS, AND **JOHN J. CUMMINGS**, STUDIO DIRECTOR, MAY BE SEEN SEATED BEFORE THE WINDOW OF THE CONTROL ROOM.

WCAM is a progressive station, and from time to time the latest improvements in the art are added to its equipment, the latest addition in this line being an RCA Frequency Monitor at the transmitter.

STUDIO NOTES

Jeannie Lang, petite star of NBC's Musical Grocery Store, is a great radio fan herself. She got so bad that one time when she was supposed to go on the air herself she missed the date because she got too much interested in the radio at home. Then they took her radio away from her. She's got it back now, though, and goes to sleep every night listening to the rhythmic strains from the various hot spots which are on the air late.

New Station Serves South Carolina

WFBC, at Greenville, is completely RCA Victor equipped

By T. A. SMITH, RCA Victor Sales Engineer

ANOTHER section of the country, previously without radio service, has been provided with a modern broadcasting station. WFBC, on the air since May 20th, has already established an enviable record for quality and signal strength.

The station, owned by the Greenville *News* - Piedmont Company, publishers of two of South Carolina's leading newspapers, is under the management of B. H. Peace, Jr., and Robert H. Lingle, Jr., is the station engineer who is responsible for all of the technical arrangements.

Studios are located in the Imperial Hotel, where one large studio, one small studio, and an announcer's room are available. A large foyer alongside the studios permits visitors to watch the broadcasts through double glass windows. The control room is equipped with the latest RCA Victor speech input apparatus, used in conjunction with condenser microphones in the studios. A pair of two speed, UZ-4210 transcription turntables are located in the announcer's room.

The transmitter is situated on E. Faris Road, in the suburbs of Greenville. The transmitter is located in a new and attractive frame building, which also contains living quarters for the operating staff.

The antenna system is of the "L" type, supported by two wood poles approximately one hundred feet high. A radial ground system has also been installed.

The transmitter is a standard RCA Victor Type 250-W, using high level Class B modulation. The transmitter is fed directly by a high quality telephone line from the studios. No remote speech input equipment is employed.

Listener response has indicated that excellent coverage is being obtained in the region about Greenville, even through summer static, which in this territory is anything

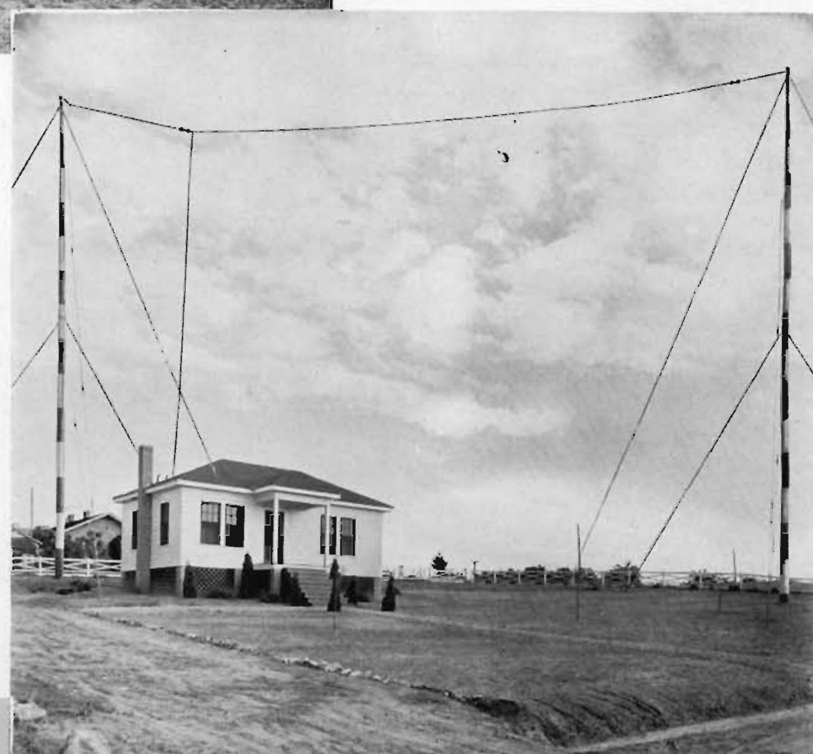
CONTROL ROOM AT WFBC

STUDIO A AT **WFBC**

but "mild." WFBC operates on 1,200 k. c., with a power of 250 watts day time, 100 watts night.

This transmitter was developed to meet an increasing demand from smaller stations for a low-power transmitter capable of high quality transmission, a transmitter which would meet the operating and performance specifications of the highly-developed transmitters of greater power but which would have initial and maintenance costs commensurate with the revenues of these smaller stations.

This demand is due to a growing realization on the part of these stations that their existence depends on their ability to compete for audience attention with the high-power chain stations. The first requisite of such competition is equipment capable of comparable transmission quality. Well-balanced transmitting equipment designed and built by a com-



THE **WFBC** TRANSMITTER HOUSE

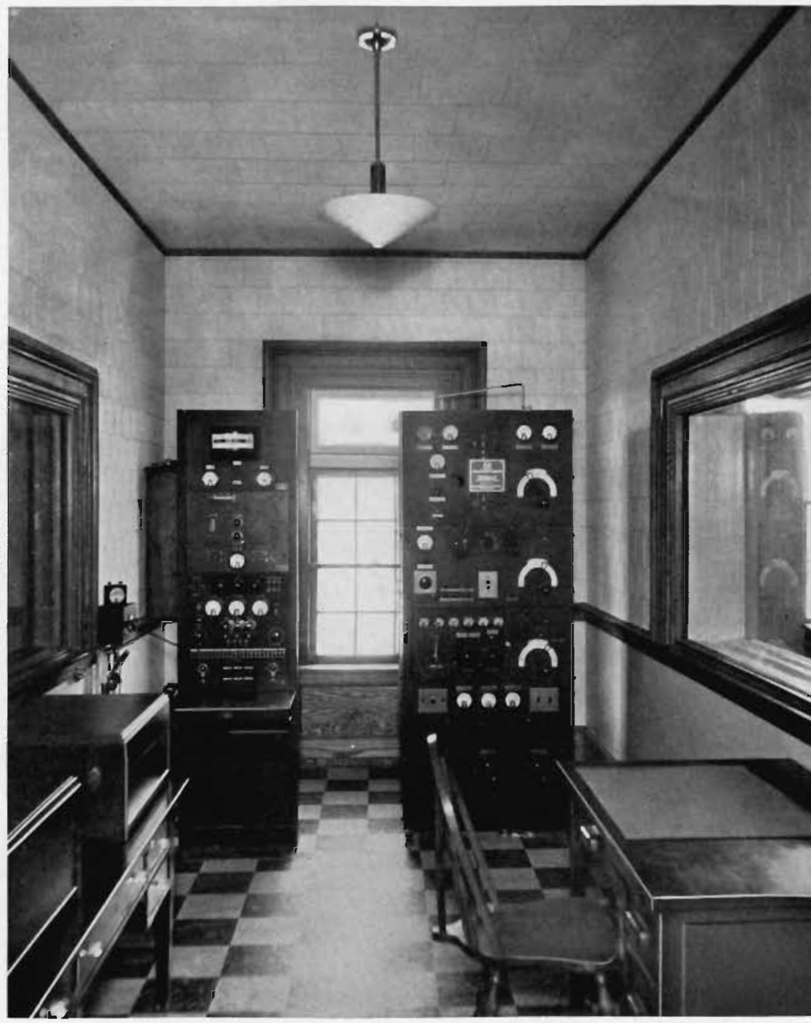
petent engineering and manufacturing organization is assurance of such quality. Moreover experience proves that such equipment is, over a period of time, more economical than "composite" equipment which requires constant modification to meet improving standards. This is a particularly important consideration in small stations, since in these stations depreciation and maintenance of equipment make up a large part of operating expenses.

