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December
1934

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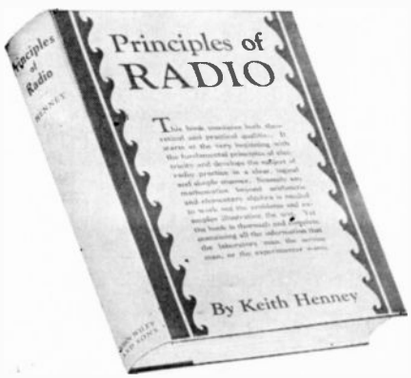


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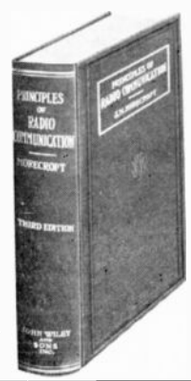

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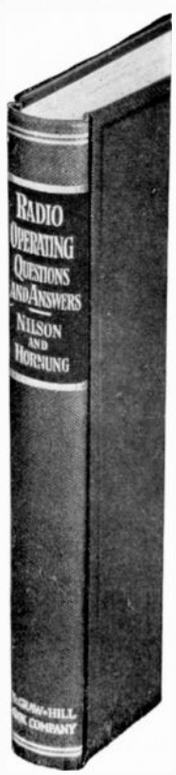
This book gives over 600 questions and answers covering all radio operator license examinations. Questions are typical of those used on examinations; answers are full and well illustrated. This edition has been enlarged to include information on broadcasting, marine, aeronautical, police and amateur radio operating and contains many new questions and answers on new transmitters, new radio laws and license regulations, etc.

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VOLUME IV NO. 3



RADIO, like many forms of business, is stepping along. The increased manufacture of radio receivers as reported by all the larger manufacturers is little, if any, behind the recovery of other forms of industry. Expenditures for new commercial transmitters shows that there is a healthy activity.

From the labor point working conditions are better. From the business point all that can be expected is already with us. Let us hope that the improvement continues.

Engineering staffs are at last able to put on the market some of the fruits of their endeavors. This is good news to all of us.

The communications riddle shows good prospect of being solved. The hearings completed at Washington should lead to some very excellent plans when finally presented to Congress early next year.

The generous dealing by the Communications Commission with applications for new and small broadcast stations will do much good, as will the studies of the clear channel station now under way.

The "shake-up" all around promises much activity, where before a dormant, doubtful, apathetic atmosphere pervaded everywhere.

The after holiday activity should show even better results and we then have the favorable prospect of at least several good months to look forward to.

# COMMERCIAL RADIO

*(FORMERLY "C-Q")*

*The Only Magazine in America Devoted Entirely to the Commercial Radio Man*

## Contents for December, 1934



Published Monthly by CQ Magazine Company, 7 West 44th Street, New York, N. Y., Phone VAnderbilt 3-8091. Yearly subscription rate $2.00 in U. S. and Canada; $2.50 foreign. Make all checks, drafts and money orders payable to the Company. Single Copies, 20 cents. 

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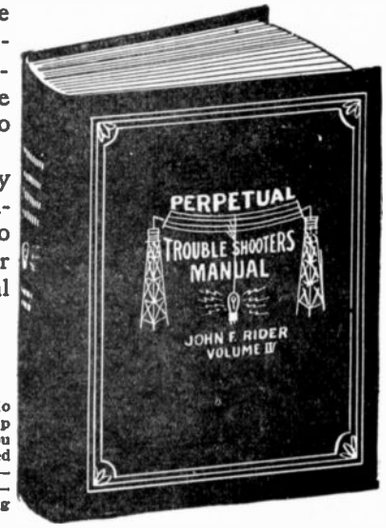
You will witness a new era in radio servicing during 1934 . . . and it is only the start of complex radio service problems . . . Research laboratories in contact with receiver manufacturers forecast increased science applied to radio receiver design . . . We are passing out of the three and four tube receiver stage—back into the 8, 10 and 12 tube stage with highly complicated electrical networks . . . Hourly use of radio service data will be imperative. . . ."

John F. Rider

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### VOLUME I

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**This volume covers the period between 1919 and early 1931. The great majority of the old receivers are to be found in this volume.**

### VOLUME II

800 Pages, $6.50

**This volume covers the period between early 1931 and the middle of 1932. It also includes some older receivers, which were not available when Volume I was printed. Point-to-point data is to be found in this volume.**

### VOLUME III

1185 Pages, $7.50

**This volume covers the period between middle 1932 and about June of 1933. It also includes some old receivers which were secured subsequent to the publication of Volumes I and II. Volume III also contains some point-to-point data and the world's only set catalog identifying about 8,000 models.**




All of these manuals contain schematic wiring diagrams, socket layouts, chassis diagrams, voltage data, photographic views, resistor data, condenser data, electrical values, alignment notes, i-f peaks, trimmer location, continuity test and point-to-point data, etc., etc. All manuals are loose leaf bound in "instant-removal" type binder and contain cumulative index.

## JOHN F. RIDER, Publisher

1440 Broadway NEW YORK CITY

# The New Automatic Microphone Boom

By DRAMIN D. JONES, Chief Engineer WAAT

THE trained technician, and others well informed, in the broadcast industry, have long been aware of the inadequacy and inefficiency of existing methods for obtaining the correct location of microphones.

It would seem that the problem of handling microphones to best advantage has been left entirely to those engaged in broadcast and sound technic.

The larger manufacturers probably feel that with the natural growth of the industry, its wants will make themselves manifest, and the need for some equipment which will render the microphone more flexible in application is substantiated by a glance into many of the leading studios of today.

The purpose of this article is to describe a new device, by means of which the microphone may be directed to practically any useful position in the total studio area. This by fully automatic means, and through the sole use of push buttons in the control room, or other desirable terminating point for the control equipment of the automatic boom.

The control engineer may, by means of this device, produce the following results:

a Raise, or lower, the microphone.

b Change the position of the pickup during the course of a broadcast and move same to any other desirable point.

c Move pickup further away or closer to sound source.

d Determine the most satisfactory and advantageous point of pickup during rehearsals, and at the outset of nonrehearsed programs.

e Produce "physical fading" effects by mechanical means.

f Create unusual sound effects.

Other uses and applications will be obvious from the following:

The automatic microphone boom has at least the following advantages over the present method of manually localizing microphones:

a No person will be required to move the microphone during the course of a program, its supervision being held under push button control by the studio engineer in the control booth.

b Program critics, supervisors, or musical directors may, in collaboration with the control engineer, make changes or last-minute corrections to suit themselves, instantly, positively, automatically.

c In the smaller stations, where the control engineer must rely on his own judgment, it will enable him to actually "feel" the program under observation, thus making the problem of securing the most effective balance greatly simplified.

d It can be used very successfully for television purposes, where the microphone must be kept from the "field of vision."

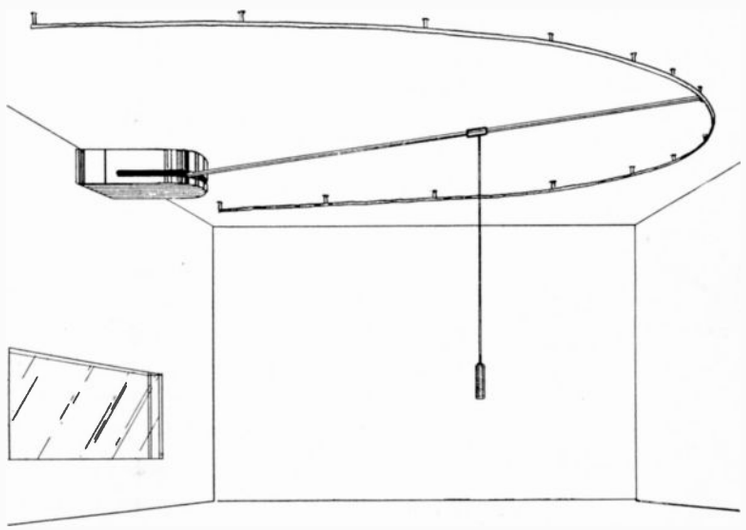
e It permits co-ordination of BOTH the acoustic as well as the electrical phases of a transmission, by centralization in the control room.

### Some Requirements for a Successful Automatic Boom

A truly automatic microphone boom, suitable for sound recording, broadcast use, and other pertinent applications, must fulfill the following requirements:

1 It must be practical, and reliable.

2 It must be constructed soundly, embodying simple mechanical and electrical principles of operation.



3 It must provide LATERAL, RADIAL and VERTICAL movement of the microphone, each action must be obtained individually, or simultaneously with any other as the particular requirements may dictate.

4 It must be compact, pleasing in appearance, and unobtrusive.

5 It must be quiet mechanically, and non-interfering electrically.

6 Its basic mechanism must be standardized for all installations.

7 It must be inexpensive to install and maintain.

Rotation of the microphone itself might be an advantage when using the velocity or other directional type microphones, it is felt however that to include mechanism for producing this movement would complicate the entire device to the extent that manufacturing costs might be prohibitive.

It is also true that semi-directional microphones would not require this feature, so as a compromise between simplicity and complexity in design, rotational movement is not considered important at the time.

### Three Basic Motions

As mentioned in the foregoing there are employed in the automatic microphone boom three basic motions, for producing lateral, radial, and vertical movement of the microphone.

These are described graphically with an adequate written explanation of the mechanics of each.

In figure 1 is shown a compete plan view of the entire system. The boom (10) is made fast to disc (11) which has gear teeth cut in part or all of its periphery. (Depending upon the type of installation.)

All the mechanism for producing lateral and vertical movement of the microphone is mounted on this disc, which is approximately 30 inches in diameter.

### Radial Motion

The boom is caused to sweep radially by the simple coupling of the worm (18) to the main disc (11). Motor (19) is reversible, and alternating current operated. (¼ h.p.)

Motor (19) is provided with a gear head reduction mechanism so that shaft (2) revolves very slowly. The entire mechanical load of the boom and microphone is handled easily.

The limits of radial motion are determined by the length of the ceiling track (13). Figure 4 shows a modification of the device more suitable for 360-degree movement. In this case no ceiling track is used, and a wire stay, as illustrated in Figure 3, is substituted.

### Lateral Motion

A study of both Figures 1 and 2 will reveal the simple details for obtaining lateral motion of the microphone (31).

Needless to say, the trolley (25) is free to travel the full working length

of the boom (10). An endless cable runs around pulleys 22 and 24, taking two or more turns at 22 for added traction.

This cable is securely fastened at a point on the trolley (25). It can be seen readily that any motion of the motor shaft (20) will result in a corresponding shift in the position of trolley (25) on the boom itself. Motor (20) is reversible, A.C. operated, ⅛ h.p. and is provided with a gear reduction head.

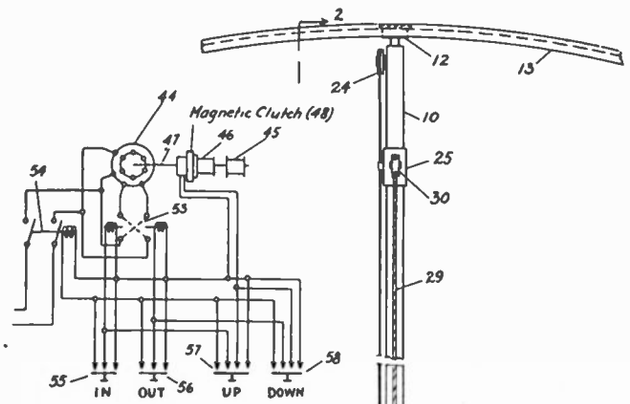


Fig. 5


Fig. 1

### Vertical Motion

Principally, vertical movement of the microphone is obtained by compounding several turns of microphone cable (29) around drums 32 and 33, the height of the microphone being governed by the distance between centers of these two drums.

It should be noted that both drums (32) and (33) are free to revolve at all times, being mounted rotably on their respective shafts. Drum (32) however is held in a fixed position on the disc (11), while drum (33) is mounted on a traveling block (34) which is caused to move by the use of motor (36) and lead screw (35). Motor (36) is ⅛ h.p. alternating current operated, reversible, and provided with a gear reduction head.

The raise-lower differential is then determined by the amount of cable (29) which is wound on drums (32) and (33).

The vertical distance the microphone is free to travel is then a function of the horizontal travel of drum (33).

As the microphone cable (29) is held taut by the weight of the microphone, any movement of the drum 33 will raise or lower the microphone.

It is possible by this method to obtain an extremely compact mechanism, capable of producing vertical movement of the microphone up to 15 feet without difficulty.

### Take-Up Mechanism.

The microphone cable after passing over drums (32) and (33) is then stored on drum (28). This storage drum is caused to move synchronously with any motion of cable (23) by relating the ratio and diameters of drums (22), (28) and the worm screw (27) properly.

### Conclusion.

Due to the transient nature of broadcast material, it is obvious that a device which will help to correct any possible discrepancy in point of pickup, automatically, and in a minimum of time, should give the studio so equipped considerable advantage.

It is also apparent that if an automatic microphone boom would increase studio flexibility, provide a new means for the answer to an old problem, that too would be an advantage.

If the automatic microphone boom were desirable from only these viewpoints, the author and inventor feels its use would be justified, and the printer's ink not wasted.

