COMMERCIAL RADIO

November
1934

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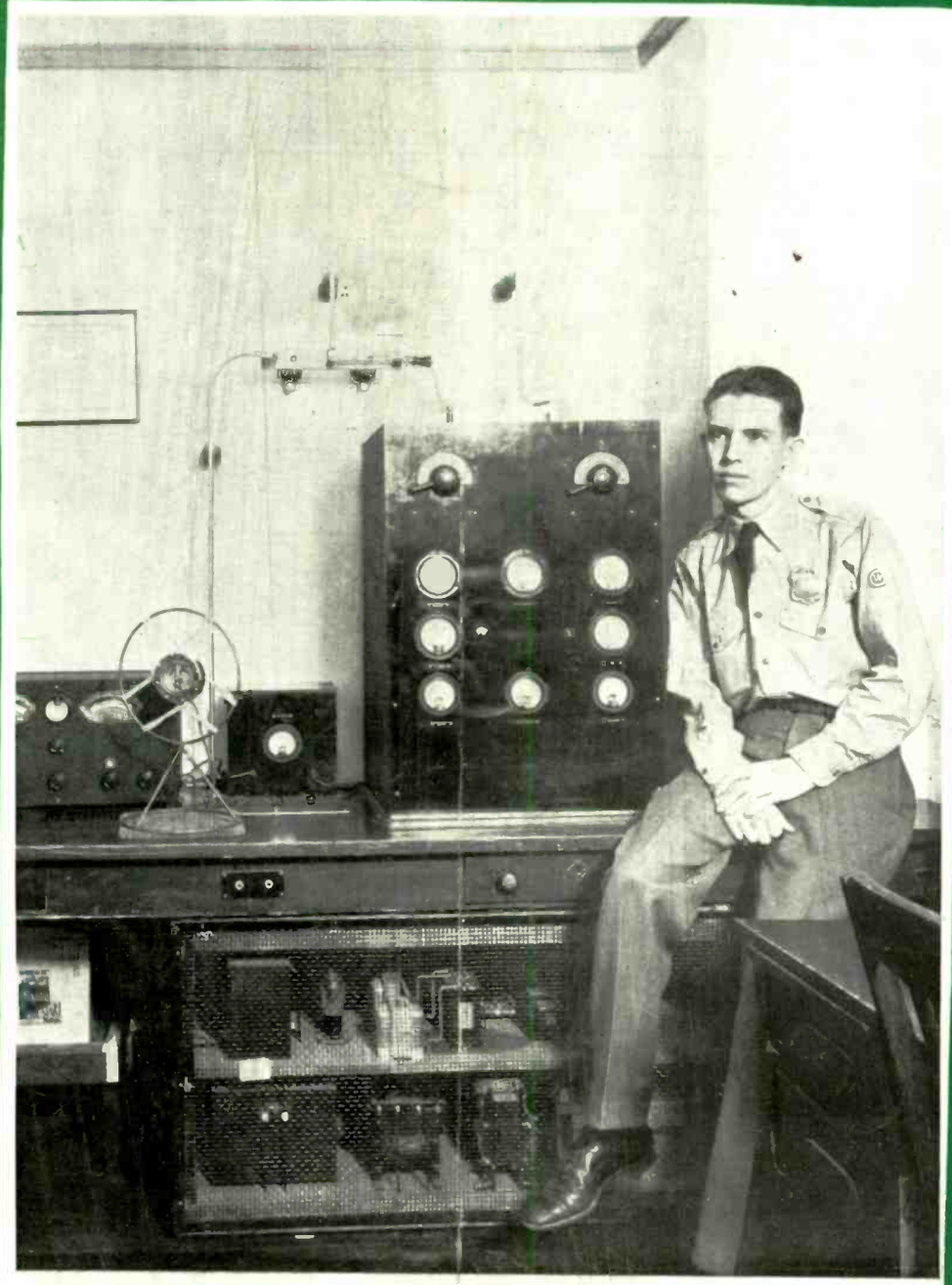

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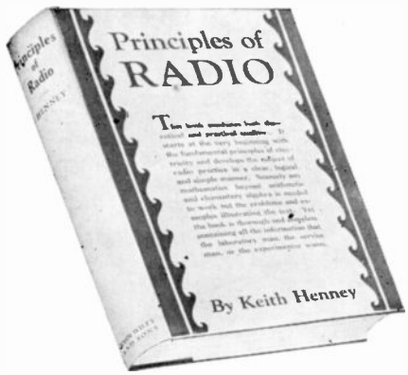