THE TRANSMITTER ROOM

Unique Low Power Station

WGNY, Chester, Orange County, N. Y., Serves Rural Population with 50 Watts

By PETER GOELET, Owner and Director



THE TRANSMITTER AND CONTROL ROOM AT STATION **WGNY.** ON THE LEFT IS THE **RCA** SPEECH INPUT RACK, WITH FREQUENCY MONITOR. ON THE RIGHT IS THE **RCA** 100 WATT TRANSMITTER. IN THE LEFT FOREGROUND ARE THE TWO **RCA** TRANSCRIPTION TURNTABLES. THE WINDOW ON THE LEFT AFFORDS A VIEW INTO THE LARGER OF THE TWO STUDIOS, AND THE WINDOW ON THE RIGHT AFFORDS A VIEW OF THE SMALLER STUDIO.

EARLY this spring, a new broadcasting station started operation in the southeastern part of New York state. Starting with the modest power of 50 watts and operating eight hours per week, WGNY is nevertheless rendering valuable local service which was not previously available.

Orange County, N. Y., is located just outside of the New York metropolitan area, situated about 50 miles from the city. It is a prosperous farming territory, with many small communities scattered throughout. It was served only by certain of the New York City stations, and the service from these stations was not always reliable, especially in the summer, when static was heavy. A need was felt for a purely local station which would be sympathetic with the interests of the residents.

In constructing the station, it was decided to locate the studios, transmitter, and offices in a Colonial style farm house, on the Goelet estate near Chester. This site conformed admirably with the rural service area. An addition was constructed in architectural harmony with the existing building.

In the building are two studios, control-transmitter room, director's office, and reception room. The studios are large enough to handle a good sized orchestra without difficulty, one being 17 feet x 18 feet, and the other, 17 feet x 26 feet. The studios have been treated acoustically by means of absorbent wall blocks to chair rail height. The results have proven very satisfactory, sufficient damping being provided, without the "ultra-dead" atmosphere which is sometimes found in broadcasting studios. Sound insulation is provided between walls, and double plate glass windows, set in felt, permit observation of broadcasting activities from the director's office and the control room.

In the control room, which is situated between the two studios, is located the transmitter and the speech input rack. The transmitter is a standard RCA Victor, type 100-W coupled to a transmission line. Upon the speech input rack, is mounted an OP-3 amplifier, a microphone switching panel, and an RCA Frequency Monitor. Two UZ-4210 transcription turntables are mounted on a table on one side of the room.

Standard RCA condenser microphones are used in the studios with a number of wall receptacles placed conveniently.

The transmitter is coupled to the antenna through a 1,200 foot transmission line. The antenna is supported by a pair of 128 foot Lehigh steel towers. The radiating system is located on a long, low hill, and employs a conventional "T" antenna with a radial ground system.

A remote pickup point is maintained at Middletown, N. Y., about six miles away, where programs are taken from the Paramount Theatre. Lines are available to other points of interest in the vicinity.

Considering the power rating of the station, exceptionally good coverage is obtained. A great deal of interest has been displayed by the local listeners, and it has been the aim of the station to provide them with good programs, rather than to emphasize the purely commercial viewpoint. Efforts are now being directed towards obtaining an increase in power to 100 watts, which, if granted, will naturally improve the service of the station.

THE DIRECTOR'S OFFICE OF STATION **WGNY**, NEAR CHESTER, NEW YORK. THE DOUBLE PLATE GLASS WINDOW ON THE RIGHT AFFORDS A DIRECT VIEW INTO THE LARGER OF THE TWO STUDIOS AT THIS STATION.

THE LARGER OF THE TWO STUDIOS AT **WGNY**. THE TRANSMITTER, THE STUDIOS, AND THE DIRECTOR'S OFFICE ARE LOCATED IN AN ATTRACTIVE FARMHOUSE ON THE GOELET ESTATE, NEAR CHESTER, NEW YORK.

The RCA Victor Type 250-W Transmitter is a deluxe model low-power transmitter designed specifically for use (1) in regional stations licensed to operate full time with an output of 250 watts, and (2) in local stations licensed to operate with an output of 250 watts day and 100 watts night. In normal operation it supplies 250 watts, 100% modulated, to the antenna. A switch on the front of the panel permits instantaneous reduction of output to 100 watts.

TOWER AT WSM SPECTACULAR

By GEORGE DEWEY HAY, Publicity Dept., WSM

A gigantic lightning rod, 878 feet in height, pierces the lower and more ominous clouds on a stormy day, marking a definite milestone in the progress of radio. WSM's new single antenna has proven to be beyond the shadow of any doubt a great improvement upon the older type of double towers with wires stretched between.

The National Life and Accident Insurance Company dedicated America's latest step in radio transmission, containing 50,000 watt power in the last word in radio station construction, on November 12th last year. With the exception of the Eifel Tower in Paris which has been recently used for radio purposes, it is the world's tallest broadcasting structure, located in the center of a beautiful thirty acre tract of land about fourteen miles due south of the city of Nashville, Tennessee. WSM's brilliantly lighted beacon is a landmark for air men and motorists for miles around.

The transmitter home is of southern colonial design with plenty of room for the very elaborate equipment necessary to keep just a little bit ahead of the times. Since the tower was officially put on the air the time lost is negligible during regular hours of operation, which are from six-thirty in the morning until midnight each day with the exception of Sunday when the schedule is a bit shorter. There have been instances during a storm when the wires from the station to the studios were impaired as a result of what lawyers term "acts of God" but otherwise WSM's batting average has been mighty close to a thousand.

Sound Reenforcing and Broadcast Pickup at Robin Hood Dell

By KENNETH W. STOWMAN, In Charge of Public Relations, Station WCAU

ONE of the most elaborate sound reenforcing systems ever attempted has been installed in Robin Hood Dell, Fairmount Park, Philadelphia, by the Amplification Division of the WCAU Broadcasting Company.

Six months ago the Philadelphia Orchestra Association, who sponsor these summer concerts invited bids from the leading amplification companies in the East. Out of the many companies who submitted bids, WCAU was selected and the contract signed for the installation. The WCAU engineers in co-operation with RCA Victor Company, Inc. installed the latest development of their laboratories.

THE ACOUSTIC SHELL AT ROBIN HOOD DELL, FAIRMOUNT PARK. THE PHILADELPHIA ORCHESTRA MAY BE SEEN ON THE STAGE, AND THE TWO RCA VICTOR TEN FOOT DIRECTIVE BAFFLE LOUDSPEAKERS FOR SOUND REENFORCING MAY BE SEEN AT THE TOP OF THE SHELL. FOUR VELOCITY MICROPHONES MAY ALSO BE SEEN MOUNTED ON STANDARDS AT THE FRONT OF THE STAGE.

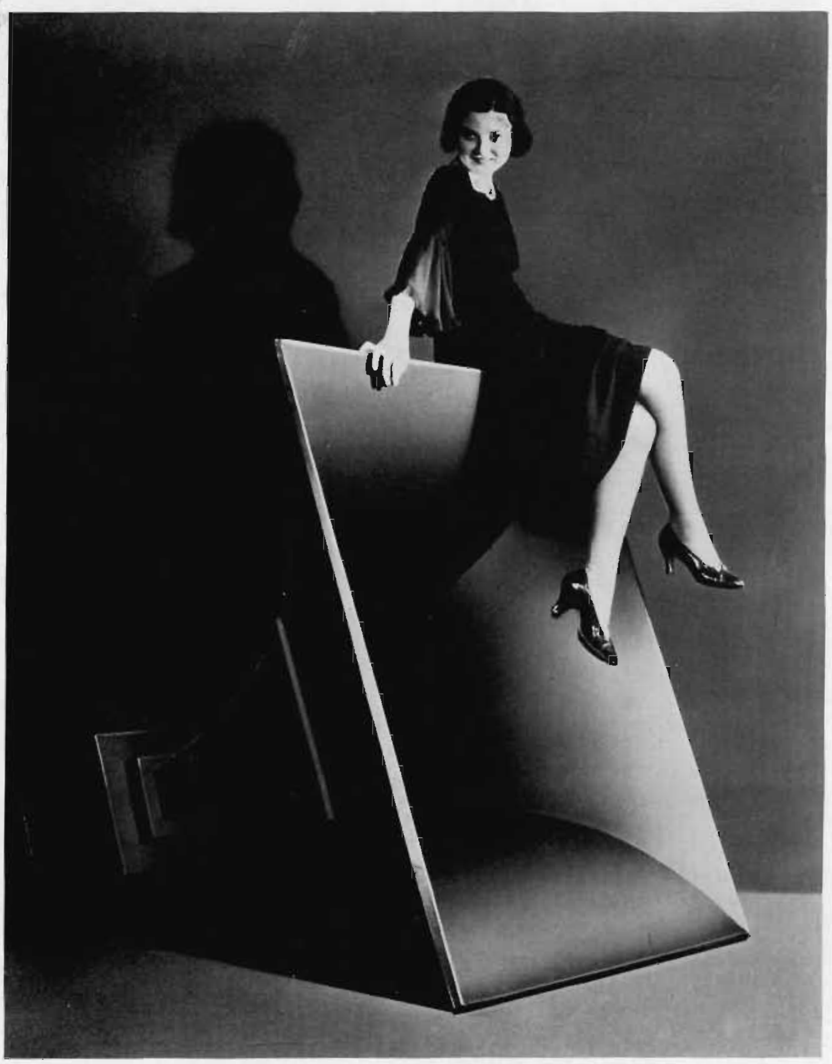
New velocity microphones are being used on the stage to pick-up the orchestra and vocal music. Frequencies ranging from the lowest audible tones to those beyond the highest heard in the orchestra are faithfully reproduced in their natural tone by these microphones. The amplification of the operatic performances on certain evenings during the week made the installation rather difficult. Velocity microphones have been placed on the stage in such a way that the artists singing on any part of the stage will be properly picked-up as well as the orchestra which is placed in the pit in front of the stage. To accomplish this, sound absorbing baffles have been fitted to the microphones to make them to some extent directional and to prevent the unwanted sound from the orchestra reaching the microphones used for the operatic stars.