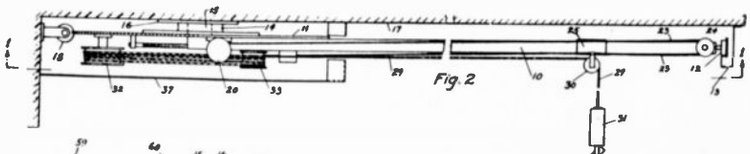


Fig. 2

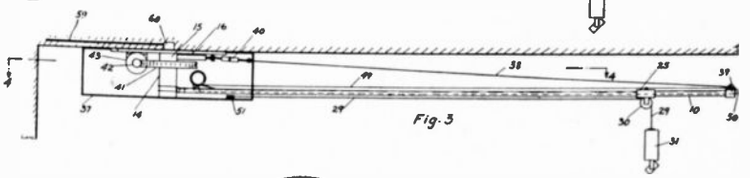


Fig. 3

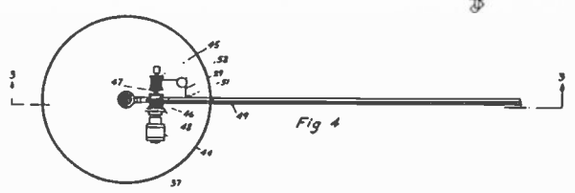


Fig. 4

## Self-Calculating Resistance Charts

**Resistance values may be determined by means of a collection of self-calculating resistance charts issued by Hardwick, Hindle, Inc., 40 Herman St., Newark, N. J. The charts provide a simple method for determining the relation between resistance, voltage, current and power of any resistor or rheostat. The collection of self-calculating charts will be sent gratis to anyone, on request.**

## 390 Apply for Ship License

The Federal Communication Commission announced a total of 390 applications for ship radio licenses from individuals between September 22 and November 23, the dates and the number announced are as follows:

September 22, 35; September 28, 17; October 4, 38; October 9, 51; October 10, 29; October 29, 24; November 7, 23; November 10, 46; November 15, 60; November 16, 19; Nov. 19, 15; Nov. 23, 33.

# TALES OF AN OLD-TIMER

Equipping Penekese Island, Leper Colony, Sept. 21, 1914

By HARRY R. CHETHAM

IN August, 1914, the Boston American took up a popular subscription for the purpose of buying a wireless station for Archie Thomas. He was confined on Penekese Island, the leper colony maintained by the State of Massachusetts. Penekese Island is situated in Buzzards Bay, near the Island of Cuttyhunk and No-Man's land. A small barren island about fifteen miles south of the city of New Bedford, Mass.

Archie Thomas, the famous boy leper, at that time was about 26 years old. His father was born in the Barbados and died of leprosy. Mrs. Thomas lived on the island with her son. On the island there was an administration building, power house, a hospital building, animal houses, cow shed, a barn and across the center of the island ran a barbed wire "dead line." The lepers were housed on one side of the island, some of them living in individual houses. There were thirty-two lepers and none of them born in the United States.

Archie Thomas was taken from the Athol High School at the age of nineteen and sent to Penekese. He was an amateur operator at the time, and a good one, too. When I met him the ravages of this dread disease had left its terrible mark upon him, and he was in pretty bad shape. The only companionship he had was the nurses, Doctor Parker, the superintendent, his mother, and a beautiful parrot, whose vocabulary and profanity had everything stopped I ever heard before. There was no communication with the outside word.

Someone interested the Boston American in the case, and enough money was raised by popular subscription to buy a composite one kilowatt spark transmitter, motor generator set, and a good receiver. At the time I was employed by the Marconi Wireless Telegraph Company of America as an inspector at Boston, Mass. Mr. T. M. Stevens, now general superintendent of the Radiomarine Corps at San Francisco, was superintendent at Boston, Mass. No one seemed to want to go to the leper colony, and I finally offered my services through Mr. T. M. Stevens for the work.

I made a survey of the island in August, 1914. In September the gear was transported to Penekese by motor boat. Also a sixty-foot mast was towed to the island. The first job was to set the mast in a cement foundation and guy it securely, as very high winds blow there at times. With the help of the engineer, this was accomplished. A power line had to be run across the island to Archie Thomas' cottage in which the wireless station was installed. This work took about a week and during that time I became very well acquainted with Archie. He had a very pleasing personality and, although he was doomed to a terrible existence, he took everything, very philosophically. He wore gloves, as his hands were eaten away. He was of considerable help also in the work. I remember one little incident. I happened to drop a plug of tobacco on the floor and Archie picked it up and handed it to me. I thanked him, but I couldn't bring myself to the point of taking another chew out of it.

A Clapp Eastham set was used and Holster Cabot motor generator. When the installation was finished I sat down to the bench with Archie. The first evening as the Boston, New York and Fall River Line steamers passed I called them and introduced Archie and the station. We also worked stations in New Bedford, Siasconsett on the Island of Nantucket, Marconi station at South Wellfleet, Providence, and Fall River.

In the next few years Archie was of great help to the Sound Line operators, and on one occasion got assistance from New Bedford when a bad fire occurred. Lieutenant Trop, U. S. N., made an inspection trip to the island while I was there. It was inspected by Harry Gawler, U. S. radio inspector. Lester Jenkins of New Bedford also visited the island. On April 28, 1932, the Veteran Wireless Operators' Association, Inc., presented me with the testimonial scroll for "Humanitarian Services on Leper Island." The presentation was made by Mayor John J. Murphy, now U. S. marshal at Boston. Ray Myers, radioman who attempted the polar submarine voyage to the north pole, also assisted, and this ceremony was broadcast over WBZ Boston and Springfield stations in a fifteen-minute program. Archie Thomas died during the war, and Penekese Island is now a harmless, peaceful bird sanctuary. The leper colony has been moved to another island in the South.

I will always look back with pleasure to this service.

# Actions of the Communications Commission

THE Broadcast Division of the Federal Communications Commission gave consideration to that part of Section 307 (b) of the Communications Act of 1934 which relates to additional 100-watt stations and reads as follows:

"Provided further, That the Commission may also grant applications for additional licenses for stations not exceeding one hundred watts of power if the Commission finds that such stations will serve the public convenience, interest or necessity, and that their operation will not interfere with the fair and efficient radio service of stations licensed under the provisions of this section."

The Division decided that these stations will be assigned only to the channels designated in Rule 121 as local channels in the Rules and Regulations of the Commission, namely: 1200, 1210, 1310, 1370, 1420 and 1500 kc. In determining interference that may be caused by these stations, the present power-frequency mileage separation tables of the Engineering Department will be followed and the technical requirements for the installation and operation will be the same as for all other broadcast stations.

New broadcast stations will be licensed under this section only after a full showing has been made that the station will be operated in public interest. This showing must include full facts concerning the applicant's financial and technical ability to operate the station requested. It must be shown that program material is available such that programs can be built that will be of service and interest to the listeners. Proof must be submitted that sufficient possibilities are available that the applicant can provide adequate talent, personnel and properly maintained equipment.

A review of existing stations in small centers of population reveals that a majority of these stations are having great difficulty in operating with adequate programs, maintenance and personnel.

Past records show that in many cases applicants hope to obtain a limited facility and expect at a later date to materially increase that facility. The present allocation does not permit such later increases and accordingly the Commission must have proof that the assignment as requested, has a reasonable promise of success.

The Broadcast Division of the Federal Communications Commission revised rules 109, 110, 111 and 120 which made a fundamental change in its broadcast quota system as promulgated to comply with Section 307 (b) of the Communications Act of 1934.

"Interference caused by stations at night is different from that caused at day. Consequently, the broadcast quota due, the limit of which is interference, has been separated into two parts, 'night quota' and 'day quota'. The quota charge for a station operating both day and night has been divided into two parts, the power and time of operation between 6:00 a. m. and 6.00 p. m. being charged to 'day quota' and the power and time of operation between 6:00 p. m. and 12:00 midnight being charged to 'night quota'. A day station, the operation of which is entirely between 6:00 a. m. and 6:00 p. m. is charged only to 'day quota.'

"The 'night quota' due and 'day quota' due are entirely separate and wholly independent of each other. Applications will be considered in two parts if night and day operation is requested, and the proper quota due considered in connection with each part."

"The 'night quota' due and assigned do not differ materially from the night portion of the present system. The 'daytime quota' due each zone and state within each zone has been increased so that the quota already assigned no longer becomes the limiting factor in many cases to an increase in daytime power of local and regional stations and day and limited time stations on clear channels."

(Continued on Page 22)

## YOUR HELP ASKED

The licenses of certain clear channel stations petitioned the Commission for an investigation of the service rendered on clear channels and a re-statement of the regulations regarding them. The Broadcast Division has decided to conduct a thorough survey of the broadcast structure both as to results of allocation on clear channels and on channels to which more than one station is assigned to operate simultaneously at night. This survey will be made for the purpose of determining the service available to the people of the United States and the type of station that the listeners in rural areas are dependent upon for their service. The degree of interference or impairment of service caused by duplication of certain high power stations is to be investigated, as well as the possibility of providing additional high power stations without reducing the service to the listening public from existing stations.

The cooperation of the licenses of all broadcast stations is requested by the Commission in making this survey. All licensees volunteering their field intensity equipment and personnel to make the observations and measurements should notify the Commission of the facilities which they are willing to place under the direction of the Commission for conducting the survey. The extent and scope of the survey will to some extent depend on the facilities that are made available.

## WHBF and KSO Kick About KICK

On January 23, 1934, an application was granted to allow The Palmer School of Chiropractic, Davenport, Iowa, to purchase from the Red Oak Radio Corp., Carter Lake, Iowa, the broadcast station license and equipment of KICK, and to move it to the City of Davenport, from Carter Lake, Iowa, the broadcast station 1420 kc to 1370 kc.

Complaints were received on this action from stations WHBF, Rock Island, and KSO, on account of wavelength. A hearing was ordered then.

The KSO wavelength assignment had subsequently to complaint been changed from 1370 to 1320 kc, and no evidence was offered.

The commission overruled the objections of Station WHBF and KICK is again authorized to go to Davenport, Ia.

## SIX GOOD LISTS

The Bureau of the International Telecommunications Union, Berne, Switzerland, offers six lists, some of which practically all commercial men are interested in. They are:

1. List of Frequencies—40 Swiss Gold Francs.
2. List of Coastal Stations and Ship Stations—4.35 Swiss Francs.
3. List of Aeronautical Stations and Aircraft Stations—4.15 Swiss Francs.
4. List of Stations Performing Special Services—5.50 Swiss Francs.
5. List of Broadcasting Stations—3.70 Swiss Francs.
6. List of Call Letters of Fixed, Land, and Mobile Stations — 7.50 Swiss Francs.

Remittance should be made by international money order to the Bureau of the International Telecommunication Union, Berne, Switzerland.

## Jibe at Announcers

### TOAST TO THE FROZEN PANS

Distilled damnation, pour it out
In bumpers, high and wide;
To the grinders of gain, we'll drink the first,
To the engineers, the best and the worst,
The dead-pan guys with the awful thirst,
Who o'er the kilowatts preside.

So here's our toast to the silent host
Of radio engineers;
The birds who roost in their shells of glass,
Plotting and planning how best to harass,
To convince an announcer he's only an ass,
Despite the shape of his ears.

Oh, it's bottoms up to the engineers,
Sagas of radioland;
The mugs who sit on the judgment seat,
Who wither you out of a vain conceit,
Then shrivel you up with a joy complete,
Announcers all understand.

—VARIETY.

## IMPORTANT DEVELOPMENT

A system of radio facsimile transmission has been given a preliminary test by the Bureau of Air Commerce, for consideration in use for disseminating weather information of the Federal Airways System.

The system tested is based on the scanning principle. On the Washington D. C. to Silver Hill, Maryland, stretch good results were obtained. Compact units capable of being plugged in a transmitting set in place of the microphone and in the receiving set as a substitute for the headphones or loud speaker, they offer a solution for a department problem.

The message to be sent is typed or written on a strip of paper tape. The tape is led into the transmitter set where the scanning beam passes rapidly over the letters and causes the impulses to be broadcast. At the receiving end the impulses are translated into extremely narrow black lines which make up the separate letters of the words. The scanning beam passes over each letter numerous times—thus, the character appearing on the tape in the receiving machine is made up of a similar number of tiny black lines. 76 words a minute were sent during the tests. Static or heavy background noises seem to have no effect, that would be likely to cause errors in reception.

While it is certain, we believe the manufacturers are the Radio Corporation, and some significance is given by the recent announcement given wide publicity by David Sarnoff, on an ultra short wave possibility along this line for television. The Department of Commerce avoids naming the manufacturer of the product.

# AIRWAY NOTES

On the Medicine Bow, Wyo. U. S. Airway Radio Station we find the field is maintained by Bureau of Air Navigation and the personnel consist of three men:

K. G. Schoewe, airways keeper in charge

E. M. Cruickshank, assistant airways keeper

The third is unknown due to present transfers.

The field is "L" shaped, 3900 ft. one way and 3200 ft. the other. Gas available by electric pump and landing flood light with 24 hour service. Airways beacon for night flying, on regular Chicago-Los Angeles airway.

Teletype weather given hourly, and continuous range and stand-by phone. The radio range is a 150 watt transmitter with a signal radius of 100 miles, either on beam or phone, the beam interlocks with the Cheyenne beam east and Rock Springs beam west.

* * *

At the Bureau of Air Commerce, Airway Radio Service, Pasco, Wash., we learn that:

The names of the operators at the station are: H. W. Johnston, E. W. Readen, G. Bates, J. C. Gemmill, and W. E. Sprinkle. W. E. Sprinkle being the relief operator stationed here for relief duty at this station and several other stations within the vicinity of a few hundred miles.

Readen has been aboard the old wind jammers and then in the Lighthouse Service both on the lightships and tenders on the Pacific prior to entry in this service. Bates put in a hitch in the navy. Gemmill put in a trick in the army, followed by a cruise for Dollar SS and a trick at Edmonds, Wash. Sprinkle has had a variety of nearly everything over quite a period of time. Johnston sailed for over a year on the Pacific coast on the notorious steam schooners, followed by a like period deep water to the Orient for Shipping Board. A short trick in broadcast, another for an airline operator and a last one for Mackay Radio at Daly City, Calif.

At present we are not conducting any special tests and are performing only routine work of broadcasting airway weather reports, furnishing radio beam service on these airways, telegraphing weather reports and departmental business, and operating as a drop on a teletypewriter circuit.