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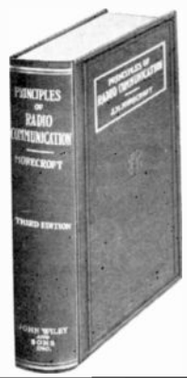

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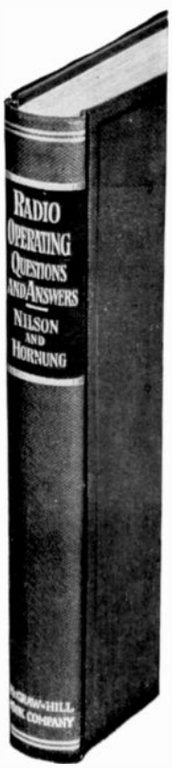

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VOLUME IV NO. 2

THE personal element may be merely desirable in some cases, but, in order that our book be OUR book, it is essential that we all make this personal element as pronounced as possible.

The variety, and intimacy of this month's contributors is just a part of how interesting and instructive this journal may be made if everyone lends a helping hand.

In every radio transmitter installation there is some little kink, or wrinkle. It may be something you engineers have worked out yourselves—it may be something just suiting your local needs—or it may be an actual improvement applicable anywhere, but not generally known.

Little or no good is served by keeping it a closed subject—out in the open a vast amount of service may be rendered. He who lives to say the least a selfish existence, by benefitting from his neighbors, does little good. He who lives to assist his fellow man lives a life of beauty and bounty.

We would like to hear from more of our readers on what little suggestions they can offer to other men engaged in their field. Send in your sketches and in looking over this issue you will see what the other fellow has already done.

Let's make this a friendly book, one where we can all exchange ideas that will help some other fellow.

COMMERCIAL RADIO

(FORMERLY "C-Q")

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

Contents for November, 1934

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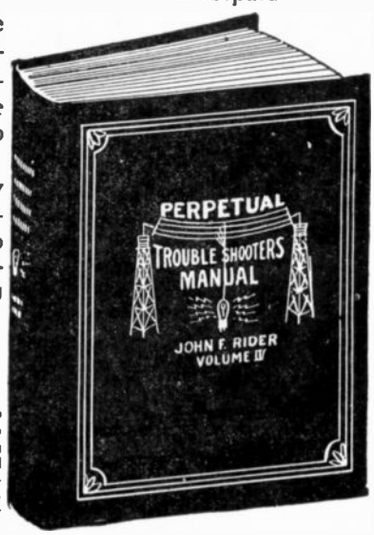

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All of these manuals contain schematic wiring diagrams, socket layouts, chassis diagrams, voltage data, photographic views, resistor data, condenser data, electrical values, alignment notes, i-f peaks, trimmer location, continuity test and point-to-point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

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NRA

WE DO OUR PART

Speech Input Equipment for Radio Broadcasting

By W. L. BLACK
Member of the Technical Staff, Bell Telephone Laboratories

As the radio listener enjoys orchestral harmonies or thrills to an adventure story, he is happily unconscious of the minute care that has been given to every piece of equipment in the broadcast system from its earliest design to its ultimate operation during the program. Communication engineers, however, are "within the family", and it is likely that no small part of their satisfaction in listening to a program is due to the thought that its smoothness and tone quality are to a very considerable extent the achievement of some of their professional associates.

The circuits and apparatus through which a broadcast program passes on its way from studio to radio transmitter are collectively known as speech input equipment.

As in public address systems and sound recording systems, high quality microphones and amplifiers are utilized; as in the telephone exchange, incoming telephone lines are selected and routed; and as in telephone repeater stations, amplifiers are associated with outgoing telephone lines are selected and routed; and, cording system, the program once presented on the air cannot be replaced by a repetition even though errors of omission or commission are made. Unlike a public address system, the program material is amplified many times in the associated radio transmitter and by the listener's radio receiver after leaving the studio and the program source is entirely isolated from the listener in the event of apparatus failure. In the event that it is a network program it is further amplified, both by telephone repeaters and by the speech input amplifiers of other stations as well as by the radio transmitter and receiver.