The main portion of the amplifying equipment is housed in a small room just to the right of the shell. The amplifiers used give an output of fifty watts. The speech input equipment has practically a flat frequency range from 30 to 10,000 cycles. This guarantees an absolute

ENGINEERS **LE ROY ANSPACH** AND **GEORGE LEWIS** AT THE CONTROLS OF THE SOUND REENFORCING AND BROADCAST PICKUP EQUIPMENT AT ROBIN HOOD DELL faithful reproduction of both the high and low frequency notes of a 'cello and also the high frequency notes of a piccolo. Prior to this installation the best frequency range was from 50 to 6,000 cycles with the result that many important parts of compositions were either improperly reproduced or entirely eliminated. The equipment is operated entirely from the alternating current supply and is duplicated to assure continuous operation.

Two large ten foot directional baffle type loudspeakers have been placed on top of the shell in such a manner than an even distribution of sound is accomplished throughout the Dell, which has a seating capacity of six thousand. The transmission is so perfect that it is practically impossible to tell whether you are hearing the sound directly from the orchestra or from the horns.

ENGINEER **LEROY ANSPACH,** AT THE CONTROLS OF THE SOUND REENFORCING EQUIPMENT AT ROBIN HOOD DELL.


SITTING PRETTY—ON TOP OF ONE OF THE DIRECTIONAL BAFFLE TYPE LOUDSPEAKERS, SUCH AS HAVE BEEN INSTALLED AT ROBIN HOOD DELL.

In addition to the amplification this year the Saturday and Sunday evening concerts are being broadcast over a coast to coast network of the Columbia Broadcasting System with WCAU acting as the key station. The equipment necessary for the broadcasting has been installed by RCA Victor Company, Inc.

The entire installation has been under the supervision of John G. Leitch, Technical Supervisor of WCAU. George Lewis, Assistant Supervisor will be in charge of amplification and broadcasting during the summer and LeRoy Anspach, Production Engineer, will be in charge of the transmission. Engineers Hank Geist and Raymond Stahl, who assisted in the installation will also be stationed at the Dell.

STUDIO NOTES

Fannie Brice tries to forget the studio audience when she broadcasts over NBC. After one or two experiments, she has resolved not to wear costume, and when she sings, she has the glass curtain down and stands directly in back of the mike. She has found that any tendency to play to the studio visitors causes her broadcasting to suffer.

The Baltimore Police Radio System

A Splendid Example of Modern Police Protection by Radio

By OSCAR McCLELLAN

IN equipping the City of Baltimore with a Police Radio System, General Charles D. Gaither, who has been Police Commissioner of that city for thirteen consecutive years, has established a system which may well be taken as an example by other big cities of the United States, and for that matter, cities of foreign countries. With the able assistance of Sergeant William Edward Taylor, Supervisor of Radio, he has inaugurated many unique and efficient features which make for a maximum of protection at a minimum of expense. It is interesting to note that since March 4th, 1933, up to the present time, the average time consumed in answering police radio calls has been two minutes, fourteen seconds, which we believe to be the best performance ever obtained by any Police Radio System.

FIGURE 1—**GENERAL GAITHER** (STANDING) AND **DISPATCHER JOHN S. LELAND** (SEATED), AT THE MASTER CONTROL BOARD LOCATED IN POLICE HEADQUARTERS, BALTIMORE, MARYLAND.

General Gaither has carefully plotted the radio districts for the City of Baltimore, much in the form of a spider web, with Police Headquarters in the center and the eight districts forming the sectors between the boundary lines radiating from that point. In each of these districts, radio equipped cars continually cruise and are continually in contact with Radio Headquarters. Four times an hour, Radio Headquarters sends out a test call at regular intervals of 10, 25, 40 and 55 minutes after the hour. (These particular times are chosen so as to avoid confliction with the test calls of certain other cities which are equipped with Police Radio Systems.) Whenever an incident or an accident requiring the attention of the police is telephoned in to Headquarters, or to any of the other police stations throughout the city, the call is immediately broadcast over the radio system by the dispatcher on watch at the master control board, located in Police Headquarters. Here the dispatcher can tell at a glance just what cars are available in each district to answer such alarms, and during the call which he sends out he directs certain cars to go to the location of the trouble. By means of a very clever and unique system of lights controlled by key switches, he can tell at a glance what cars are available and what cars are already busy on other calls or "out of service." At the left of this switch board there is a bank of green lights, each bearing a number, and at the right is a corresponding bank of white lights bearing similar numbers. Every police "cruiser" car which is available is represented by a green light on the left half of the board and whenever one of these cars is directed to answer an alarm, the operator at this control board throws a key switch bearing the number of this car, and immediately the corresponding green light on the left half of the board is extinguished and a white light on the right side of the board is illuminated, indicating that this particular car is busily engaged in

POLICE RADIO ORGANIZATION
BALTIMORE POLICE DEPARTMENT

General Charles D. Gaither,
Police Commissioner
George G. Henry,
Chief Inspector
Sergeant William E. Taylor,
Supervisor of Radio
Dispatcher, John S. Leland
(Also two relief dispatchers)
Charles E. A. Linn, First Operator
George J. Haslup, Second Operator
Joseph M. Carney, Third Operator
Ernest E. Oliphant, Fourth Operator
Ferdinand I. Kammer, Fifth Operator
John Quincy Adams, Sixth Operator
Joseph J. Recker, Seventh Operator
F. Russell Durham, Eighth Operator
(Cruising car personnel not listed)

answering an alarm. After the alarm has been answered and the case cleared up, one of the two men who operate this particular car telephones in to Police Headquarters, making a routine report on the subject, and they are then directed to return to their regular cruising activities. The dispatcher at Police Headquarters then transfers this car back into "available service," and by means of the key switch, the corresponding white light is extinguished on the right hand side of the board and the green light re-appears at the left side of the board.

Under ordinary circumstances, at present, there are fourteen of these cars in active service, which means that there are fourteen green lights appearing at the left side of the control board. The switch board, however, has been designed and built with a view toward future expansion, and there are positions available for a total of sixty cars.

In addition to the colored light system just described, and a two-way telephone instrument, there is incorporated in the switch board a microphone and a telephone amplifier for the voice line, which extends from Police Headquarters to the location of the 500 watt transmitter, 4½ miles distant, at the "Northern" police station. At the Northern police station, an efficient and attractive installation has been made, including an RCA Victor ET-3670 Police Alarm Radio Transmitter and a UT-4199, 400/500 watt power amplifier-modulator unit, all mounted on a specially constructed oak desk. Between these two units there is also a telephone amplifier for the voice line connecting this point with Police Headquarters. Gazing out through one of the windows of this transmitter station, one may see the 70 foot wooden mast which supports the single wire transmitting antenna. This particular location was chosen after considerable time had been spent making surveys and field intensity measurements, and the results of the preliminary tests have been confirmed by the excellent performance obtained in service.