Practically all experiments and technical problems are worked out in the vicinity of Washington, Bellefonte, and Newark. It is understood that the Bureau is attempting to work out a problem of utilizing radio as a connecting medium for the teletypewriters, rather than leased wires, also some system of radio control for use on remotely controlled equipment.

* * *

The quickness of thought in suggesting to a pilot caught in the fog to try the navy yard field 4 miles away where he learned by phone visibility was good to land is given much credit by the department. The plane had air mail on and the line had never before made a landing at such a field. Fuel was low, no chance to continue, and not enough to return to starting point—no opening in the sky clear enough to land a plane. T. F. Haviland, radio operator at Charleston, S. C., airway stations, gets big and deserved credit.

# Gas Filled Thermionic Rectifiers

By S. B. INGRAM

*Member of the Technical Staff, Bell Telephone Laboratories*

THE introduction of power tubes into radio transmitting systems during the last decade brought a demand for sources of high potential direct current to supply anode voltage. High-vacuum tubes, themselves, have proved quite satisfactory for this purpose, but because of certain advantages of convenience and efficiency, thermionic rectifiers of the mercury-vapor type are gradually replacing them.

The form of the current-voltage characteristics of a vacuum and of a mercury-vapor rectifier show how markedly different are the properties of these two types of devices. The current-voltage characteristic of a 237A rectifier, a high-vacuum, water-cooled type, is shown in Figure 1, while the corresponding curve for a 266A mercury-vapor hot-cathode tube, which is now replacing the former in many installations, is shown in Figure 2.

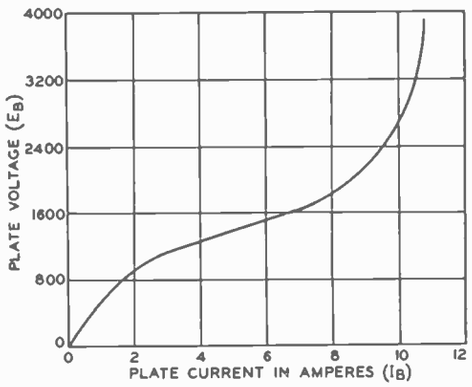



Fig. 1—*Characteristic of 237A vacuum rectifier*

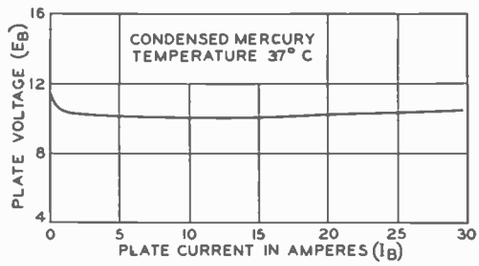



Fig. 2—*Characteristic of 266A mercury-vapor rectifier*

In the high-vacuum rectifier the presence of electron space-charge between the filament and plate creates a potential barrier which the electrons must surmount, making it necessary to apply plate potentials of the order of several thousands of volts to draw plate currents of a few amperes. This, of course, results in the dissipation of a large amount of power in the anode, and to carry away the excess energy, water-cooling of the plates has been introduced in all the larger tubes. This energy loss within the tube represents, of course, a considerable loss in the efficiency of the rectifier.

The presence of gas in mercury vapor rectifiers, on the other hand, gives them very different properties. The electrons emitted from the filament collide with mercury atoms and ionize them. The ionization process consists in the removal of an electron from the neutral atom, thus giving a free electron and a positively charged ion. The positive ions neutralize the electron space charge and thus destroy the barrier which made high plate voltage necessary in the vacuum tube. As a result the potential drop across a mercury vapor rectifier is practically independent of plate current and has a value of only some 10 or 20 volts. This low drop results in small energy dissipation in the tube and a corresponding increase in rectifier efficiency. The low plate loss also obviates the necessity for water-cooling the anodes, and thus makes the gas tubes somewhat simpler to operate than the large vacuum tubes.

Another advantage of the gas-filled rectifier compared to the high-vacuum type is the better "regulation" of the rectifier output. In other words, the voltage output of the rectifier is more nearly independent of the direct current drawn. In vacuum-tube rectifiers the tube drop is large and increases with the current, thus causing the output voltage to fall off as the load increases. With gas-filled rectifiers, on the other hand, the tube drop is small compared with the total applied voltage and substantially independent of current, and as a result the output voltage is more nearly independent of the current.

The introduction of gas into a vacuum tube greatly changes the conduction phenomena within it, and the design of the tube, therefore, must be approached from a widely different angle. A consideration of the filaments used in vacuum and gas-filled tubes will illustrate this point. In a vacuum tube the filament or cathode must always be of simple geometrical shape: a straight wire, or a V or W shape arranged in such a way that the field of the plate can penetrate readily to all points on the filament. A typical example is shown in Figure 3. If this is not done, if, for instance, the cathode contains a fold or cavity of some sort, the electrons within this cavity are, to a great extent, electrostatically shielded from the field of the plate, and so cannot emerge to contribute to the plate current. In a gas-filled tube, on the other hand, the geometry of the cathode is not restricted by any such limitation. The space between the anode and cathode is filled by a swarm of electrons whose space charge is neutralized by a practically equal number of positive ions. This cloud of charged particles mixed with neutral gas molecules is known as the "plasma" and fills the whole tube. The plasma completely surrounds the filament and, if the latter is

of complicated geometrical shape, penetrates into the folds and recesses, making it possible to extract electrons from them. For this reason one is at liberty on account of its low electron emission efficiency.

The 237A vacuum rectifier tube which has a pure tungsten filament capable of supplying 10 amperes current has a power consumption of 1220 watts. The electron emission efficiency is therefore

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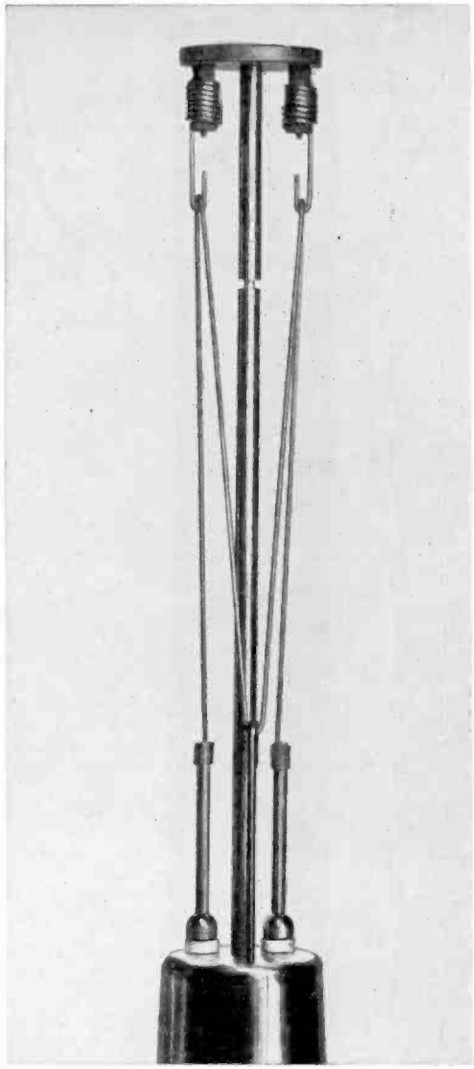


Fig. 3—*The filament of a vacuum tube is of simple geometrical design, usually a V or a W as in this 237A tube*

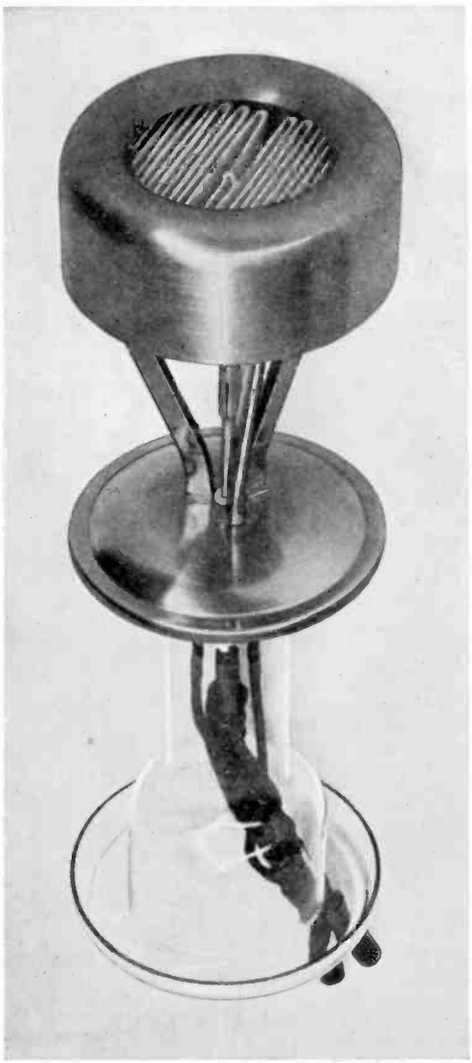
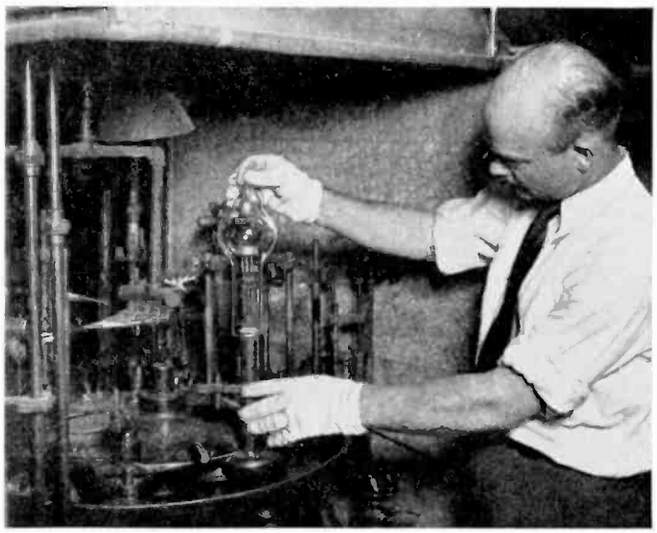


Fig. 4—*The filament of a mercury-vapor tube may be folded back and forth to obtain a large area as in this filament of a 266A tube*

in the gas tubes to fold a filament back and forth in the form of a bellows, thus obtaining a large emitting surface concentrated in a relatively small volume as shown in Figure 4. This greatly increases the efficiency of the filament with respect to power consumption by reducing the loss of heat by radiation. This heat efficiency is further increased in some tubes by surrounding the filament with a bright metal heat shield open on the side facing the anode. These various heat saving devices increase the emission efficiency of the cathode by several fold.

Of the various electron emitting sources common in vacuum tube practice, the oxide-coated filament has proved the most suitable in tubes with gas filling. Thoriated tungsten is not satisfactory because its high emission efficiency depends upon the presence of a monatomic layer of thorium or tungsten, and this delicate layer is more susceptible to destruction by positive-ion bombardment than is the more rugged oxide coating. Pure tungsten proves to be unsuitable



*A 267A mercury vapor tube being placed in a sealing-in machine during assembly by C. L. Johnson*

# IT'S BIG BUSINESS NOW

## Yes Sir, It's Not a Hobby Anymore

By MATT SLOAN

MANY of us remember the old days, the good old days, when stopping in to see a broadcaster was dropping around the back alley somewhere, climbing up a flight of shaky wooden stairs, and finally having the owner, operator, put on a new phonograph record while he steps out of the studio to say hello. Momentarily relieved until the finish of the record so he could transact the business of the day.

A great many of us remember the days back in the early twenties when "the radio" was up on the top floor of some department store perked off in a corner. An official license to transmit then meant the glory of being heard on the air for the sport of it, or just the little advertising of the store or business that went along with the station name everywhere.

The "big" interests then sold radio sets and seemed to make money that way, counting the broadcast station as a necessary evil to sell more receiving sets.

But, the big shakeup came when the 'phone company thought out a new plan for getting some of that profit that it had forsaken in its original contract to not make receivers. It startled things a little by putting the sponsored hour on the air, and things have been moving pretty swiftly ever since.

Then, just a couple of stations were added by wire, and then just a few more. That told the tale, and soon the 'phone company went out of the broadcast business and the little wires wound further and further into the hinterland to form the skeleton work for the chain broadcasting. And, it also formed the binding string to the popular local broadcasting station.

Broadcasting today is an honest-to-goodness business. There was a time when it seemed only an expensive hobby for those engaged in the field.

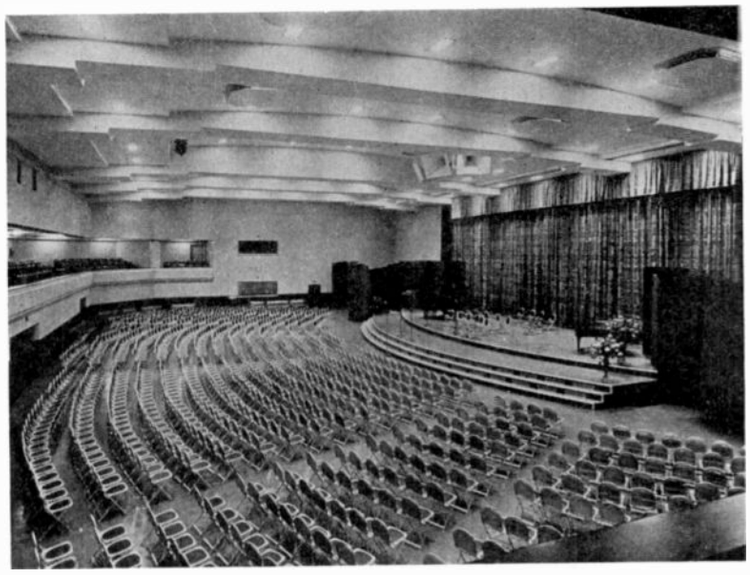
The consolidation of the three big interests into broadcasting took a good deal of the sport out of it. Well, maybe the government helped a little, too. It takes a pretty hearty constitution to file a renewal application for license, and follow up with the ins and outs of why and how, and when the decree is finally entered to jostle up a smile.