On account of the very low output of any of the high quality microphones—double-button carbon, condenser, and moving coil—considerable amplification is immediately necessary and the noise level in the first amplifier stage must be extremely low. In the earliest speech input systems, the amplifiers used for this purpose had resistance and impedance coupled stages. The subsequent availability of high quality audio frequency transformers with permalloy cores has made possible the use of transformer coupled stages throughout the amplifiers. The early amplifiers obtained their filament and plate supplies and grid bias potentials from batteries. Later, it became feasible to use alternating current rectified and filtered for the plate supply, and the voltage drop in a resistance in the plate return circuit for grid potential. Even more recently, with the availability of exceedingly quiet equipotential type vacuum tubes such as the Western Electric 262A, it has become possible to

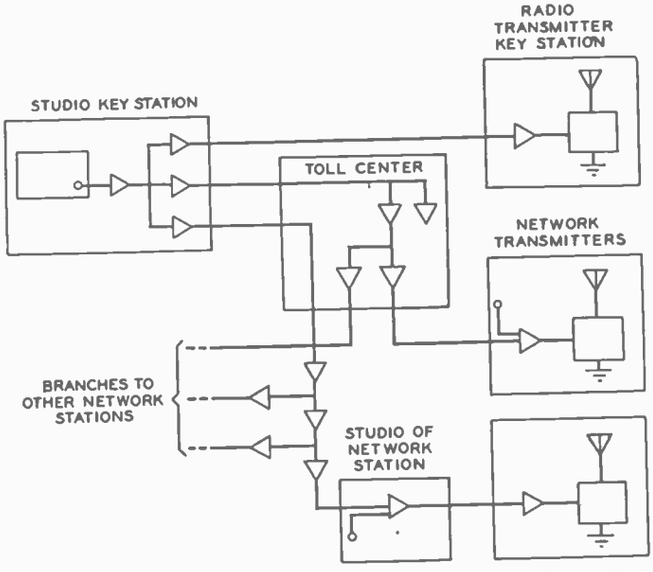


Fig. 1 *Elements of a typical broadcast network. Actual networks may have several key stations and as many as seventy or more transmitters radiating the same program.*

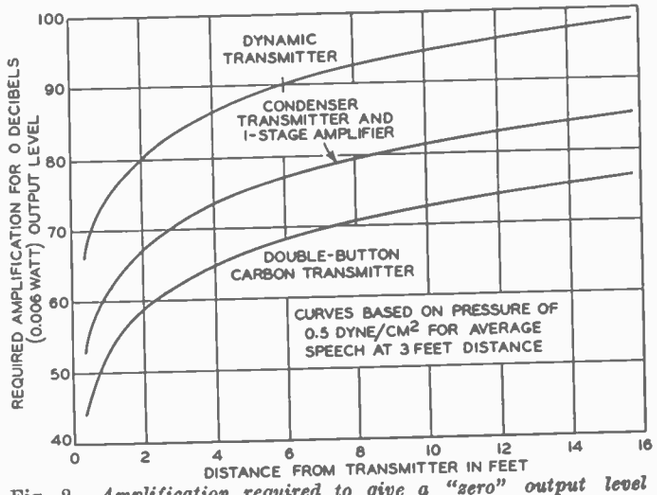


Fig. 2. *Amplification required to give a "zero" output level (0.006 watt) with average speech at various distances from the transmitter.*