ABSTRACT OF ACTIVITIES OF BALTIMORE POLICE RADIO SYSTEM FOR THE MONTHS OF MARCH, APRIL, MAY AND JUNE, 1933

	March	April	May	June
TOTAL CALLS	341	499	664	667
Murder			2	
Assault (Deadly Weapon)	6	3	12	3
Rape			2	
Assault (Common)	6	6	15	9
Holdup and Robbery		1	5	3
Burglary	4	4	8	4
Automobile Thieves	2	8	7	1
Embezzlement			1	
Deserter, U. S. Army			1	
Vagrancy			1	4
Disturbing the Peace	4	18	18	27
Disorderly Conduct	26	33	98	77
Suspicious Characters	3	8	28	
Failing to stop after accident			2	3
Opr. under influence of liquor		2	2	4
Drunk on the street	9	6	12	7
Bicycle Thieves			2	
Larceny			12	3
Held for investigation		7		6
Attempted Burglary		3		
Unauthorized Use of Cars		1		2
TOTAL ARRESTS	60	100	228	153
Locating Persons by Radio			7	6
Life Saved (Gas Cases)		1	2	2
Life Saved (Drowning)			1	
Returned—Lost Children		1	7	2
Returned—Adults				
Recovered Automobiles	5	10	16	9
Recovered Bicycles			2	
Automobile Accidents	13	29	42	76
Accidents (General)	2	8	22	
Alarms of Fire	35	65	55	53
AVERAGE TIME (Consumed in answering calls)	2 min. 30 sec.	2 min. 21 sec.	2 min.	2 min. 14 sec.

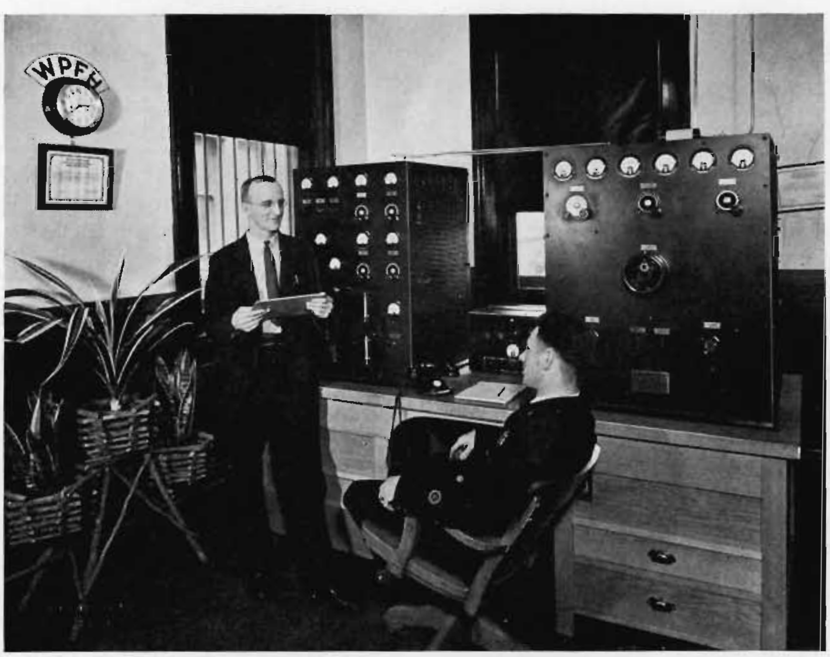


FIGURE 2—**SERGEANT WILLIAM EDWARD TAYLOR** (STANDING), SUPERVISOR OF RADIO FOR THE POLICE DEPARTMENT, BALTIMORE, MARYLAND, AND **FIRST OPERATOR CHARLES E. A. LINN** (SEATED), AT THE RCA VICTOR TRANSMITTER LOCATED IN THE NORTHERN POLICE STATION.

The transmitter itself is placed on the air only when actually needed, during the broadcasting of alarms and the regular test calls at fifteen minute intervals and at other times it is kept in a stand-by position. Regular listening watches are maintained on a short wave receiver at the transmitter station during the periods prescribed by the Federal Radio Commission.

Up to the present time, a total of 25 cars have been equipped with RCA Victor Police Radio Receivers. Copper screen antenna installations have been made in the tops of these cars, which makes for very efficient operation. General Gaither hopes in the near future to have an additional 35 cars similarly equipped.

In the 91.7 square miles covered by the eight radio districts of Baltimore, there is a total of approximately 900,000 population. In cases of emergency, the fourteen cars engaged in cruising throughout these eight districts may be sent to fourteen fixed positions which command all the main arteries leading into and out of the city. This means that criminals attempting to make their escape by automobile would find all roads effectively blocked in every direction.

A very interesting feature at the master radio control room at Police Headquarters is the map of the city of Baltimore, in which thousands of little colored pins have been inserted. Each pin represents a police alarm which has been answered through the medium of radio since the inauguration of this system on March 4th. These pins are in three different colors, one color representing alarms which occurred between 8 A. M. and 4 P. M., another color representing the alarms which occurred between 4 P. M. and midnight, and the third color representing the alarms which occurred between midnight and 8 A. M. Thus at a glance may be seen the "busiest" districts and also one may analyse the busiest time throughout the 24 hour day. This information is of great importance in planning for future expansion and operation.

RECENT RCA VICTOR POLICE RADIO INSTALLATIONS

City	Call	Frequency	Transmitter	Receivers
Reading, Pa.	WPFE	2442 K. C.	100 Watts	7
Baltimore, Md.	WPFH	2414 K. C.	500 Watts	28
Lexington, Ky.	WPET	1712 K. C.	500 Watts	12
Knoxville, Tenn.	WPFO	2470 K. C.	500 Watts	12
Des Moines, Iowa	KZGZ	2470 K. C.	100 Watts	
Kansas City, Kans.	KGPE	2422 K. C.	500 Watts	

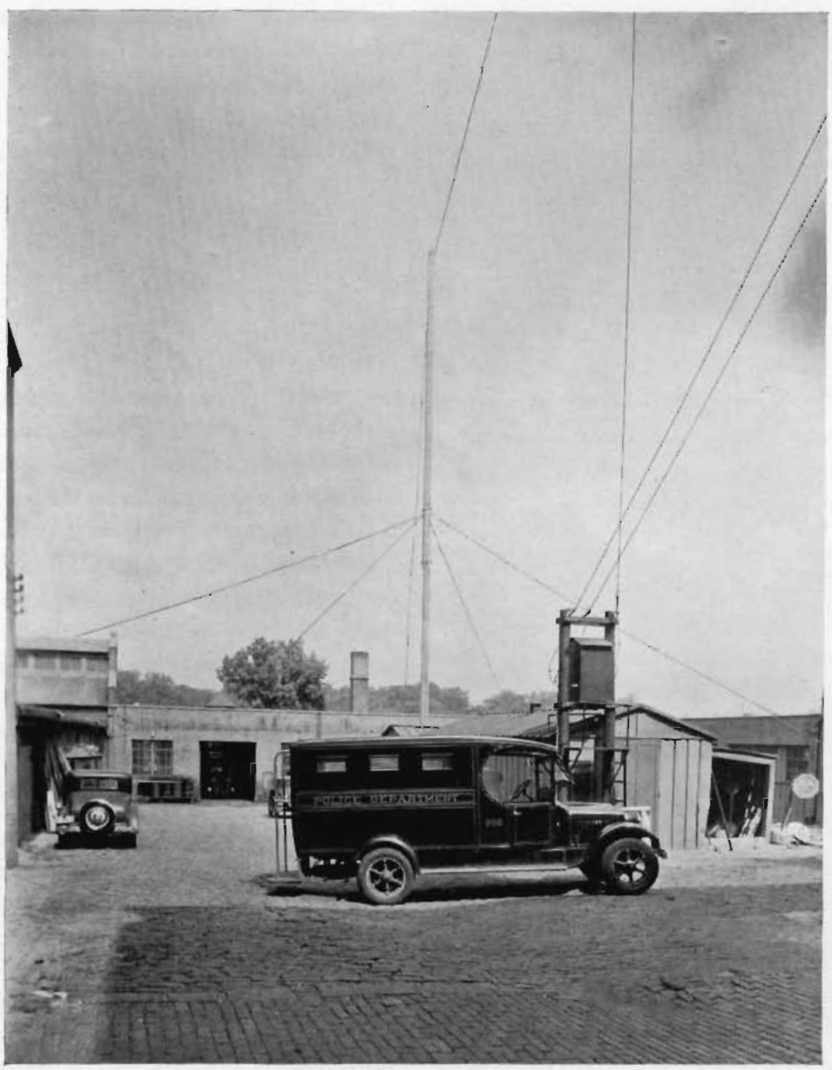


FIGURE 4—THE ANTENNA INSTALLATION AT **WPFH**, POLICE RADIO TRANSMITTER, BALTIMORE, MARYLAND.