Broadcasters were at attention when the first news of the sponsored hours for pay came along. It meant a way to make the old station pay and put in those little refinements that had been put off so long. When the wire chain came closer and closer and more and more threatening it was no time to be off on a holiday, or a hunting trip, either.

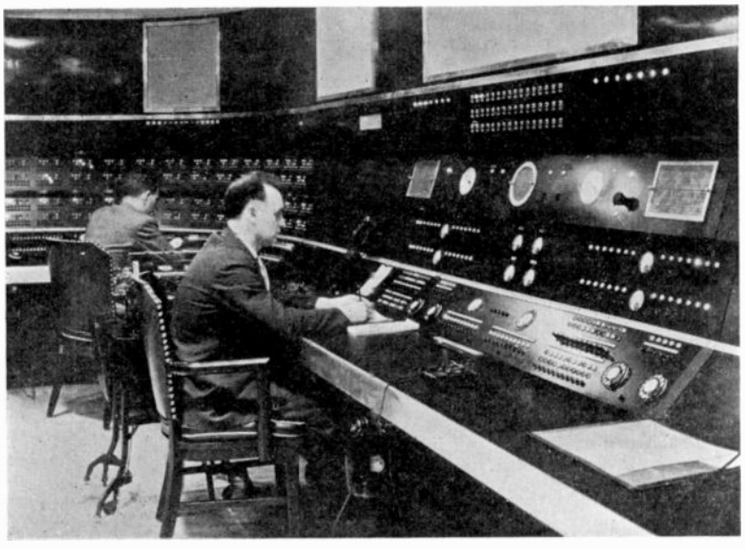
It was nice to get that local outlet proposition. Maybe not so nice for the other little fellow in town, but then let him worry for himself. Those little wires coming through, "Reserve Sunday night seven to eight for Savannah Cigar Company. Wire reply," are like music after a long summer holiday. They mean money for new equipment, money for the pay roll, and a little harder squeeze play for the neighbor who has been climbing up a little. What will he use to pay for the new equipment of more modern specification that will be necessary under order number umpty ump from the Commission? How will he pay to have his data placed in a more favorable light for his renewal license when the call comes? Bet he will wish for some of those nice little wires to reserve time for the Savannah Cigar Company, at the full national rate.

Well, it does seem a little strange when the engineers, and the business managers of the fellow who sent the wire come along and make suggestions here and there on how things should go along. Seems funny how they always think of the things that cost money. Oh, well, with those nice little time reservations in back of our mind, it seems best to do something about those suggestions. Maybe more time space reservations will come along and somehow balance up the budget. Funny, though, I thought this was my station but more and more I have to give in.

Everything going fine now; wonder how long it will stay that way? What's this, bad news from the Commission? They want more reports? Touchy ones, too; well, they will cost money, too. Just when that new studio layout was in sight,



*World's Largest Broadcast Room—Three stories high, 78 by 132 feet. A fair-size theatre itself in Radio City. The National Broadcast Company extensive features on chain originate here. Every seat is taken by friends of sponsored programs or those fortunate enough to get tickets from N.B.C.*



*Master Control Panel in N.B.C. headquarters, N. Y. City. Through here the different studios are connected with the nation-wide networks of N.B.C.*

too. Well, a hop over to Washington with this report will clear it all up. Oh, yes, I forgot I have to send a copy to the big chain people. Wonder what they will think of it?

By gosh, I am letting up on my contacts there. Guess it will mean a run in to see them also and keep the good spirits up. KXYZ lost out that way. They were going along nicely until someone cemented a little closer relations with the big chain people and they were left high and dry without being a local outlet any more. Say, that was a sad story, all right; nice little station, that outfit. Soon started to go to pieces after losing out with the chain people. The Commission started to ride them to death, lost their wave first and then their time. They are just about going along now. Looks pretty bad for them. Say, it would be pretty tough to be closed out that way.

Then there is the talent. Sadie Johnson used to be a good fellow, used to say hello to all the staff. Used to like to hang around and seemed to get fun out of it. It did not take much to keep Sadie happy then. Now, she is Miss Elizabeth Johnson, the unapproachable, except through her manager, who talks in large figures of the importance of his "star." Formerly it was a little flattery and real honest to goodness blarney that coaxed them before the microphone. Now, it's all different and the artists are waiting and anxious to get before the mic, at a price. That is the only catch—the price—and the bigger they are the higher they come. Either fortunately, or unfortunately, though, many stations have built up their stars only to have them either drawn away from them by bigger offers, or to leave them outright high and dry on the record they made. There is the old trouper, of course, who has already made his or her name in the show business, and has deserted the boards for the microphone. It's just like the movies—they come high.

The radio commission, along with other things, has helped to make it a professional proposition. There was a day when a fellow could play his Victrola record and it was all right. Now, he may play his record if he wants to, but he knows it is a dead mark against him with the Commission. The fight is for the highest class of "public interest, convenience, and necessity." The old-time hit and miss mechanical side is all gone now. You just have to keep the wave where it should be and no fooling about it. If you don't, the watchdogs of the air will get you, and the appeal that you are just an honest fellow trying to get along will not help you when you are asked for a report of the engineering brains and equipment of your station.

When you start to slip and wonder if you will ever do a comeback, setting right side up, you are suddenly awakened by the fact that your honest and hard working neighbor is after your wavelength and time, and you have to tell them why he should not have it, when you really should be out drumming up business to keep the old thing blasting.

So, we find all you need is the very finest and costly equipment, the very best technical staff agoing, the finest talent, plus a selling force equal to none, and an expert managing of the business affairs of the station to keep going. Then if you are lucky, have the right contacts and so on, you may find yourself the lucky outlet of the big time chain of stations, with those nice little messages coming over for time reservations.

You have in reality become a working cog in the big time chain, and you have many reminders of it. You put up a hard fight to make a go of it, and you are lucky if some enterprising neighbor does not figure you have a good thing of it, and soon start up and come fighting, at a loss of course, until you find you are really not a cog in the big time chain, but your neighbor has taken over that privilege. It's big business, and it cannot be played by a smalltimer. The American public must have the finest, and a lot they have to say about getting it.

*O. B. Hanson, N.B.C. chief engineer, showing R. C. Patterson, executive vice president of N.B.C., around the working apparatus of N.B.C. headquarters.*

## Spokane, Wash., Air Service Personnel

R. Montle, operator in charge—former service U. S. Navy during and after World War, 4½ years commercial operating, practically all with TRT Co., past 10 years with present service, first under P. O. department, then Department of Commerce.

C. C. Sundin, senior operator, former service commercial, mostly west coast and then Alaska. Last 5 years in the present service.

G. P. Overton, assistant operator, former service U. S. Navy during and after World War, past 3 years present service.

J. R. Bishop, assistant operator, former service, U. S. Navy, past 3½ years this service.

This is a combined Radio and Radio Range station. The Radio Range (radio beam) operating continuously excepting being interrupted to make scheduled broadcasts of weather reports covering the airways on which the beam is directed.



# Newark Gets New Police Radio

THE tip of a flag pole serving as an antenna, hollow wires which, like water pipes, carry electricity without leaking, and a quartz crystal scarcely thicker than a hair which acts as a control by vibrating 5,000,000 times a second, are among the features of the radio system just placed in operation by the police department of the city of Newark.

The system jointly produced by the Western Electric Company and Bell Telephone Laboratories uses an ultra-high frequency, 30,100 kilocycles. This is within a new band tentatively assigned for police work by the Federal Communications Commission to relieve crowding in the medium bands. A leader in opening up this band, Newark gains the advantage of radio operation free from atmospheric disturbances and from overlapping with other stations.

In addition to a main control room at headquarters, duplicate controls together with the transmitter are located on the 34th floor of the National Newark and Essex Bank Building, highest building in Newark. Vacuum tubes in the transmitter multiply the vibrations of the hair-thick crystal six times, producing the precise frequency required.

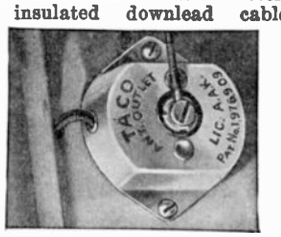
A "concentric" transmission line composed of one copper tube within another runs to the roof, the outer tube preventing the escape of any current, and thus making the line "water tight." The line runs up the inside of a 100-foot flagpole topped by a 22-foot brass tube which acts as the antenna 600 feet above street level.

In addition to 40 police cars, receiving sets are planned at headquarters, precinct stations, several fire department cars and homes of officials.

## MULTIPLE OUTLET ANTENNA SYSTEM

By means of a simple, readily installed collection of matched components, the usual aerial can be made to serve several radio sets in the multiple dwelling. A kit comprises a roll of special downlead cable, several radio set outlets, a terminal unit with attached ground clamp, and lead-in clamps. This multiple antenna system covers the broadcast and short-wave bands down as low as 15 meters.

The insulated downlead cable is




stretched taut between stand-off insulators at top and bottom, and runs a little to one side of a vertical row of windows. At each set location the downlead cable is bared and tapped. The outlet unit is neat and inconspicuous, measuring only 2x1½x½ inches overall. An approved lightning arrester may be used at the top or aerial end of the downlead.

Licensed under A. A. K. Inc. patents, No. 1,976,909, the multiple radio antenna system kit is by the Technical Appliance Corp., 27-26 Jackson Avenue, Long Island City, N. Y.

# *A High Speed Level Recorder for Acoustic Measurements*

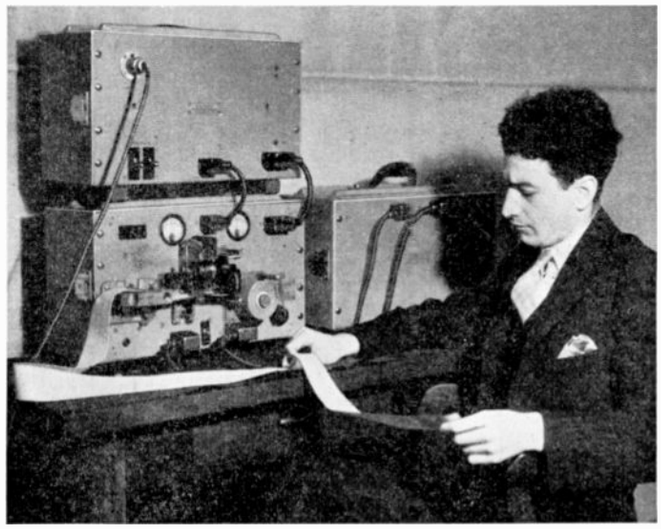
By E. H. BEDELL

*Member of the Technical Staff, Bell Telephone Laboratories*

FOR many years the oscillograph has been available for recording or making visible rapid variations in electric current. Used with a microphone, the oscillograph has also been valuable in studying the wave forms of sound. A knowledge of wave forms, however, is of secondary interest for many purposes; what is wanted is a record of the intensity level of the sound as it varies in passages of speech and music. Although intensity level may be determined from a record of wave form, it is not easy to determine it with any accuracy over a range greater than twenty or thirty db, while for some acoustic studies it is desirable that the record cover a range of at least sixty db. To make this possible a level recorder has recently been developed in these laboratories which records levels on a logarithmic scale over a range of ninety db. One of its important features is the high rate of change in intensity level that it is able to record. Other level recorders have been developed recently but they do not admit either so wide a range in level nor so rapid a change.

This new recorder consists essentially of an amplifier and a rectifier, and potentiometers by which the output of the rectifier is automatically held constant while the input power changes. The potentiometers are graduated logarithmically so that each step in their setting produces the same db change in gain of the amplifier. The position of the potentiometer arms is thus a measure in db of the change in gain required to hold the rectifier output constant, and is thus also a measure of the change in level of the input. The position of the potentiometer arms is recorded on a moving tape so that a continuous record of the level is obtained.

A constant-speed motor drives the potentiometer arms in unison through either of two clutches. The motor is connected to the driving part of the clutches through bevel gears so that one clutch rotates in one direction and the other, in the other direction. When neither clutch is energized the potentiometer arm remains stationary, and with one clutch operated the potentiometer is moved to increase the gain of the amplifier, while with the other clutch operated, the rotation decreases the gain. A schematic diagram of the arrangement is shown in Figure 1.



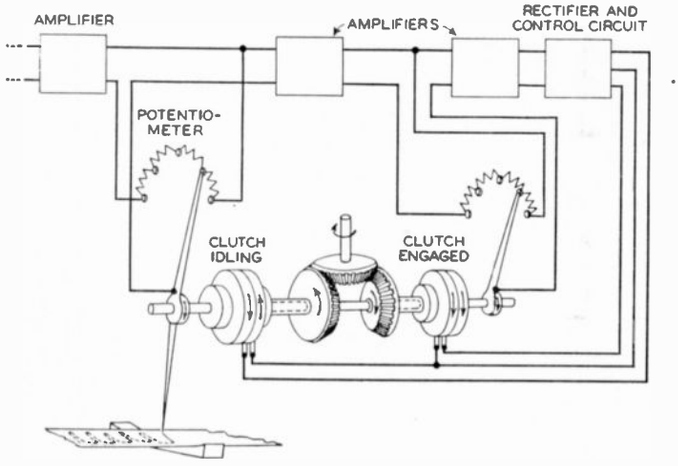



Fig. 1—*Simplified schematic of high-speed level recorder*

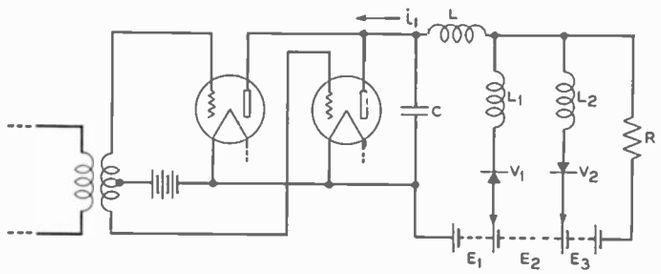



Fig. 2—*Schematic of rectifier circuit showing method of operating the clutches*

Each of the potentiometers have sixty contact blocks and thus sixty steps. On one potentiometer each step makes a change of one db, thus giving an overall change of 60 db. The steps on the other give each a ½ db change—thus providing an overall range of 30 db. Switches are provided so that either or both of the potentiometers may be used, thus giving a range of 30 db in half db steps, of 60 db in one db steps, or 90 db in 1½ db steps. Although these ranges are entirely adequate for most work, the potentiometers are constructed so that they may be removed and replaced by others of different ranges.