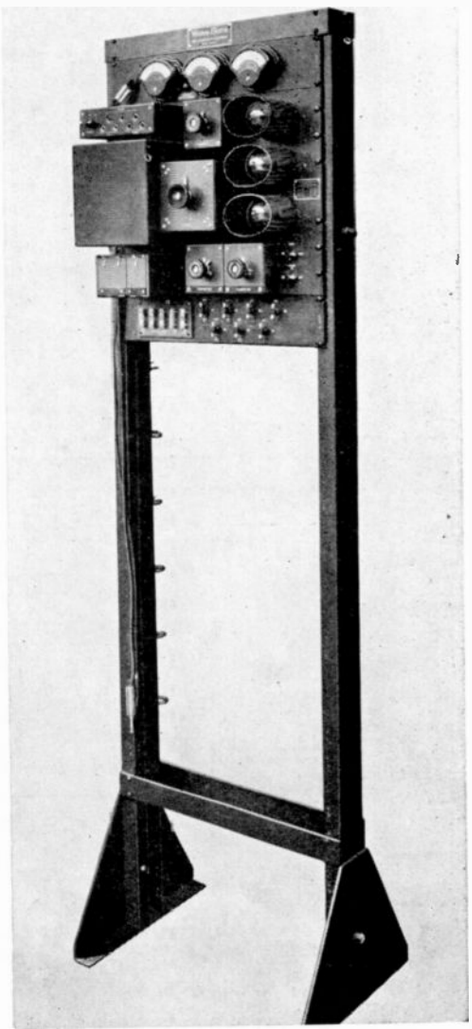


Fig. 3. *The Western Electric No. 1A Speech Input Equipment*

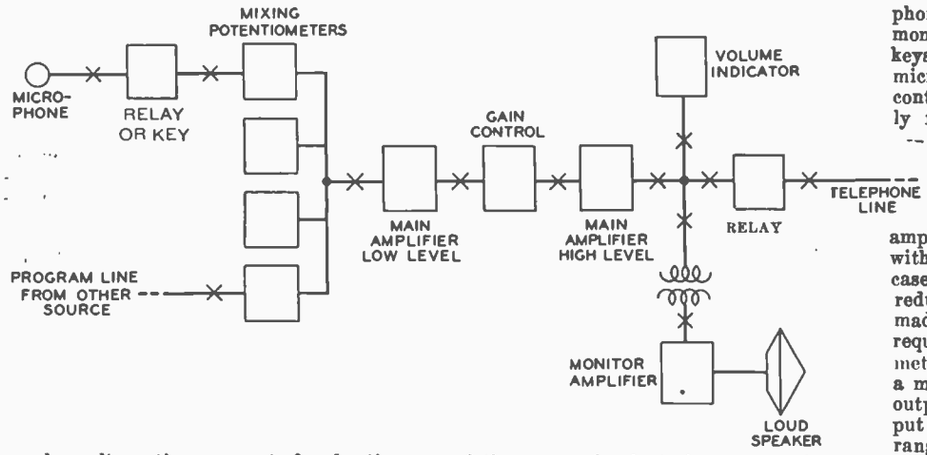


Fig. 4. *A typical studio channel*

employ alternating current for heating the filaments without any material decrease in the amplifier signal-to-noise ratio. These uses of alternating current have resulted in considerably simpler installations occupying less space, capable of being put in service in considerably less time and at greatly reduced expense, and requiring far less maintenance. The elimination of batteries at program pick-up points has been completed by the introduction of the Western Electric No. 618A (moving coil) microphone, which requires no direct current supply.

The microphone in the studio and the amplifier required to supply an immediately associated radio transmitter, together with the power supply for the amplifier, are of course the fundamental essentials of a speech input equipment. However, it was found that satisfactory control of the program necessitated a loud speaker for indication to the operator of the quality and continuity at the output of the system. To provide adequate energy to operate one or more loud speakers at comfortable volume and to isolate them electrically from the main program circuit, a monitoring amplifier is bridged at the output of the main amplifier system, through a high impedance so that it may be removed or connected without changing the program level.

It was also found that satisfactory control of the program energy level necessitated a visual indication to the operator of the energy level at the output of the system. For this purpose a volume indicator is used. This ordinarily consists of a rectifier associated with a direct current meter. The input to the rectifier is ordinarily bridged on the main program circuit through a coupling circuit of high impedance and consequently low bridging loss. Since no meter has a sufficiently long scale to indicate directly the wide range of energy values encountered, there is ordinarily a calibrated attenuation circuit ahead of the rectifier which can be set by a key or dial switch or both. In practice, the settings of the attenuation circuit, once made, are left undisturbed and the volume control is used to hold the swings of the meter within a definite range.

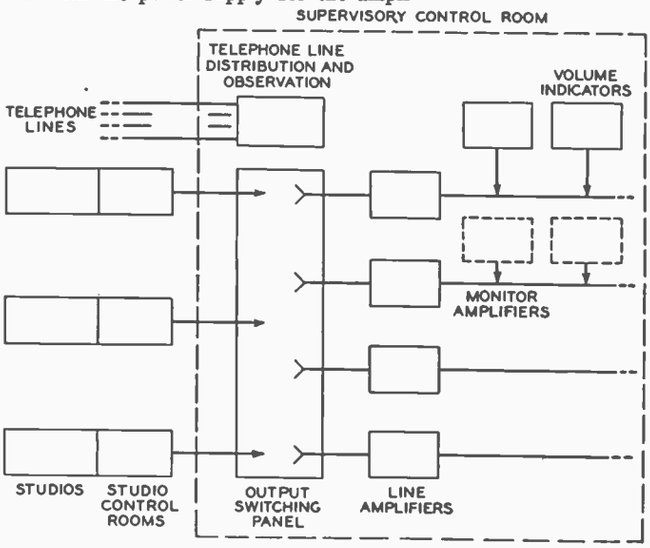


Fig. 5.—*While each of several studios has its own control room, a supervisory control room is necessary for the group.*