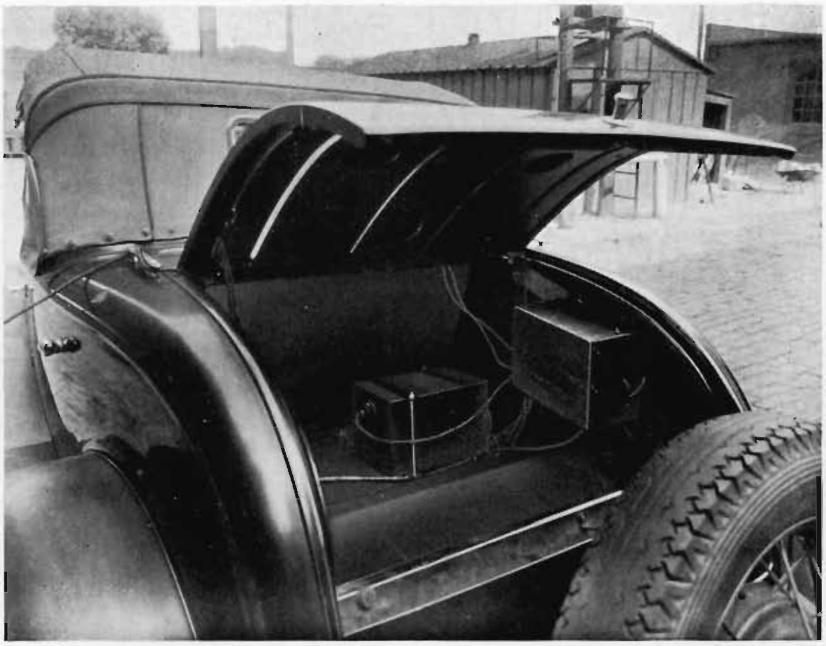


FIGURE 3—TYPICAL INSTALLATION IN POLICE CRUISING CAR, BALTIMORE, MARYLAND

Another interesting feature in the master control station at Police Headquarters is a specially designed map which facilitates the location of any street address. This map is designed with numbers around the margin, and a numbered tape which is pivoted at the center of the map so that any street address may be located in the entire city of Baltimore at a moment's notice. (These maps are published for all important cities in the United States, and may be obtained from Hearne Brothers in Detroit.)

The entire Police Radio System is operated by three watches, starting from midnight to 8 A. M., 8 A. M. to 4 P. M. and 4 P. M. to midnight. Sergeant Taylor has not only supervised the installation of the transmitter and all the receivers in the cruising cars, but he has personally instructed and educated all the operators in the art and technique of radio operating, running classes in his own day and night school so successfully that all the men have qualified for operator's licenses before the Federal Radio Commission. Sergeant Taylor also supervises the service station which maintains the transmitting equipment, the master control board at Radio Headquarters, and the radio receivers in the cruising cars. The unique design of the master control board at Police Headquarters is a product of his ingenuity and the board itself was built in his service station.

The accompanying table or "abstract" indicates the number of crimes of various sorts, the total number of calls, the total number of arrests, and the average time consumed each month in answering these calls. It is believed that this analysis will be of great interest to police officials of other cities—not only those which are already equipped with Police Radio Systems, but those which contemplate the installation of Police Radio Systems.

POLICE CHIEF QUINN BROADCASTS AS HOBBY

Police Chief William J. Quinn of San Francisco, looks on radio work as recreation, and classes his radio talks over NBC as his "favorite hobby" when questioned by interviewers.

WILBUR RHODES APPOINTED RCA VICTOR REPRESENTATIVE FOR MASSACHUSETTS

To Specialize in the New Police Radio Equipment

Wilbur Rhodes, who until recently represented RCA Victor in the Chicago District on Centralized Radio equipment, has been appointed Police Radio representative to cover the State of Massachusetts, and upon his recent visit to Camden, expressed much enthusiasm for the Company's new line of high frequency Police Radio equipment.

Mr. Rhodes' first connection with the RCA organization was in 1927, when he joined the Technical and Test Department at the laboratory in Van Cortlandt Park, coming from the Westinghouse Electric & Manufacturing Company, Springfield, Mass. Since then he has progressed from the Engineering Department to the Sales Department, and is widely known in the organization as well as in the field.

In the days when RCA Radiolas and Electrolas were being built into Victor combinations at Camden, Mr. Rhodes made frequent trips between the Technical and Test Department in New York and the factory in Camden, in the interest of coordination, and later was assigned as resident engineer at Camden. He was subsequently transferred to the Sales Department and assigned to the Chicago District, where he not only promoted the sales, but supervised the installation of many pioneer Centralized Radio systems in hotels, hospitals, schools, and other institutions.

If Mr. Rhodes does as well with Police Radio equipment in Massachusetts as he has done with Centralized Radio in the Chicago District (and we, of course, are confident that he will), we prophesy that the State of Massachusetts will soon be stricken off the criminals' hunting grounds as "heap bad medicine."

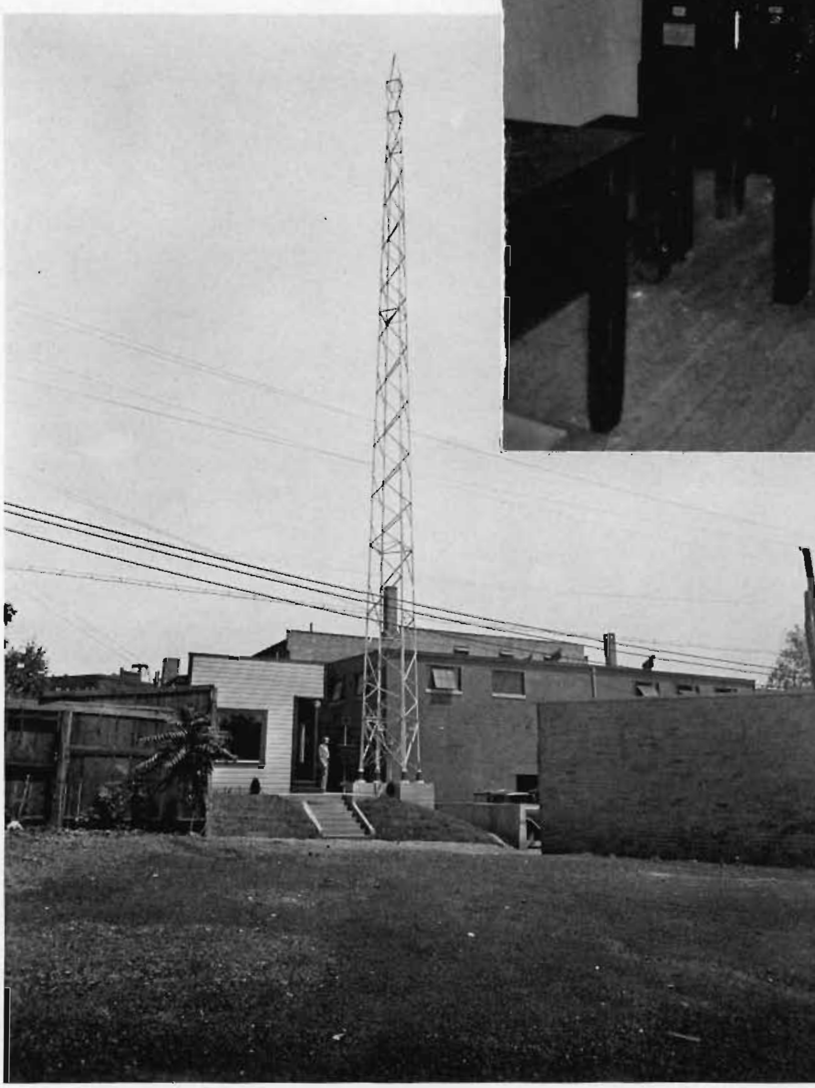
New Police Radio System for East Tennessee

By BEN ADLER, RCA Victor Sales Engineer

ABOUT six months ago the officials of Knoxville and Knox County, Tennessee, found themselves face to face with a serious problem in crime prevention. Along with the new administration in Washington came definite indications that the ten year old Cove Creek Dam project would become a reality. This meant that East Tennessee would not only return to prosperity thru the expenditure of approximately fifty millions of dollars but that it would attract criminals of all types from all over the country.