A colored paper with a white wax coating on one side is used for the record, and a stylus which cuts through the wax traces out the curve of level changes. The record is thus a dark line on a white background, which is easily photographed if desired. The paper is an inexpensive standard commercial product, and the record made is permanent. The paper runs over a curved guide with a radius of curvature equal to the length of the stylus arm. The guide is placed slightly above the plane formed by the paper driving roll and a secondary guide so that the paper is held snugly against the concave side of the guide. Four speeds, ranging from three inches per second to a little less than three inches per minute are provided for the paper. Its width is 2¼ inches and the maximum stylus deflection is two inches so that the three intensity scales give 15, 30, or 45 db per inch. A marker placed just before the

stylus may be employed to trace horizontal lines on the tape to make it easy to read the levels recorded.

Current from the rectifier is employed to energize the clutches by the circuit arrangement shown schematically in Figure 2. Here $L^1$ and $L^2$ represent the two clutch coils, and $V^1$ and $V^2$ are copper-oxide rectifiers conducting in the directions indicated by the arrows. When, due to changes in input level, the rectifier current $i^1$ becomes less than $E^3 \div R$, current will flow through $L^2$, and the potentiometers will be moved to increase the gain. When the rectifier current becomes greater than $(E^3 + E^4) \div R$, current will flow through $L^1$, and the potentiometers will be operated to decrease the gain. Between these two values of current neither clutch is operated. This range for which neither clutch is operated may be adjusted by controlling the value of $E^3$, and can be reduced to zero. If it is made smaller than the change in gain produced by one step of the potentiometer, however, the system will oscillate, so that in practice $E^3$ is made slightly larger.

Two of the primary requirements of such a level recorder are that it be able to follow faithfully the rapidly varying levels. Its performance in these two respects is shown in Figures 3 and 4. In Figure 3 the input was a 1000-cycle current modulated at a continuously increasing frequency over a range of 3 db. It will be noticed that up to a modulating frequency of about 60 cycles per second the record faithfully reproduces the input. Above 40 cycles the amplitude drops off but the recorder indicates the modulating frequency faithfully up to well over 150 cycles per second. Figure 4 shows a calibration of the three level ranges of 30, 60 and 90 db. For each, the input level was changed in successive 5-db steps over the full range, which the recorder faithfully followed.

The motor that drives the tape also drives the two clutches through another chain of gears. The gears of this drive may be changed independently of those driving the tape, which allows the maximum rate at which level variations are recorded to be changed. This rate of change in level depends also on the combination of potentiometers employed and may be varied from 10 to 560 db per second. Which speed is selected depends on the use to which the recorder is being put at the time. Possibilities in this respect are indicated in Figure 5, which shows a graph of the sentence "Joe took father's shoe bench out" recorded at three different speeds of gain change. The upper curve, employing the maximum speed of level change, shows how the recorder may be employed to record the

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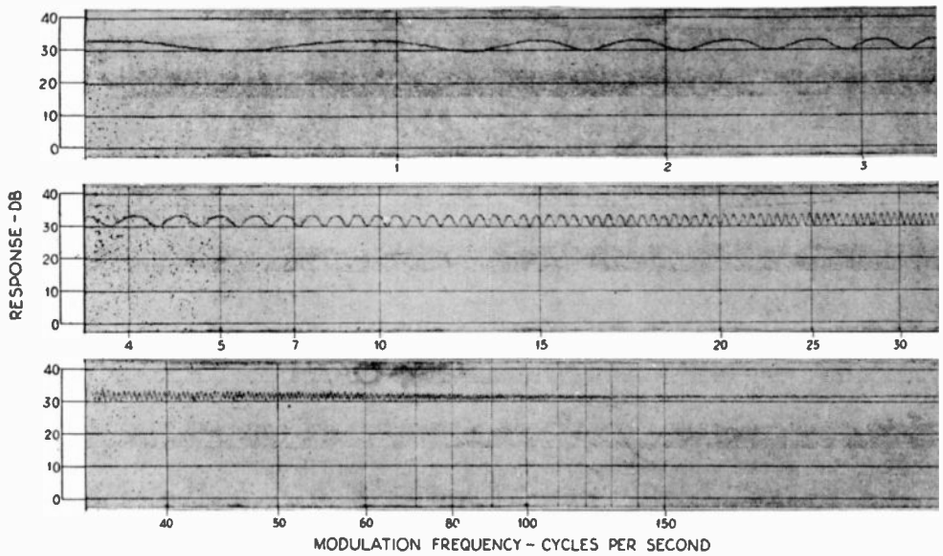


Fig. 3—*At Left—A calibration shows that the recorder will faithfully follow 3 db changes occurring at the rate of sixty per second*

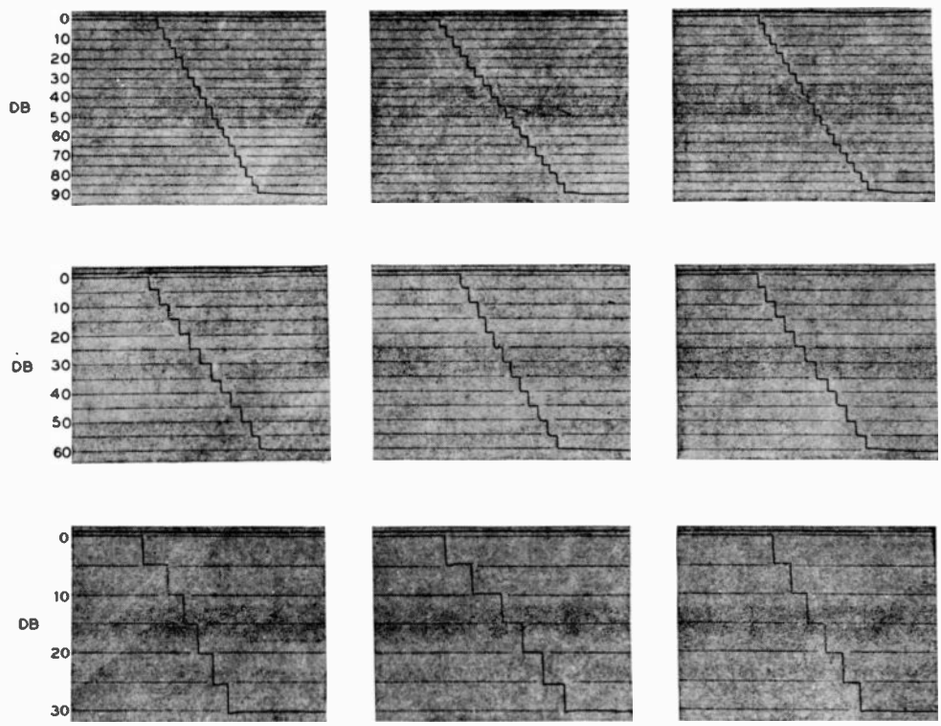


Fig. 4—*At Right—A calibration of the three potentiometer ranges in steps of 5 db: left, 20 cycles; center, 1000 cycles; right, 15,000 cycles*

# "IN BALTIMORE"

By WM. D. KELLY

The big news in Baltimore is that WBAL, the 10 kw local, has been sold to Hearst, who will take over January 1st, so 'tis said. It is expected that there will be some changes in various departments, including engineering.

At WCAO the gang has gone in for Ham Radio in a big way. The chief, James Schultz, has a 500-watt rig at Transmitter building, using call W3DAA.

Charlie Seibold has a CW rig at his home, with call W3EWS.

Bassford, the bridegroom, has started up again—call W3ZV.

Martin Jones has the call W3AMN and Urban (Gus) Lynch is pounding out with W3HL.

Howard O'Day is the Chief on the SS City of Norfolk, one of the Baltimore mail wagons sailing from Baltimore and Norfolk to Hamburg and Havre.

"Ove" Duncan, a ham and ex BC man is pushing a pen at the USF & G.

At WCBM Frank Snyder still holds the title as code hound. He adds parts to B/C receivers and makes 'em tune 600 meters. And to his pet Super Het takes parts out and it tunes short waves.

August Eckles has gone in for Class B stuff in his Ham XMTR (W3-BHQ) and is winding his own transformers.

Eddie Laker of WCBM has built himself a 5 meter rig but has no spare parts left for the power supply—hi.

Sammy Houston, WCBM control room, who runs the Ham staton W3DKE on 160 meters phone says this 2 and 3 a.m. stuff "ain't no good."

The great mystery at WCBM is who broke the light switch and the master detekitiff is George Porter Houston, the chief engineer.

Al Kries, xmtr engineer WCBM, is an expert at winding transformers. There seems to be a competition on between him and August Eckles.

Wm. Q. Ranft, chief engineer WFBR, recently paid a visit to RCA headquarters, Camden, N. J. He inspected new transmitters and in-put equipment.

Eddie Stover is the champion of long distance travelers for WFBR. He drives his new Ford one-eighth of a mile to work.

Clement P. Holloway did a bit of traveling, too. He was MC at a family reunion in Philadelphia. They put him thru the mill but he came out with flying colors.

Bill Kelly, WFBR'S heavyweight and supervisor of control room, went and bought himself a new Plymouth, and does he brag—but no one will listen to him.

Paul Ruckert did his traveling via air waves, giving the listeners and Nancy Turner's Studio Tea Party a short talk on the workings of the Control Room and how hard a control man works.

Stewart Kennard, the demon of Nemos, has been around too, for just recently he celebrated his 10th year with WFBR, not counting the two hours he lost that day he was fired and hired all at once.

Carlton Nopper, WFBR Xmtr staff, does his traveling with a Scott all wave since he got married.

Elmer K. Sterling and Louis Gould are the boys at the Lord Baltimore Hotel who put radio in every room.

# Radio Marker Beacon Used to Indicate Location of Radio Towers

HIGH radio towers such as those used for transoceanic communication, and for some commercial broadcasting stations, become definite hazards to airplanes when visibility is poor and the towers are not readily discernible. In some cases these towers exceed 800 feet in height. With advances in radio and aircraft instruments which make blind flying more and more practicable, and with the prospect that blind landings also will be a part of flying routine, the problem becomes more acute.

Such obstructions in the vicinity of airway routes, or near airports, are marked by red lights as warnings to airmen flying at night in clear weather, and by alternate bands of either chrome yellow and black or white and international orange, painted on the structures as day markings. For instrument or "blind" flying, some type of obstruction marking not dependent upon visibility is required, and for this purpose the Bureau of Air Commerce turned to radio. The project is being carried out by R. P. Battle, principal radio electrician.

Two experimental installations of radio marker beacons designed to serve as obstruction markers for radio towers have been tested in cooperation with commercial radio stations, one at WOR's new broadcast station at Carteret, N. J., and the other at station WJR, Wyandotte, Mich. The two installations were similar in principle, but the transmitter used at Wyandotte was of lower power.

If and when radio towers and other high obstructions, such as monuments and suspension bridges, are provided with radio marker beacons to indicate their locations, some definite signal will be recognized as the warning to airmen that sufficient altitude should be maintained to avoid colliding with the obstruction. A signal consisting of five dashes repeated at frequent intervals will probably be adopted.

### Operation of System

With such a system of radio markings, the pilot flying blind would be following the radio range beacon course, listening to the monotone indicating that he is slightly off to the right of his course. Approaching the obstruction, he would hear the five dashes superimposed over the monotone and modulated at a different audio frequency. He would check his altitude immediately, and, if necessary, would climb to a higher level. Presently the five-dash signal would fade out, and he would know that he had passed the towers or other obstruction.

A radio marker beacon for obstructions, with either visual or aural indications, may also prove to be helpful by assisting the pilot to orient himself with relation to the airport. Knowing the location of the obstruction and its distance and direction from the airport, he will know, upon hearing its signal, how to direct the airplane in order to fly to the landing area.

WOR is located approximately 8 miles south of the Newark, N. J., radio range beacon and weather broadcasting station. It is about 1¼ miles east of the airway course between Camden and Newark. As its towers are 350 feet high, and are close to the righthand side of the airway when flying toward the airport, it is felt that they constitute a hazard to aircraft entering Newark airport under conditions of poor visibility.

The marker beacon was found to be effective when its carrier frequency was maintained at 1,200 cycles difference from the range. This separation, however, may be shifted somewhat, depending upon the audio frequency of the range modulation. The Newark range modulation frequency was approximately 700 cycles. The 1,200-cycle separation is obtained by using a crystal controlled oscillator having a quartz crystal differing by 1,200 cycles from the range frequency.

### Broken Signal Most Effective

Using a pair of telephones coupled to the output of the audio oscillator and the receiver tuned to the range with loud speaker volume on the latter, the experiments covered variations, throughout the entire audio frequency range of the oscillator, in order to arrive at the most satisfactory marker modulating frequency. By listening to the combination of the two signals the most outstanding frequency above or below range modulation was selected to modulate the marker. It was the opinion of several present, including an engineer of WOR, that a frequency between 100 and 150 cycles was most desirable. Accordingly, 120 cycles was chosen for this purpose. This signal superimposed upon the range proved satisfactory in actual flight tests using either a broken or continuous signal emitted from the marker. After a series of tests, it was agreed that the broken signal was most efficient in identifying the towers and did not impair to as great an extent the "on course" signal when flying closest to the marker.