As the programs became more complex it was found that a single microphone in a studio was not adequate for all programs. This requirement of several microphones in a studio, for example, one for the announcer exclusively, one for musical accompaniment and one or more for the several speakers of a dramatic production, together with the necessity of providing for programs from other sources, necessitated means of quiet, precise and, in some instances, remote or multiple control microphone switching. This switching is accomplished by lever unit keys or, if the switching must be controlled from more than one point or controlled remotely, by means of telephone type relays usually operated by momentary contact push-button or lever keys. With the use of several program microphones it also became desirable to control the output level of each separately from that of the others as, for example, when an announcement is made with a background of music. In such a case the level of the music is gradually reduced while the announcement is being made and then gradually increased. This requirement is met by the use of potentiometers, the input of each associated with a microphone or program source and the outputs connected together and to the input of the main amplifier. Such an arrangement is known as a mixer. Ordinarily, the mixing potentiometers are located immediately at the outputs of the microphones so that the required apparatus investment may be as small as possible. However, this location necessitates not only that the output impedance of any potentiometer be substantially constant regardless of setting so that a change in the setting of one does not affect transmission efficiency through the others, but also requires, particularly with more recent types of microphones, extremely quiet operation. This is necessary because all of the amplification in the system follows the potentiometers.

Pickup of programs at points outside the regular studios—an early step in the evolution of broadcasting—brought about the development of portable speech input equipment. All the essential facilities of the studio equipment are incorporated but in the mechanical design emphasis is naturally laid on lightness and compactness. For example, the convenience of loud speaker monitoring must be sacrificed for the light weight of a headset. Programs are transmitted over wire lines at levels comparable with those of telephone conversations. Sufficient attenuation is introduced at the studio to reduce the level to that of the local microphone output, so that the incoming program can be handled substantially as though it originated in the studio.

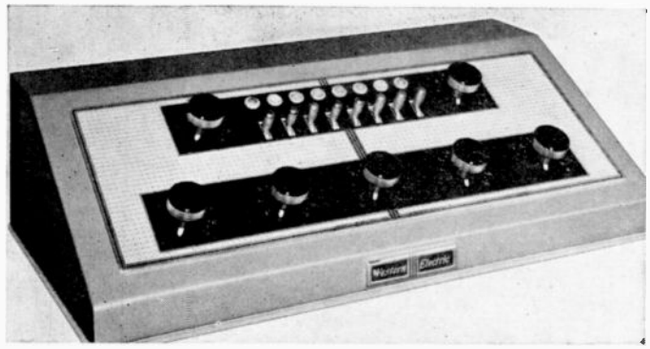


Fig. 6.—*The five lower knobs on the 10A Cabinet Control the output of five microphones or program lines, while the upper knobs have a similar function for the main and monitoring amplifiers.*

When one studio program immediately follows another, it is desirable for smooth transition from one to the other that two studios be available so that the performers may be preparing in one for the subsequent program during the presentation of the earlier. Furthermore, rehearsals under conditions simulating those of actual broadcasting are conducted for the more elaborate programs. The re-

(Continued on Page 16)

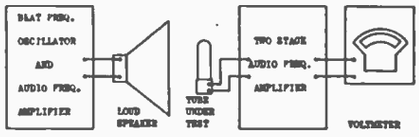
TESTS SHOW MICROPHONISM

By ROGER M. WISE

Chief Tube Engineer, Hygrade Sylvania Corporation

MICROPHONISM, that annoying singing noise that was troublesome in certain older types of tubes, such as type 99, has recently been the subject of some interesting tests by the Engineering Department of Hygrade Sylvania Corporation. Comparison tests between

FIG. 1



type 99, incorporating the original thoriated tungsten filament, and type 99 using the oxide-coated nickel ribbon filament construction recently developed by Hygrade Sylvania engineers, have brot out amazing differences in microphonic response.

The method used to measure microphonic response in a radio tube is illustrated in Figure 1. A standard beat frequency oscillator and a fairly high gain frequency amplifier supply the necessary energy for the loud speaker. The tube to be tested is placed directly in front of the loud speaker, and is mounted on sponge rubber to minimize the transmission of waves from the speaker to the mounting stand. The sound waves transmitted directly by the loud speaker are impressed on the tube, which acts as a microphone. A high gain frequency amplifier further amplifies the pulsations generated in the tube as the result of the mechanical motion caused by the speaker. The output voltmeter indicates microphonic output in volts.