The success of Police Radio in other cities convinced the officials of Knoxville, Knox County and sixteen surrounding counties that the installation of such system would be their first move toward protecting the citizens of East Tennessee from this unavoidable invasion of crime.

W. ROSS HAHN, WHO HANDLED THE INSTALLATION WORK OF THE **RCA VICTOR** POLICE RADIO TRANSMITTER AT **WPFO,** KNOXVILLE, TENN.



THE 94 FOOT BLAW KNOX VERTICAL RADIATOR OF **WPFO,** POLICE RADIO STATION AT KNOXVILLE, TENN.

Walter Anderson, Director of Public Safety of Knoxville and Sheriff Brewer of Knox County placed in the very capable hands of City Office Engineer Hal H. Hale, the responsibility of investigating Police Radio Systems and equipment used in other cities thruout the country. Mr. Hale spent several months gathering data on the capabilities of Police Radio. After careful consideration on the part of the city and county officials, the contract for the installation of a 500 watt police transmitter and twenty automobile receivers was awarded to the RCA Victor Company, Inc.

Careful planning and hard work on the part of the city engineering department permitted the placement of Knoxville's new Police Radio System into operation during the same week that the Cove Creek Dam project became a law. The Police Radio Station was dedicated on Safety Day in Knoxville. The dedicatory exercises included the largest and most colorful parade ever witnessed on the streets of Knoxville.

The system has been in operation since May 20th of this year and both Director Anderson and Sheriff Brewer have on several occasions pronounced it a tremendous success. It is considered to be an indispensible part of their public safety equipment.

LEFT TO RIGHT—**HAL H. HALE,** CITY OFFICE ENGINEER, KNOXVILLE, **SHERIFF BREWER,** KNOX COUNTY, **WALTER ANDERSON,** DIRECTOR OF PUBLIC SAFETY, KNOXVILLE, AND **CHIEF OF POLICE YORK,** KNOXVILLE, OUTSIDE THE NEW POLICE RADIO TRANSMITTING STATION, **WPFO**

The transmitter proper consists of a standard RCA Victor Type ET-3670 one hundred watt exciter unit and Type UT-4199 500 watt modulator-amplifier unit. It is located in Knoxville's Public Safety Building in the desk sergeant's office which has been acoustically treated and air conditioned to render it suitable for use as a radio operating room.

The operator's desk is so located in the room that all of the meters on the panels of the transmitter units can be viewed by the operator. An RCA Type 40TA speech amplifier is located on this desk and is equipped with controls for placing

(Continued on Page 47)

MILBORNE SHARPE, CHIEF OPERATOR OF **WPFO,** AT THE **RCA VICTOR** POLICE TRANSMITTER AT KNOXVILLE, TENN.

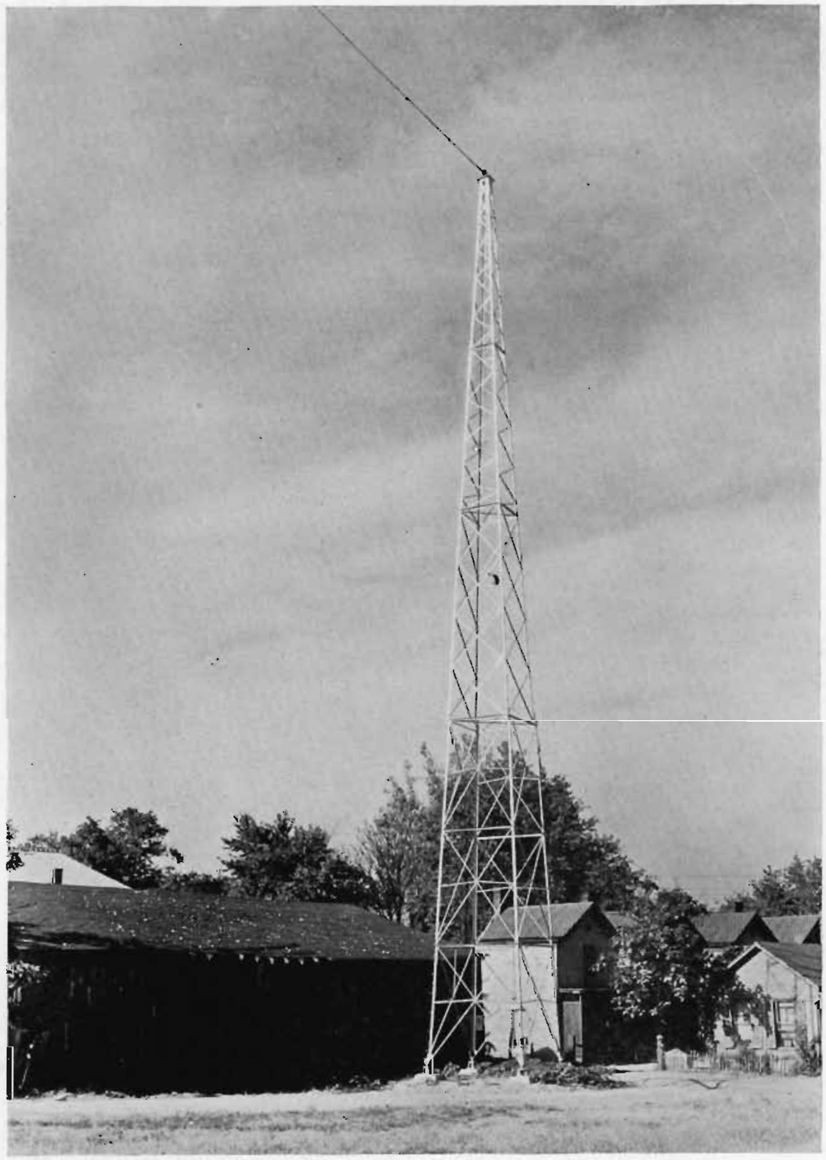
What Police Radio is Doing for Central Kentucky

By **PAUL MORTON, City Manager, City of Lexington, Ky.**

RADIO communication has been utilized in many ways for various purposes. Like other inventions, it has reached its present state of perfection and usefulness only thru constant improvements and experiments. Likewise it is true, in order to derive the most benefit from radio, it is necessary to continually take advantage of improvements and new possibilities. During the rapid progress in advancement, radio communication has been successfully applied to police activities. First, more or less as an experiment in a single community and then gradually extended to cover greater areas.

Central Kentucky has taken advantage of the fact that radio may cover a relatively large area as applied to the apprehension of criminals and prevention of crime, along with several other items of police nature. Station WPET, the nucleus of the system, is located at Lexington. Fifteen other cities in Central Kentucky now comprise the area served with police radio. This means that each city within a radius of thirty-five miles from Lexington is practically in constant touch with each of the other cities in this "net" so far as police affairs are concerned. Each of these cities has the facilities of the police alarm station WPET available for broadcasting any alarm by merely calling, via long-distance telephone and giving the desired information. That information is then broadcast and each city receives same with a minimum delay. Before the installation of the radio system, it would have been necessary to have made fifteen separate long-distance telephone calls to accomplish the same end in contrast to only one under the present system. This effects a great saving in time and money.