The antenna system was of the single-wire L type and an average height of approximately 16 feet above the ground. This antenna had a horizontal length of 150 feet and a vertical downlead of about 12 feet, the transmitter standing 6 feet above the ground, giving the overall height of 18 feet. The antenna resistance was measured to have a value of 17 ohms when connected to a 175-foot ground system running 8 inches under ground and directly under the horizontal antenna. Three ground rods were driven and tied onto a no. 6 ground wire. With 1.35 amperes in the antenna, the power supplied to antenna circuit was 31 watts. It is believed that a power between 25 and 30 watts is sufficient. Increasing the power from 50 to 75 watts is very undesirable, as the range of the transmitter then causes considerable interference with the range at a great distance. Tuning the marker to 338 kilocycles or zero beat with the range (the Newark radio range beacon transmits on 338 kilocycles) is also believed undesirable, as the difficulty in continuous.

(Continued on Page 19)

# New Broadcast Stations

**Examiner Approved Application**

Station WIS, Owners Station: WIS, Inc. Columbia, S. Car.

**New Stations Applied for by:**

Herbert A. Folsom, Augusta, Me., 100 watts on 1379 kc.

Homer York, Lufkin, Tex. 250 watts on 1340 kc.

E. W. Patrick, Brookfield, Mo. 100 watts on 1310 kc.

Eastern Broadcasting Co., Portland, Me. 100 watts on 1210 kc.

Patrick J. Goode, New Haven, Conn. 250 watts on 970 kc.

OK Broadcasting Co., Cleveland, O. 100 watts on 1500 kc.

Willard G. Demuth, Urickville, O. 100 watts on 1420 kc.

J. C. and E. W. Lee, Riverside, Cal. 100 watts on 820 kc.

Samuel Nathaniel Morris, Stamford, Tex. 100 watts on 1200 kc.

East Texas Broadcasting Co., Dallas, Tex. 100 watts on 1500 kc.

National Battery Broadcasting Co., St. Paul, Minn., 500 watts on 680 kc.

Southern Minnesota Broadcasting Co., Rochester, Minn, 100 watts on 1310 kc.

Wilton E. Hall, Anderson, S. Car. 250 watts on 1200 kc.

Hauser Radio Co., Ventura, Cal., 100 watts on 1210 kc

Palmer Broadcasting Syndicate, Wilmington, Del., 100 watts on 1210 kc.

Brothers and England, Mansfield, O. 100 watts on 1370 kc.

Wm. H. West, St. Louis, Mo. 100 watts on 1200 kc.

Northern California Amusement Co., Inc., Yrenka, Cal. 100 watts on 1500 kc.

The Close-Up Publishing Co., Bell, Cal., 100 watts, 1070 kc.

D. E. Kendrick and W. E. Vogelback, Indianapolis, Ind., 5 kw on 850 kc.

Richard Field Lewis, Del Monte, Cal., 100 watts on 1210 kc.

James M. Patterson, Jr., Stillwater, Okla., 100 watts, 1210 kc.

Fred L. Packard, A. Rosenberg, Los Angeles, Cal., 100 watts on 1160 kc.

Salt Lake City Broadcasting Co., Hutchinson, Kans., 100 watts on 1500 kc.

Dr. George W. Young, Minneapolis, Minn., 100 watts on 1370 kc.

Attala Broadcasting Corp., Kosciusko, Miss., 100 watts on 1210 kc.

Samuel Nathanial Morris, Stamford, Tex., 100 watts on 1420 kc.

Mississippi Valley Broadcasting Co., Inc. Hannibal, Mo., 100 watts on 1310 kc.

The Minneapolis Broadcaster, Minneapolis, Minn. 100 watts, on 1370 kc.

Palestine Broadcasting Assoc., Palestine, Tex. 100 watts, on 1420 kc.

F. N. Pierce, Taylor, Tex. 100 watts, on 1310 kc.

Black Hills Broadcast Co., Rapid City, S. Dak. 100 watts, on 1370 kc.

Peninsula Daily Herald Co., Monterey, Cal. 100 watts, on 820 kc.

A. Garfied Tubbs, Pampa, Tex., 1 kw, on 940 kc.

George B. Bairey, Valley City, N. Dak. 100 watts, on 1310 kc.

Denton Broadcasting Co., Denton, Tex. 100 watts, on 1420 kc.

W. L. Waltman, Muskogee, Wis., 100 watts on 1200 kc.

Charles Sprague is doing big things at WJIM, Lansing, Mich.

## BROADCAST STATION NEWS

Walter A. Graham who was formerly in Gross Radio, Inc. New York radio store, is now with WOV, New York.

J. K. Moore is with WMBR, Jacksonville, Fla.

The boys at KOIN, Columbia, Portland, Ore. outlet, recently packed an auto full of things for a trip to Pendleton, 230 miles inland, to pick up the Indian war whoops and other sounds of a roundup for the Columbia network stations.

John Kileen of New York was recently named Director of Broadcasting Division of the Federal Communications Commission at Washington, D. C. His former interests were the National Electric Association, the General Electric Company, and publishing a national weekly paper. He was born at Troy, N. Y., 1876.

Walter H. Dicker is working as relief at WGBI. He was formerly with WLBW at Erie, Pa.

George W. Brock was promoted to Chief Engineer at KGFF, Shawnee, Okla. Good luck, George.

Marvin A. Prince is Chief Engineer at KMMJ, and an amateur (W9EIY) on his off time.

George Krivitzky is Chief Engineer at WKBZ, Scottsville, Mich., soon to be at Muskegon, Mich.

Robert H. Lingle, Jr., Chief Engineer of WFBC, Greenville, S. Car., is happy that his station has been authorized to increase to 1000 watts. Previously they had 250 watts.

M. A. Price is Chief Engineer at KMMJ, Clay Center, Nebr.

Thomas A. Hale is at WFBL, Syracuse, N. Y., and recently received the commission Ensign in the Naval Communication Reserve.

Arthur C. McClelland is now chief engineer of Radio WAIU, Columbus, Ohio.

Patrick J. Atkinson is with KTRH, Houston, Texas.

Marcellus T. Beale is with the Washington Columbia Broadcasting System office.

Charles Grenier got himself an announcing job with WBNX, New York.

M. C. Barton, Jr., chief engineer of WIS, Columbia, S. Car, is busy on a 2500 watt job for their station.

J. W. Kyle is now with WMBG, Richmond, Va.

George B. Hart is on the WLW, Cincinnati, Ohio, Crosley staff.

J. B. Epperson, chief engineer of WNOX, down south almost wrote an article for us recently, but did write for several other books, and got his material published, too.

George W. Brock is now with KADA, Ada, Okla. He formerly was chief engineer at KGFF, Shawnee, Okla.

Roy C. Fell joined up with KOA at Denver, Colo. Was formerly in the air service radio.

# KOL Makes Improvements

By EUGENE BRATSBERG

ERECTING the nation's tallest self-supporting radio antenna, more than doubling its daytime power, and installing a new 5,000-watt transmitter, Station KOL, Seattle, has a vastly increased listening area. November 18 the equipment went into operation.

Towering nearly 200 feet higher than the Statue of Liberty (490 feet as contrasted with 305 feet) the new "vertical radiator" is a good 20 feet higher than any similar radio tower in the United States. From its heavy reinforced concrete base just a few feet above sea level on Harbor Island, the 126,000-pound steel mast rises above Seattle's tallest hilltop.

The KOL tower itself acts as the antenna. It is supported by four huge insulators, each nearly five feet tall, specially designed to support the entire weight of the tower plus uplift and compression during high winds. Early antennae of this type were partially supported by guy wires, but by careful designing they have been done away with in this instance. This is to eliminate any absorption of the radio signal due to guy wires. It is interesting to note that during the course of construction, lacking guys and reinforcing cross bars, the tower withstood a semi-hurricane wind of over 80 miles an hour without the slightest damage. In operation it will be charged with about 25,000 volts and its base will be surrounded by a heavy board fence to safeguard lives.

Old style aerials could never attain an efficiency greater than 22½ per cent due to the improper angle of radiation. More than 80 per cent efficiency is figured from KOL's new radiating system located on filled-in tide flats. Much of this increased efficiency is due to the patented ground screen and the copper wire radials buried in the salt water soaked soil surrounding the tower.

The United States Department of Commerce Bureau of Aeronautics requirements dictate that this antenna shall be painted in orange and white stripes and well lighted to warn aviators. A dual lighting system has been so arranged that if one light in either group burns out the second group of lights will automatically turn on, thus assuring continuous lighting of the tower. In addition there will be two 1,000-watt narrow beam "ceiling" lights placed at diagonal corners of the base of the tower focused straight up into the air flooding the structure and, in clear weather, extending beyond to a height of nearly a mile.

Lightning, naturally, is expected to strike the mast from time to time, so, in order to protect the transmitter and other property, ball gaps have been installed at the base of the tower which will instantaneously ground the lightning without harm to the equipment.

A 5,000-watt, crystal controlled, 100 per cent modulated transmitter embodying all the latest improvements to be adopted by the industry, has been designed by A. D. Gunston, KOL's chief engineer, and constructed in the station's laboratory by Gunston and his assistant engineers, Clyde Bond and Albert Hen-

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# SHIP PHONE APPLICATION DENIED

**Preliminary Statement**

AUTHORITY is sought to construct six general experimental radio-telephone stations to be assigned the frequency 38.6 megacycles. It is proposed to locate a fifty watt transmitter in the city of Philadelphia and a two watt transmitter on each of five tugs operated by the Atlantic Refining Company in the Philadelphia harbor.

Prior to the date of hearing the Atlantic Refining Company served notice upon the Commission and the respondent, American Telephone and Telegraph Company, that it would seek to amend the applications by substituting the "Atlantic Communications Corporation" as applicant. A motion to so amend, made at the time of hearing, was not opposed.

**The Facts**

The Atlantic Communications Corporation was organized on July 24, 1934, under the laws of Pennsylvania, to establish and operate a general radio communications service. Each of the officers of this corporation is a citizen of the United States and an officer of the Atlantic Refining Company. The communications engineer of the Atlantic Refining Company is superintendent of the Atlantic Communications Corporation, while the superintendent of radio installation and operation of the Atlantic Communications Corporation is also an employee of the Atlantic Refining Cmpany. Both of these men are experienced engineers.

The Atlantic Refining Company has a plant near Philadelphia on the Schuylkill River, and there are several refineries of other companies located nearby. The Atlantic Refining Company operates five tugs, twenty-two sea-going tankers, numerous barges, and from five to twelve chartered tankers. In addition to the tugs of this company, there are fifteen or twenty such vessels owned by four other organizations operating in the Philadelphia Harbor.

A total of 7,338 boats of all descriptions arrived in the Port of Philadelphia during the year 1933. During the same year the refinery of the Atlantic Refining Company received 450 large tankers, representing about one-third of the large shipping in the Schuylkill River. Of a total of about four hundred and fifty ships served by tugs at Philadelphia during 1933, approximately four hundred and twenty-five were aided by tugs of the Atlantic Refining Company.

It is proposed to install a fifty watt transmitter in a penthouse on a 22-story office building in down-town Philadelphia, to be remotely controlled from the main office to the Atlantic Refining Company. Two receivers, to be located a distance of about five miles down the Schuylkill River, would be connected by land wire to the control point. Each of the five tugs operated by the Atlantic Refining Company would be provided with a two watt combination transmitter and receiver, so that constant communication by radio between the control point and each of the tugs would be available. Further, it is proposed to provide direct communication between telephone subscribers of Philadelphia and the tugs. This would be accomplished by having a telephone number assigned to the main transmitter in such a way that a subscriber calling that number would obtain a direct communication with the tugs equipped as proposed. The principal purpose of these applications is to provide constantly available communication facilities between the Atlantic Refining Company's main offices and its tugs.

None of the tugs are equipped with radio apparatus at the present time and even if so equipped it would be necessary to communicate with them in an indirect manner by filing a telegram which would be forwarded to the Radio Marine Corporation to be transmitted by one of their transmitters. Messages to and from the tugs are now handled by telephone lines to various shore points, making it necessary for the boat to dock in order to establish communication with the headquarters office.

The applicant points out that the Schuylkill River varies in width from 400 feet at its mouth to 300 feet at a point opposite the refinery of the Atlantic Refining Company, and provides few points where a ship may be turned around. The proposed radio facilities would provide a means of advising incoming tugs of the condition of the river and docks, particularly during freshets, floods and the breaking of ice. There are but two fire boats at the Port of Philadelphia. All of the tugs of the Atlantic Refining Company are equipped with fire fighting apparatus, and at times when the fire boats are in the Delaware River, provide the only fire fighting equipment in the Schuylkill. The use of radio would, of course, make the fire fighting equipment of the tugs more readily available and would also permit those tugs to aid in policing water-front property.

The equipment which the applicant proposes to install is commercially available, having been developed by another organization carrying on experiments over Experimental Stations W3XAY and W3XAZ, licensed in the name of the Atlantic Refining Company. No experimental work has been carried on by either the Atlantic Refining Company or the Atlantic Communications Corporation. It appears that the equipment which the applicant seeks to install is capable of rendering satisfactory service and the applicant is satisfied that the frequency specified, namely 38.6 megacycles, is suitable. No definite plans have been made for a technical staff to engage in experimental work nor has any definite program of research been adopted.

While the service is intended primarily to meet the needs of the Atlantic Refining Company, the Atlantic Communications Corporation will provide the service to all persons who subscibe therefor, at rates to be established, and install satisfactory equipment. Unless the Commission directs otherwise, the Atlantic Communications Corporation would require all subscribers to install apparatus such as it expects to purchase. In emergencies an attempt would be made to establish communication where necessary, regardless of the type of equipment used. The approximate cost of installation required of the subscribers would be from $2,000.00 to $2,500.00.