Microphonism is caused by vibrations of the filament, under mechanical shocks, which in turn causes variations in the characteristics of the tube and pulsations in the plate current. These pulsations, amplified by succeeding stages and fed back to the loud speaker, cause the sound which engineers term "microphonics."

In the familiar thoriated tungsten filament type 99 the adjustment of filament tension is so critical that only a few tubes of this type are even comparatively free from vibration of the filament, which in turn causes microphonism when this tube is used in the ordinary receiver. In order to secure high efficiency with the short tungsten filament, it is necessary to use a very small control grid and plate, so that the inter-electrode spacing would be small, thus compensating somewhat for the lack of filament length. On the other hand the grid could not be made too small, as the filament has a tendency to bow, with resultant danger of a short occurring between grid and filament. When the tungsten filament is stretched too tightly, it has a tendency to vibrate like a violin string. When left too loose, it will whip around under any slight mechanical shock. Either of these effects will cause microphonism.

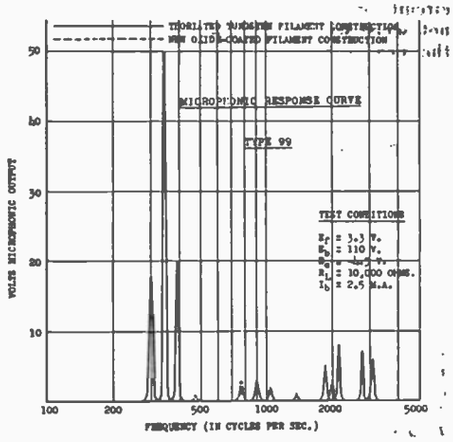


FIG. 2

In redesigning the type 99, these faults were carefully considered. The straight-through tungsten filament was replaced by a "V" type oxide-coated nickel ribbon. This filament can be more

(Continued on Page 21)

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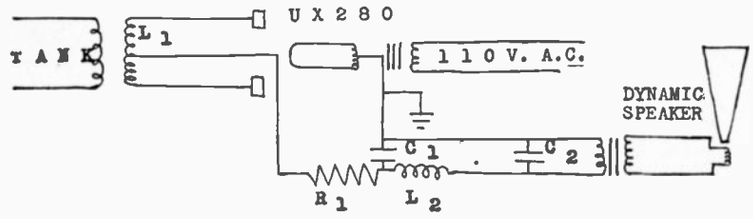
THE STATION AUDIO CHECK

By DANIEL E. NOBLE, Engineer WCAC

An audio monitor in the modulator circuit or in the speech amplifier will not serve as a check against difficulty in the final output R.F. stage. At WCAC we couple an ordinary 280 rectifier tube to the tank of the output stage in the manner shown in the diagram herewith.



L1=Mid-tapped coil 20 to 40 turns (depending on frequency and coupling)
L2= 60 M. H. Choke.
C1 & C2= .0005 Mica Condensers. (Low pass filter)
R1=15,000 to 30,000 Ohms. Flattens out rectifier characteristics to decrease distortion. Jensen or other dynamic speaker.
(No attempt is made to tune L2.)

POLICE RADIO AT HIGHLAND PARK

By HENRY DRANE, JR.

WE are very glad to contribute a little description of our station. We are very sorry we have no photos at present as we are doing a little rebuilding at this time and of course are not in position to photograph our equipment, but we shall be able to send you them at a later date. Our station, WMO, is probably very similar to many others in the country, but I will try to dwell on some of the points that may be interesting.

Station WMO has been in continual service since June, 1929, and was one of the first police radio stations in the country. It serves a city of 50,000 population crowded into an area of less than two and a half square miles, in the metropolitan area of Detroit. We have three patroling cars in service 24 hours, which gives each car a quite small area to cover. It is estimated that a police car passes every house or building every 15 minutes. There is also a sergeant's car that patrols the entire city, and a detective cruiser that answers all important calls, and takes care of the breaking ins and larcenies. On the day shift a traffic car is in service. This station must share a frequency with three other local stations. A telephone link connects all four stations so each may signal the other when it desires to use the frequency and when any of the other stations are on the air this station carrier is automatically locked off until the channel is clear. Of course the signal system will clear the channel in case of an urgent message. This system seems to work out very well where a crowded condition such as this exists.