There are numerous benefits to be derived from this system by each city and county; that is, ability to contact their own radio equipped cars for orders from their headquarters in emergencies, more efficient police service in their immediate area at a reduced expense, helpful information concerning activities in surrounding cities, and the feeling



ONE OF THE INSULATED 103 FOOT MILLIKEN TOWERS AT **WPET.**

D. A. REESOR, RCA VICTOR SALES ENGINEER, WHO HANDLED THE LEXINGTON POLICE RADIO JOB. WE WISH TO MAKE ACKNOWLEDGMENT TO MR. REESOR FOR THE SPLENDID PHOTOGRAPHS OF THIS INSTALLATION WHICH HE FURNISHED, A FEW OF WHICH APPEAR WITH THIS ARTICLE.

of security due to close contact with other cities and law enforcing agencies. All these advantages are realized with the use of only one transmitter centrally located, and is available to each city in the "net" twenty-four hours daily.

There is a connection which is very successful in Central Kentucky as a whole toward the apprehension of criminals and prevention of crime, in addition to the advantages

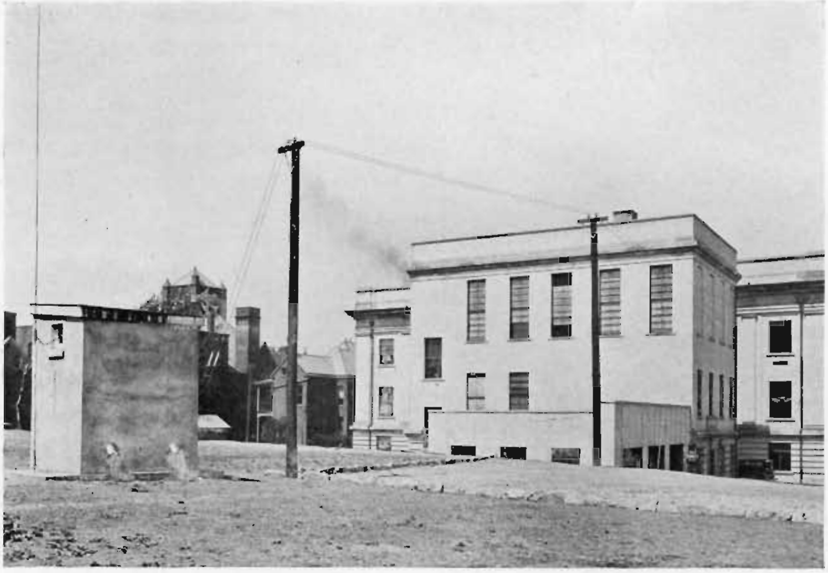
RUSSELL PENN, CHIEF OPERATOR, SEATED BEFORE THE TRANSMITTER AT THE LEXINGTON POLICE RADIO STATION, **WPET.** MR. PENN IS A GRADUATE OF THE UNIVERSITY OF KENTUCKY, COLLEGE OF ENGINEERING (B. S. IN M. E.) CLASS OF 1927. HE IS ALSO AN EXPERIENCED **RCA** SHIP RADIO OPERATOR.

FRANK H. GRAVITT, ASSISTANT OPERATOR, LEXINGTON POLICE RADIO STATION, **WPET.** MR. GRAVITT IS A GRADUATE OF THE UNIVERSITY OF KENTUCKY, COLLEGE OF ENGINEERING (B. S. IN M. E.) CLASS OF 1929

to each city in handling their own particular local matters. In the present state of organized crime, the criminal has taken advantage of all available resources such as fast cars, modern firearms, and even radio in some instances. In possession of these, in addition to well laid plans, he has a decided advantage over the law enforcement officers unless there is something to offset this condition. The radio equipped "network" in Central Kentucky has been recognized to have greatly offset the criminal's advantage and has proven this fact beyond a doubt in several instances. A crime committed is almost instantly known by each police department and law enforcement agency within the area, thus a large number know all the available facts concerning the crime and have all the information obtainable to aid in apprehending the criminal. The criminal is immediately surrounded and all routes of escape cut off before he is able to get outside the area. Additional information which is obtained later and may aid in the search is given the men in various cruisers and at stationary points. Thus no time is lost by having to call back for additional information or learn of the progress being made in other sections of the "net." The criminal no longer must consider the immediate problem of escaping police officers at the scene of the crime, but must contend with every officer and obstacle within the entire area of the "net." He has a minimum chance of escape after having committed the crime, due to the alarm via radio.

While the actual capture of the criminals at the scene of the crime or afterward is probably the more evident example of results obtained, the presence of this system in Central Kentucky has undoubtedly proved to be equally important in the prevention of crime. The criminal must consider the problem

PROGRESS VIEW DURING THE CONSTRUCTION OF THE GROUNDING SYSTEM AT **WPET.** THE No. 0 STRANDED COPPER CABLE USED IN THIS NETWORK IS WELL BRAZED AT ALL JOINTS.



VIEW OF THE TRANSMISSION LINE AND "DOG HOUSE" AT LEXINGTON POLICE RADIO STATION, **WPET.**

of escape when he is contemplating a crime if he expects to accomplish his end. Unless he can do this with a fair degree of certainty, he cannot feel confident and consequently does not like to take the chance of being captured and punished. Knowing the potential power of the radio equipped "network" in Central Kentucky from previous examples of other criminals being speedily brought to justice, the would-be criminal cannot feel confident of a successful undertaking within this area. The area representing Central Kentucky's radio equipped "net" shows the red danger signal on the criminal's map of proposed operations

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Statement issued by W. R. G. Baker, Vice-President of the RCA Victor Co. to newspapers on July 12, 1933

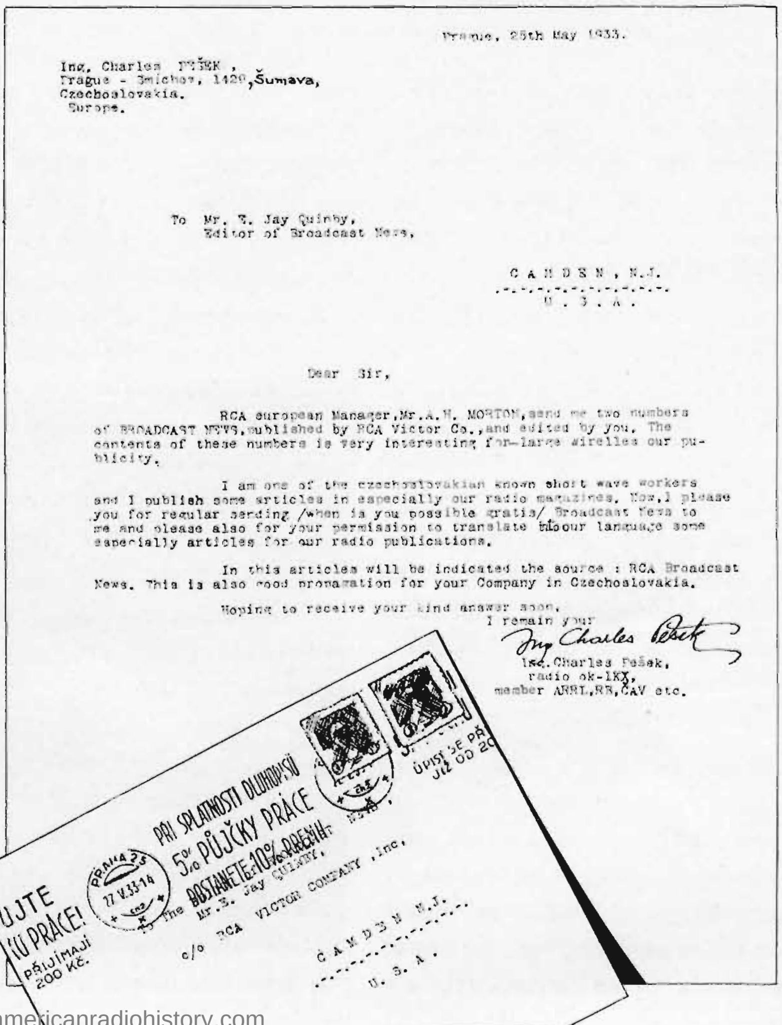
"Through the medium of our Employees' Representation Plan, the company has been asked to consider—prior to the establishment of a Code for the Radio Industry—the increasing of rates for all hourly and piece-work employees.