The records indicate that the applicant has made no inquiries or surveys to determine which, if any, of the vessels operating in the Philadelphia harbor and owned by organizations other than the Atlantic Refining Company, would be interested in subscribing to the proposed service.

It is estimated that the cost of installing the six stations here involved would be $20,000.00, and that sum is on deposit in cash to the credit of the Atlantic Communications Corporation in a Philadelphia bank.

Paragraph 269 of the Commission's Rules and Regulations defines a coastal harbor station as "A coastal station used primarily for radio communication service with small craft or other vessels that employ relatively low-power transmitters of limited range," while Paragraph 275 (c) allocates certain frequencies between

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# Correspondence

*Editor, Commercial Radio—*

Though not a subscriber, I am a constant reader of your magazine and enjoy reading, whether I get a copy for nothing or buy it at a news stand. (Most of the time I am forced to buy.)

Time and again I notice skeds of Px, Wx, etc., published in various Radio magazines, in most cases the wrong time is used, specifying GMT when they really mean GCT.

I often wonder how many people know the difference between the GMT and GCT—some say, "It is all the same."

In your magazine for April, 1934, pages 27, 28 and 29 are chuck full of skeds and marked GMT. It is wrong—the skeds are given in GCT. Look on page 29—right on the first line "1700 GMT noon at NAA." Fine and dandy—now look in the Radio Aids to Navigation (Red Book) H. O. publication. All the skeds world over are given in GCT—1700 GCT noon at NAA is correct; if it was GMT, the noon at NAA would be 0500.

THE DIFFERENCE BETWEEN THE GCT AND GMT IS 12 HOURS.

It should never be confused by anyone and wilfully say that "it is all the same." It can't be the same.

Prior to about 1925 the GMT was used in navigation and radio skeds but GCT became international and Berne, also U. S. Government Radio publications came forward basing on the GCT, the GMT went out of style so to speak, because, for some reason they liked to have the time begin at midnight instead of noon.

And so it is: GCT (Greenwich Civil Time) starts at midnight and the GMT (Greenwich Mean Time) starts at noon. both at Greenwich Meridian. Who said "It's all the same?"

With best wishes,

Very truly yours,

(Signed) EUGENE O. SANIN

Radio Oper. S. S. Oregon

# KYW GOES ON THE AIR

## Westinghouse Station Moved From Chicago, Takes Its Place

THE new Westinghouse Electric & Mfg. Co. radio station KYW was ready for operation December 3d.

The pioneer middle west station KYW in Chicago, which transmitted its first programs in 1921, now has become a Philadelphia station designed for 50 kilowatt transmission, but modified for operation at 10 kilowatts.

For a long time the Westinghouse people felt they were not getting what they desired in Chicago, and it was decided to move the station to Philadelphia, where better is looked for. Needless to say the National Broadcast chain can make good use of a Philadelphia outlet of the type of the new KYW makeup.

The salient points of the new station are:

Carrier power—50 Kw.
Modulation capacity—100 per cent.
Frequency—990 kilocycles.
Power supply—4150 volts, 3 phase, 60 cycles.
Power input—277 Kw. (including lights.)
R. F. output tubes—Eight 270's.
Modulator output tubes—Four 848's.
Class of modulation—High level, Class B.
Modulation fidelity—± 2 db, 30 to 8000 cycles.
Main rectifier tubes—Six 857's.
Main rectifier output—12,000 v., 17 amp. d.c.
Frequency source—Quartz crystal osc.
Frequency stability—.005 per cent or better.
Tube cooling—Closed circuit of distilled water.
Tube filament supply—All a.c. (no generators.)
P. A. tank condensers—Nitrogen pressure filled.
Harmonic reduction — Uses static shield and balanced tank condensers.
Method of clearing carrier noise—Magnetron suppressor.
Monitoring devices:
1. Cathode ray oscilloscope.
2. Frequency.
3. Overmodulation indicator.
4. High quality loud speaker.
5. Rectox volume indicators.
6. Misc. automatic monitors.

The directional antenna system is an interesting feature. Four 245-foot vertical antennas each connected separately to the transmitter, so that the power of the transmitter will be divided into these four units. By controlling the phase relationship of the current delivered to the four vertical masts, it is claimed to be possible to accurately adjust the direction of the radio beam so that maximum signal will be delivered into Philadelphia, and a minimum signal will be delivered in other directions where interference would result with other radio stations, control being accomplished from the control room of the station. The power supply to the station is 4150 volts, 3 phase, 60 cycle.

Another interesting feature is the fact that the filaments of all of the transmitting tubes operate directly from alternating current. All other high power broadcasting stations have required the use of large motor generators to convert the alternating current into direct current for the transmitting tube filaments. To neutralize the noise on the carrier wave radiated due to the use of alternating current filaments, a "magnetron suppressor" which introduces a current of the right phase and amplitude into the power amplifier circuit is made use of.

High level Class B modulation will be used. It is claimed that 100 per cent modulation will be possible over the musical scale, including frequencies between 30 and 10,000 cycles, by the use of enormous audio transformers, free from the usual distortion. To safeguard against over modulation, an over-modulation indicator which operates in connection with the radio power amplifier at the transmitter. On the panel in the station control room, a red light flashes each time the modulation exceeds a predetermined value and warns the operator so that the volume can be reduced.

### Nitrogen Filled Condensers

Departing from the large plate condensers generally used for tuning, the tuning condensers of KYW are mounted in cylindrical tanks measuring not over a foot in diameter and three feet high. These tanks are sealed and nitrogen is introduced under high pressure, greatly reducing the size from the usual open air type. Even though the parts of the condenser are sealed inside, it is possible to tune them from the front panel of the transmitter control board by turning the dial, being connected through a flexible tuning cable. The condensers were developed by Heintz & Kaufman, Ltd., of San Francisco. On some models, these condensers are being arranged with reversible motors and gears inside the tank with only three electric wires coming through to push buttons on the transmitter control panel. The outer case of the condensers acts as an electrostatic shield, preventing any interference between the condenser plates and adjacent electrical circuits. The pressure of the gas between the plates allows for the closer spacing of the plates without any possibility of breakdown.

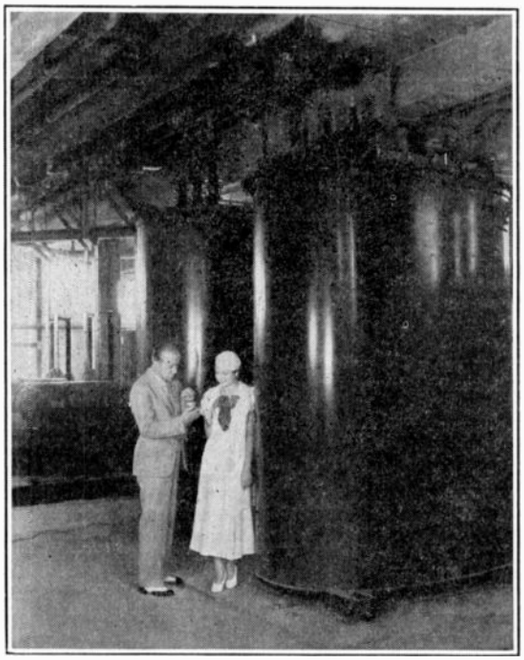
The modulator and power amplifier tubes of the transmitter are kept cool by distilled water circulated through a closed water system by centrifugal pumps. Heat is extracted from the distilled water in a large radiator through which air is kept in motion by blowers. Filament under voltage and over current relays, plate overcurrent relays and bias cut-out relays are provided.

For monitoring of the station output, some of the radio frequency output energy is sent back to the control room and rectified. This may either be amplified and connected to the loud speaker system or it may be connected to the cathode ray oscillograph for analytical purposes.

### Detailed Antenna System

Fifty-five thousand feet of wire representing nearly a ton of copper has been cut, formed into special cages and suspended horizontally between insulators at a height of ten feet above the ground around the bases of the four antenna masts. This is used to improve the ground system so as to make the antenna as efficient as possible.

The four antenna masts are made of telescopic steel tubing 200 feet high each. These are mounted at the top of a wooden frame work tower 45 feet high. By using the four element antenna, Westinghouse engineers say the directional characteristics are maintained and at the same time sky-wave is reduced to a minimum. This is given as the reason for the four element instead of the two element antenna system for directional purposes, and so saving considerable waste of signal towards the sky.



*High Level Class B Modulation using equipment similar to that designed by Westinghouse for WLW 500 Kw transmitter. Enormous audio transformers.*

## Gas-Filled Thermionic Rectifiers

(Continued from Page 10)

about 8 milliamperes per watt of filament power. The 266A mercury-vapor rectifier, on the other hand, which will supply 20 amperes of current, consumes only 300 watts, the emission efficiency being about 67 milliamperes per watt.

In the anode element of the gas rectifier tubes there is again a sharp contrast with the corresponding element of a vacuum rectifier tube. In a vacuum rectifier tube the anode always surrounds the filament, and is placed symmetrically with respect to it so that its field may be as uniform as possible over the cathode surface. In the gas tubes, however, since the plasma fills the whole tube, the anode is restricted by no such requirement. It is therefore usually brought into the bulb at the opposite end from the filament and is separated from the latter by a space of one or two inches. This construction has the advantage that a long glass path gives high insulation resistance between the anode and cathode during the non-conducting portion of the cycle when a high inverse voltage is applied to the tube. To avoid high voltage gradients in the gas, which might give rise to disruptive discharge in the inverse direction, sharp points and corners are avoided on both the cathode and anode structures. So far it has been possible to design the larger rectifiers in such a way that voltages as high as 20,000 volts may be safely applied without "arc back," as breakdown in the inverse direction is called.

In small rectifiers, the energy dissipated in the anode is so slight that the temperature is not raised high enough to cause thermionic emission, but the larger sizes, when working near their maximum current rating, must absorb and reradiate a considerable amount of heat. If active material from the cathode should vaporize and deposit on the anode, and the latter should come to a visible red temperature, thermionic emission might become sufficient to cause "arc back." This temperature is kept within safe limits by making the anodes sufficiently large, and by employing graphite, which has a very high heat emissivity, as the anode material.

To compare the efficiencies of the vacuum and mercury-vapor rectifiers, it will be instructive to consider an actual system where the latter type of tubes have replaced the former. In the 50 kw broadcast transmitter, requiring a dc power supply of 12 kw amperes at 17.5 kilovolts, six 266A mercury-vapor rectifiers have replaced the six 237A vacuum rectifiers formerly in use. The cathode of the 266A tube requires only 300 watts, giving a total cathode heating power of 1800 watts, while 7300 watts are required by the filaments of the water-cooled type. The total anode power dissipated by the gas-filled tubes is about 350 watts compared to roughly 20,000 watts that must be carried off by the much more complicated water-cooling system of the 237A tubes. The power supply efficiency of the newer equipments has thus been increased from 88 per cent to 99 per cent.

One of the important factors in the operation of these tubes is the mercury-vapor pressure, which is determined by the temperature of the coolest part of the bulb, usually a point near the base of the tube. The optimum pressure is about $5 \times 10^{-3}$ mm of mercury, and corresponds to a condensed-mercury temperature of about 40° C. The useful operating range of pressure for high voltage rectifiers is from about $1 \times 10^{-3}$ mm to $5 \times 10^{-3}$ mm, corresponding to condensed-mercury temperatures of 20° C. and 70° C. respectively. Since the coolest part of the bulb operates somewhat above the temperature of the surrounding air, the air temperature range will be lower than this, usually by about 15° C. Thus 5° C. to 55° C. would be a typical ambient temperature range. Continued operation below the lower temperature limit will shorten the life of the tubes through destructive positive-ion bombardment of the filament under the higher arc drop which prevails at low mercury pressure. Above the upper limit, due to the increased mercury-vapor pressure, the breakdown voltage is reduced so that the tubes will not stand the high inverse voltages to which they are subjected in most high voltage rectifier circuits.

Rectifier tubes may be filled with gases other than mercury vapor. Mercury happens to be the one chemical element whose vapor pressure at room temperature is in the range suitable for gas discharges, that is, from $10^{-3}$ mm of mercury to several millimeters. With other gases, dependence must be placed upon the original gas filling to last throughout the life of the tube. Owing to absorption by the metal parts and sputtered deposits on the walls and electrodes, the "clean up" of most gases is quite rapid, rendering them unfit for this use. The rare gases, however, are not so much subject to this difficulty, and it is possible to use them. Argon and neon are the most commonly employed. Even these, however, are absorbed, and it is necessary to fill the tubes to a pressure of several tenths of a millimeter to obtain satisfactory life. At such pressures the breakdown voltage, which determines the magnitude of the alternating potential which can be rectified, is of the order of several hundreds of volts, whereas with mercury at pressures below $5 \times 10^{-3}$ mm, voltages up to 20,000 can be rectified.

Although rare gases are not satisfactory for high voltage rectifiers, they have certain advantages for low voltage work, which makes their use desirable in some tubes. When a rare-gas filling is used the gas density is independent of bulb temperature so that such tubes may be operated over a much wider ambient temperature range. Also mercury vapor tubes require from five to fifteen minutes to come to temperature equilibrium and during this time the gradual decrease of tube drop results in a variation of dc output which is quite noticeable in low voltage rectifiers. If this effect is objectionable it may be avoided by using tubes filled with argon or some other of the rare gases.

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## Radio Marker Beacon

(Continued from Page 15)

operation under these conditions causes noticeable "wobbling" effect of the range due to beating between the transmitter carriers, resulting in a very broad and ineffective range course. For this reason it has been found imperative to use transmitters controlled by quartz plates.