The transmitting equipment at WMO is quite standard. It started as a simple breadboard layout in 1929 operating on 1712 kc but has since evolved into a quite modern panel outfit on 2414 kc 50 watt carrier. All the equipment is composite. The transmitter itself is made up of a 47 crystal stage, 2 type 210 buffer stages, 211 final, modulated by a pair of 845 tubes in parallel operating class A. A single heavy duty rectifier supplies D.C. to all plate circuits, and a small rectifier furnishes bias for the modulator. The speech equipment is all A.C. operated except for the operator's condenser microphone. A two channel mixer, where the dispatcher and operator microphones terminate, feeds into a three stage amplifier which in turn is coupled to a 500 ohm line and then to the transmitter.

The whole system is remotely controlled from the police desk where all the dispatch is done.

The above just about goes over the main points of our system. We have found our station a decided help in the policing of this city during the last five years.

You might be interested in the personnel of this station. There are three of us here and we work four 8-hour shifts and two 12-hour shifts per week.

Henry Drane, Jr. Acting as Chief Operator, worked four years for R.C.A. on ships out of New York, was Chief Operator on SS. Pres. Harrison of the Dollar Line, Chief on SS Monterey of Ward Line, and Chief on SS Huron of the Porto Rico Line. Also worked for U. S. Shipping Board and the Radio Department, Ford Motor Co. Employed by this city October 11, 1929. Holds Comm. Radiotelegraph First Class License with Radiophone First Class Endorsement. Is an amateur, call W8QH-W8CEV.

Charles H. Thorton. Formerly with the Sparton Radio Co. (Sparks-Withington Co.) of Jackson, Mich., as a district representative. Employed by Saginaw Police Department as operator in that station. Employed by this Department in April, 1932. Holds radiotelephone First Class license. Is an amateur, call W8ZN.

Wyman B. Hubbard. For the last ten years a service man, originally from California. Asso. member I.R.E.; holds Radiotelephone First Class license, is also an amateur, call W8HZC.

KCCF, Rodeo, Air Service Radio

By ROBERT B. EASLEY

WE have three men here, T. J. Edwards, U. S. Navy, U. S. C. G. ("Saranac" and others), commercial enterprise connected with radio in Houston, and finally KCCF, at Rodeo, N. M. He is married. Another is A. Brigadier, who did two "hitches" in the Navy, then graduated into this organization. Single. My own record is all commercial, savors somewhat of the "rolling stone" about which you've read. Started with the old I.W.T. on KOKS, in '28. Before that had some little experience teaching in a radio school, of which I'm heartily ashamed, and about it the less said the better. Went from KOKS to KATHERINE KTOI to MALABAR WKCR to BARNEGAT LIGHTSHIP to CLARE WKCB to MEDEA PJBH (relieving op who died en route to the states) to JOHN WORTHINGTON to SOLITAIRE to CURRIER to BIDWELL. Left BIDWELL at Sun, Texas, same trip she went into drydock at Chester, Pa., and had big explosion, killing several. Operated KTSM broadcast in El Paso awhile, KFH in Wichita, Kans., helped install KGZM Police station in El Paso, then acquired interest in XEJ, Juarez, Mex. Did not become rich. Then, to present station KCCF.

Incidentally, when I went on CATHERINE KTOI, relieved George Alagna, now involved in investigation of "Morro Castle" disaster. Have met him at his home in Brooklyn and in various static rooms since, corresponded intermittently, and want to go on record that he is one FB Om—not at all the type of person who would burn the ship because of a row with the skipper or others.

Here is a sample of the way the messages come in:

DPH E60® 25 59'35 L ↖4 979

PHOENIX CEILING 60 HUNDRED FEET, OVERCAST, TEMP 59, DEWPOINT 35. WIND SOUTHEAST 4 MILES PER HOUR, BAROMETER 29.79.

As you know, the Ops of radio stations in this organization (except those located in large towns) do various maintenance work on the landing fields, buildings and equipment in addition to radio duties. We stand 12-hour watches for 30 to 35 days, then get off for 7 to 12 days. Little worse hours than marine operating, but we do not complain, since we realize there IS a pressing need for economy.

At KCCF we have Diesel-operated generators, two of them, 15 KW each, running alternate days, to supply juice for field lights, radio, water pump, 1 KW beacon light et cetera. Large range station, using only a 851, 1 KW air-cooled tube, in final stage, but giving beaucoup results. 256 KCs. Communication (weather report interchange hourly, messages, traffic movements, etc.) carried on with short wave 400 watt combination radiotelegraph and rdofone set. Use 5940 kcs day, 2968 kcs night. Code or fone mostly code. Work the American Airlines planes, too, when they call, on fone—their frequency (nite) 3232.5 kcs.