"This matter has been given very serious consideration and I am pleased to advise that—subject to such modifications as may be necessary upon the establishment of a Code for the Radio Industry—a 10% increase in wages for all hourly rated and piece-work employees will be effective July 24th—which is the date we return to work after our vacation period. This rate increase will effect approximately 80% of the employees of the RCA Victor Co.

"While our rates at this time and in the past have always averaged high in the Radio Industry, the RCA Victor Company is taking this step in order to further the effort being made by our National Goverment to increase the buying power and put more people to work.

"The company appreciates the loyalty that has been demonstrated by its employees during these trying times and wishes to assure them all of the advantages that will be brought about through the establishment of a Code for the Radio Industry."

Broadcast News Magazine Popular in Czechoslovakia



Prague, 25th May 1933.

Ing. Charles PEŠEK,
Prague - Smichov, 1420, Šumava,
Czechoslovakia.
Europe.

To Mr. E. Jay Quinby,
Editor of Broadcast News,

C A M D E N , N.J.
U . S . A .

Dear Sir,

RCA european Manager, Mr. A. H. MORTON, send me two numbers of BROADCAST NEWS, published by RCA Victor Co., and edited by you. The contents of these numbers is very interesting for large wireless our publicity.

I am one of the czechoslovakian known short wave workers and I publish some articles in especially our radio magazines. Now, I please you for regular sending /when is you possible gratis/ Broadcast News to me and please also for your permission to translate into our language some especially articles for our radio publications.

In this articles will be indicated the source : RCA Broadcast News. This is also good propagation for your Company in Czechoslovakia.

Hoping to receive your kind answer soon,
I remain your
Ing. Charles Pešek
Ing. Charles Pešek,
radio ok-1KX,
member ARRL, RR, ČAV etc.

"His Master's Voice" of the Air

RADIO COMMUNICATION "ON THE WING"

THIS is the Stinson "Jr." four place cabin airplane which is used for testing and demonstrating various types of aircraft equipment by the Aviation Radio Section, RCA Victor Company, Inc.

Aircraft radio is put to the hardest of any radio equipment usage. In a period of a few hours it may have to stand up and must work under the most trying conditions of extreme cold, extreme heat, storms, rough air, and thunder storms which are full of static, and it must come through working 100% O. K., for upon it depend the safety of as many as twenty lives and the expensive aircraft equipment itself.

Radio equipment that works 100% in the laboratory will not always do so in an airplane, and therefore it must be given actual flight tests. It has been found through experience that just flying around the home airport will not give the testing results desired and cross country flights must be made as long as three or four hundred miles to encounter the various weather conditions, such as snow storms, rain, fog high winds with rough air, and thunder storms.

Pilots who are to fly this equipment on air lines with mail and passengers and on privately owned aircraft will not take any manufacturer's word that apparatus works, but insist on actual flight tests by pilots who know what is expected of the equipment.

In contacting various pilots and air lines about the country and finding out what they want, development material is obtained for the engineers. Working with them to get new apparatus built, then tested, and after it is proven to be what is believed it should be, the product is made ready to offer to market. The airplane also plays the important part for travel to and from prospective users and demonstrations

NEW POLICE RADIO FOR EASTERN TENNESSEE

(Continued from Page 43)

the transmitter into operation and for regulating the modulation level. The desk sergeant at his Gamewell panel is close enough to the radio operator's desk to hand the operator written instructions covering each dispatch to be issued over the air. A city map hangs on the wall in the radio room that can easily be viewed by the operator from his position at his desk. The city is shown divided into zones. Each zone is covered by a radio equipped automobile. Three small colored electric lights in each zone on the map shows at a glance whether the car in each zone is cruising, out on call or out of service. The lights are controlled by push buttons on the operator's desk.

The antenna system for the transmitter consists of a 94 foot quarter wave vertical radiator of Blaw Knox manufacture. It is located on the ground to the rear of the Public Safety Building. A two wire transmission line connects the output of the transmitter to the antenna. Transmission line terminating equipment used to match the impedance of the line to that of the antenna is contained in a small wooden box located near the base of the antenna tower.

The site for the transmitter was selected after field intensity measurements were made on a temporary set up. The information obtained from the preliminary survey together with actual measurements made on the final installation indicate that the entire set up is operating efficiently. There are very few places in Knox County where the signal intensity drops below 100 microvolts per meter. Practically no dead spots can be found thruout the entire county.

The station's call letters are WPFO. It operates on a frequency of 2,470 kilocycles and was installed for operation on a power of 250 or 500 watts.

What Is It, Old Timer?

IN response to the several* requests of our readers who are interested in seeing a picture of the editor, we are pleased to publish the accompanying portrait, contributed by our enthusiastic critic, George P. Hopkins, of Brooklyn, New York.

The original is done in brilliant colors, and we regret that we cannot reproduce this glorious work of art in its original form. However, the black and white cut will serve to give curious readers an idea of your editor in action. Every detail in this picture has its particular significance — the lantern burning midnight oil, is draped with cobwebs—indicating that we are entirely too busy to trim it—or anything else. The door, you will note, is boarded up, as the forms have closed for this issue, and we simply *must* not be bothered by any intruders until the magazine is off the press—or maybe it's to keep out Stanley Goulden, who has just discovered that the word REENFORCE was spelled REINFORCE in our last issue. However, he has sent us a telegram (under the door) to the effect that he found this glaring mistake—and his wire will soon join the rest of the material in our waste basket which has been rejected by our board of censors.

The train in the picture on the wall is tearing right out of the frame and shooting skyward—symbolic of the upward trend of business which is getting completely out of control of the pessimists, and the ship in the other view is sailing on a sea that is fast leaking out of the picture. This indicates that the third floor is all wet, and that the second floor will soon be the same.

The vacant chair, upset in the foreground implies that the stenographer has rushed out in a huff—being unable to stand the editor's Corema Seegars.

The pile of letters on the desk might be compliments from ardent admirers and interested readers, but, until ye editor reads them he will continue to suspect that they are unpaid bills for groceries and personal phone calls.

The broken XXX cider bottle suspended by the silk ribbon, indicates that the central figure has just returned from the christening of another youngster, or yacht, or something.

*Two.

CITY MANAGER OF MIAMI RECOMMENDS POLICE RADIO

(The following editorial appeared in the MIAMI POST, June 3)

City Manager L. L. Lee, in his tentative budget for this year, recommends that the city construct and operate a police radio system as used in the larger cities. Palm Beach is constructing a police radio and Jacksonville has been operating one, with much success, for some time.

The situation in Miami is a little different to other parts of the country. Here we are at the end of the country with practically nowhere to go but north. Crime committed in this area usually results, if the culprits are caught, in arrests somewhere in the northern part of the state. Criminals after pulling off a job here make for the only way out—the north. They are usually caught before they get to Jacksonville if they try to make a straight getaway. They can also make for the Tamiami Trail and the west coast. That is just as dangerous a route for criminals as the east coast.

What is really needed is a network of police and sheriff radio stations scattered all over the southern part of the state. This can be done very cheaply now with a new transmitter built by RCA. These small transmitters capable of covering a circle of ten miles, can be installed almost as easily as plugging in a toaster. They cost one thousand dollars a unit and one unit will cover Miami. Another could be used in Miami Beach. Another in Coral Gables. Another one in Homestead and we'd have Dade county pretty well covered. All for a matter of four thousand dollars. To get real use out of police radio here we must be able to cover territory much larger than the city and this scattering of transmitters would accomplish that. To build a transmitter large enough, in the regular way, to cover the area we need would cost twenty thousand dollars. The new small transmitters operate receivers in police cars and special small receiving sets fastened to the belts of patrol men.

SOUTH PORTAL, RCA HALL
IN THE ELECTRICAL BUILDING AT THE "CENTURY OF PROGRESS" EXHIBITION, CHICAGO. HERE MAY BE SEEN GATHERED, THE MANY PRODUCTS AND ACTIVITIES OF THE RCA ORGANIZATION.

RCA Victor
BROADCAST EQUIPMENT

—The Result of Over 30 Years of Leadership in

MUSICAL REPRODUCTION