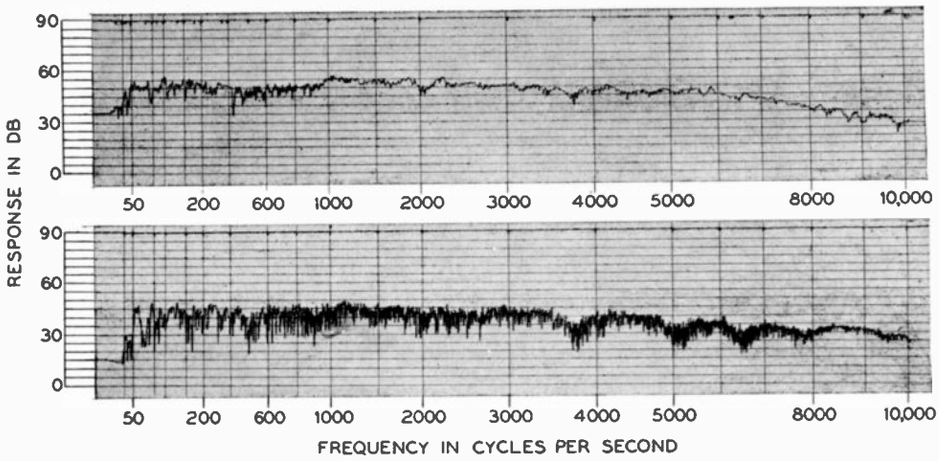


Fig. 6—*Response curves of loud speaker obtained with level recorder: upper curve with microphone two feet from loud speaker, and lower curve at eight feet.*

## A HIGH SPEED LEVEL RECORDER

(Continued from Page 14)

syllabic power of speech, while the lower curves, taken with a much slower speed, show how the power may be averaged over longer time intervals.

The curves of Figure 6 illustrate the use of the recorder for plotting the response-frequency curves of loud speakers or microphones. For the upper curve the microphone was placed about two feet from the loud speaker, for the lower curve about eight feet. The effect of the greater ratio of reverberant to direct sound is plainly evident in the greater irregularities of the curve.

The appearance of the recorder is shown in the photograph at the head of this article. The amplifier, the mechanical system, and the rectifier which furnishes the power supply, each occupy one of three cases, which are interconnected with plug-in cords so that the instrument is readily portable. The input transformer of the amplifier has a low impedance winding designed for use with the moving coil microphone, but a high impedance input terminal is also provided to allow of other uses. A manual gain control is furnished in addition to the automatic potentiometer control so that the curves may be brought to a convenient position on the tape. This instrument has been used successfully for many recent acoustic studies, and should find wider use in the future.

## KCL Makes Improvements

(Continued from Page 16)

derson. Nearly $1,800 worth of tubes will be used in the new set, among them the latest type air-cooled rectifier tubes for the power supply which will materially aid in giving the highest possible quality to the signals.

Entirely automatic throughout, the transmitter can be started and stopped with a single push button. If a speaker or singer should "blast" the microphone too loud, the set will instantly go off the air instead of blowing out a tube, and, ten seconds later, come back on without the touch of a human hand. As a safety precaution the power is automatically cut off when any window or door in the wire cage surrounding the transmitter is opened. A dual power supply that will cut from one to the other automatically within two seconds should one fail, guarantees that KOL will maintain all schedules.

Twenty gallons of pure distilled water per minute are required to cool the two big power tubes. Should the temperature rise above 160 degrees or the water pipe become obstructed, the transmitter will automatically shut off.

The new transmitter house, built expressly for the new equipment, also has an auxiliary studio and a small apartment for the night watchman.

Simultaneous with the installation of the new transmitter, speech amplifying equipment and vertical antenna, KOL commences broadcasting on an increased power of 2,500 watts daytime and 1,000 watts after sundown.

John L. Hall, Seattle engineer, supervised the erection of the huge tower, the actual work being done by the E. & M. Transfer Company of Seattle. The mast was designed and fabricated by the International Stacy Company of Columbus, Ohio. McClelland and Jones were the architects who designed the special transmitter house.

KOL's magnificent pipe organ, broadcasting studios and executive offices, of course, will remain in the Northern Life tower.

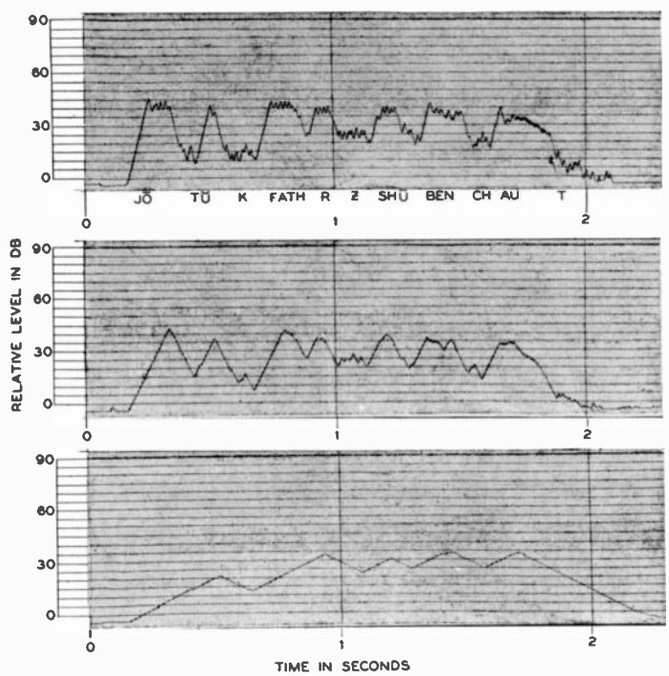


Fig. 5—*The effect of changes in the rate at which the gain is varied is to modify the time over which the level is averaged. Upper curve at 560 db per second, middle at 140 db per second, and lower at 70 db per second*

## Ship Phone Application Denied

(Continued from Page 17)

2504 and 2740 kilocycles for that service.

Companies of the Bell Telephone system have constructed stations designed for public telephone service with vessels in harbors at Boston, Mass., New York City and at three points on the Pacific coast. The Boston station was only recently opened for commercial operation, and the volume of traffic which will be handled cannot yet be predicted. The stations on the Pacific coast have not yet been opened for commercial traffic and will not be opened until a substantial need is shown for the service. The Bell Telephone Company of Pennsylvania has made a survey of conditions in the Philadelphia Harbor and has reached the conclusion that there is not now such a demand as would warrant the establishment of the service. If and when that company is satisfied that such a demand

exists, it will seek to provide the service.

**Conclusions**

The granting of these applications would provide a service valuable to the Atlantic Refining Company in the conduct of its business; valuable to such other operators of tugs in the Philadelphia Harbor as might subscribe thereto; and valuable to the public in general, and shipping interests in particular, in connection with fire prevention, police protection and similar emergencies.

While authority is sought to construct general experimental stations to use a frequency allocated for experimental work, the contemplated service is essentially that of coastal harbor stations, a service recognized by the Commission and provided for in the allocation of frequencies. The present record does not disclose that there is a substantial need in the Philadelphia area for coastal harbor service. The applicant is not "engaged in fundamental research or improving the technique of the radio art," and does not "show satisfactory evidence of being able to contribute substantially toward its progress." Paragraph 307 of the Commissions Rules and Regulations requires that such a showing be made by an applicant to qualify him to receive an experimental license. Furthermore, this case does not appear to involve "special reasons to obtain information or data which give promise of being a benefit to the radio art," which would warrant the Commission in authorizing the transmission of general message traffic over the proposed station, under the provisions of Paragraph 320 of the Commissions Rules and Regulations.

**Recommendation**

It is accordingly recommended that the applications of the Atlantic Refining Company be considered as applications of Atlantic Communications Corporation, and denied.

## High Average of Success for Byrd Broadcasts

OUT of every 100 words spoken into CBS microphones by members of the Byrd Antarctic expedition during the past 52 weeks, approximately 67 have been intelligibly received in New York, according to E. K. Cohan, technical director of the Columbia Broadcasting System. The series of Little America broadcasts has just completed the first year of transmission over a 10,000-mile short-wave circuit.

Cohan discloses that the voice signals as received here have had an average of 66.75 per cent intelligibility. In three of the weeks, however, New York radio engineers failed to pick up the expedition's signals, so that an average of 71 per cent intelligibility has been maintained in the remaining 49 broadcasts.

This has been accomplished in the face of many impossible and often grimly humorous obstacles as recorded by Charles J. V. Murphy in an entertaining log of what goes on in the radio shack 10,000 miles "down under" the civilized world. Murphy, former New York newspaper man, as combination communications officer, radio announcer and showman of the Byrd Antarctic Expedition, each Wednesday marshals to the microphone everything of human interest in Little America.

Murphy's log traces vividly the radio series from the initial broadcast at sea on November 16, 1933. It describes such tense moments as that when the piano on the S. S. Jacob Ruppert broke its moorings as the ship rolled in a heavy Pacific sea and threatened to disrupt a broadcast; when Admiral Byrd and Murphy almost missed their broadcast as gales blew their ship from its anchorage and left them high and dry on the shores of Easter Island.

Murphy portrays his "local artists" as the "most disreputable company that ever faced a microphone" because of their appearance after enduring many hardships. But he lauds them for catching the spirit of the thing readily and even developing a "microphone manner."

As Cohan describes the plans to pick up programs at a stated time each week as "little short of sheer optimism," so does Murphy see a "suggestion of magic in the way the two young engineers, John N. Dyer and Guy Hutcheson, bridge the 10,000 miles to New York in collaboration with engineers in New York and at any of the four relay points, Buenos Aires, Honolulu, San Francisco, and Riverhead, L. I."

## KOB'S PROBLEM WAS CRYSTAL HEAT CONTROL

By GEORGE S. JOHNSON,
Station Manager.

THIS is one of the oldest land stations in the United States, having been started by Dean Goddard of the New Mexico State College right after the World War as 5CX and used to transmit storm warnings and weather reports in code.

The station grew from 5 watts to its present 10,000 watts and is now the most powerful educational station in the United States.

The entire station was rebuilt two years ago and moved to Albuquerque. Although the transmitter is composite, it is completely modern in every detail. The antenna consists of T-type suspended between two 200-foot insulated Blaw-Knox towers. We have a few kinks in our equipment which may be of interest.

Due to the extreme changes in temperature in New Mexico it was advisable to build the crystal heat control unit to more adequately fit this climate. This box has two separately controlled heat chambers, the inner controlled by the usual mercury thermostat and the outer chamber controlled by a by-metallic thermostat. The whole unit has several layers of aluminum and asbestos to insulate against changes in atmospheric temperature. The inner temperature changes only two-tenths of a degree with a 50-degree change outside.

Also incorporated in this crystal unit is a means to change the frequency by 30 cycles without changing the thermostat. Any operator who has experience in trying to adjust a mercury thermostat will realize the advantage of this.

The crystal circuit is the same as used in every broadcast equipment. However, the plate coil of the 210 oscillator is tuned by a .00025 fixed mica condenser and a 100yy venier condenser. A small adjustment of the venier condenser gives the desired change in frequency. This scheme is not recommended unless the crystal oscillator is very highly loaded.



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## ROCKFORD IS A ONE-MAN AIR STATION

By FRED RUCKER, Radio Operator

I AM going to give you a brief description of our Rockford, Ill., range station. This type of station is known as an "Independent Radio Range Station," and requires the services of only one radio operator to maintain the equipment and keep the station in continuous operation, the transmitter being automatically keyed. The station is located in the center of a twelve-acre field about four miles north of Rockford on the west side of the Rock River.

We use a 1500-watt Westinghouse transmitter which is made up of four units, i.e., rectifier, two power amplifier units and an exciter unit. Coupled to the transmitter is a goniometer unit and a loop tuning unit. The goniometer unit couples the transmitter outputs to the loop tuning unit antenna so that the courses will be radiated in the proper directions. The loop tuning unit consists of four sets of series coils and capacitators and serves to tune the antenna system to resonance and balance it to ground. Four 125-foot towers of the TL or tower radiator type serve as the antennae. The station provides four courses, each course directed as follows: NE, NW, SE and SW, the main travelled courses being the northwest and southeast courses, which are travelled daily by air transport companies flying between Chicago and the Twin Cities.

The signals from this installation may be of the visual or aural type. However, only the aural signals are being used at present. The visual type of signal consists of low frequency modulations on the carrier wave which are used to operate tuned vibrator reed indicators, giving a visual indication of the course to the pilot of a plane at all times. The aural type of signal are letters of the continental Morse code, sent out by keying the carrier wave in such a manner that when the pilot is on course he receives a steady signal, interrupted at intervals by the station call letters. If the pilot gets off course, the predominating signal received contains only the letter A or N, depending which off course side he may be on and the direction of travel.

The writer started out as a telegraph operator, thence several years as a navy radio operator. Spent considerable time on foreign duty around the world. Some of the favorite haunts were Constantinople, Athens, Black Sea ports, Bombay, Singapore and Japanese and Chinese ports. Have been letting radio fool me for about twenty years. In the Airways, was formerly at Atlanta, El Paso, thence to Salt Lake City and finally Rockford,

## Actions of the Communications Commission

(Continued from Page 7)

Rule 120 was modified so that the maximum daytime power on the regional channels listed in this rule was increased to 5,000 watts. No other change was made in the maximum power of other classes of stations.

In increasing the daytime quota due the several states, it is not the intention of the Commission to license additional new daytime stations unless a full showing has been made that public interest will be served in making such a grant. The applicant must definitely establish the need for the additional service, the financial and technical ability to operate such a station in accordance with the Rules and Regulations, and that the station can exist on the basis of the grant requested.

A survey of the stations in small cities or communities indicates that it is extremely difficult for such stations to operate even though they have full time. The possibility of a daytime station under similar circumstances becoming a success is greatly decreased.

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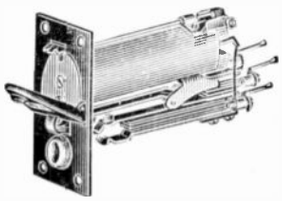

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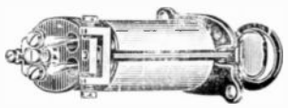

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