In transmitting our hourly weather observations, Ardmore starts, giving head-

(Continued on Page 10)

An Extension of Land Telephone Lines by Ultra-Short Wave Radio

By F. F. MERRIAM
Member of the Technical Staff, Bell Telephone Laboratories

FOLLOWING the commercial application of short waves to transoceanic telephony in 1928 and 1929, attention was directed by Bell Telephone Laboratories toward determining the properties and usefulness of the ultra-short waves. It was decided in cooperation with the New England Telephone and Telegraph Company to carry out the trial installation across Cape Cod Bay, between Green Harbor and Provincetown, Mass. The coastal station of the New England Telephone and Telegraph Company, already existing at Green Harbor, made a convenient place in which to install one end of the system. The physical conditions are also favorable for an ultra-short wave link between that point and Provincetown, 25 miles away. The sand dunes near Provincetown, rising about 100 feet in height, make it possible to secure an optical path across the bay. Furthermore, Provincetown is fairly accessible by motor car around the Cape and is already provided with wide circuits, so that the radio link need not be completely depended upon. This location is thus a good proving ground for this new type of telephone circuit.

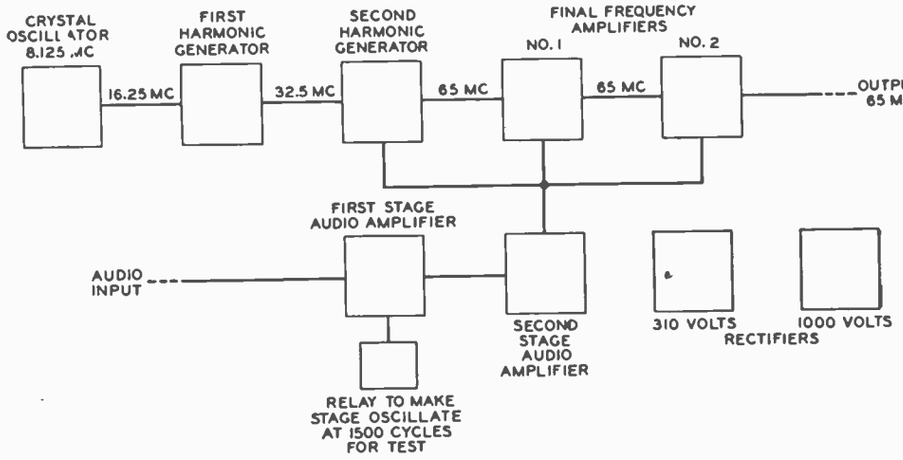


Fig. 1.—*Block schematic of ultra-short-wave transmitter*

The short-wave transoceanic circuits are operated at frequencies between 5 and 21 megacycles while the ultra-short waves are at frequencies above 30 megacycles, which is generally taken as the upper limit of the short wave range. It had previously been discovered that these higher frequencies were not in general reflected from the Kennelly-Heaviside layer. They were, therefore, considered primarily suitable for short-distance communication, where the waves followed essentially an optical or straight-line path from the transmitter to the receiver. In the telephone plant there are instances where natural barriers so separate points only a short distance apart that it is difficult and expensive to construct ordinary telephone lines or submarine cables to connect them. It seemed that for such conditions ultra-short wave radio extensions might be a satisfactory means of giving telephone communication. To be economically feasible, however, such radio circuits must be inexpensive both in first cost and in operation.

During the last few years, the Laboratories have been experimenting with an ultra-short wave circuit between Deal and Holmdel, New Jersey, with the thought of developing equipment capable of unattended operation. Some time ago this development reached the stage where it seemed desirable to carry out a trial of a two-way circuit under conditions approximating commercial use to gain experience with the problems involved in regular operation. In particular, it was desired to design and install the radio stations for operation without direct attendance, so that the apparatus could be located remotely from a central office.

After a study of possible locations, it was decided in cooperation with the New England Telephone and Telegraph Company to carry out the trial installation across Cape Cod Bay, between Green Harbor and Provincetown, Mass. The coastal station of the New England Telephone and Telegraph Company, already existing at Green Harbor, made a convenient place in which to install one end of the system. The physical conditions are also favorable for an ultra-short wave link between that point and Provincetown, 25 miles away. The sand dunes near Provincetown, rising about 100 feet in height, make it possible to secure an optical path across the bay. Furthermore, Provincetown is fairly accessible by motor car around the Cape and is already provided with wide circuits, so that the radio link need not be completely depended upon. This location is thus a good proving ground for this new type of telephone circuit.

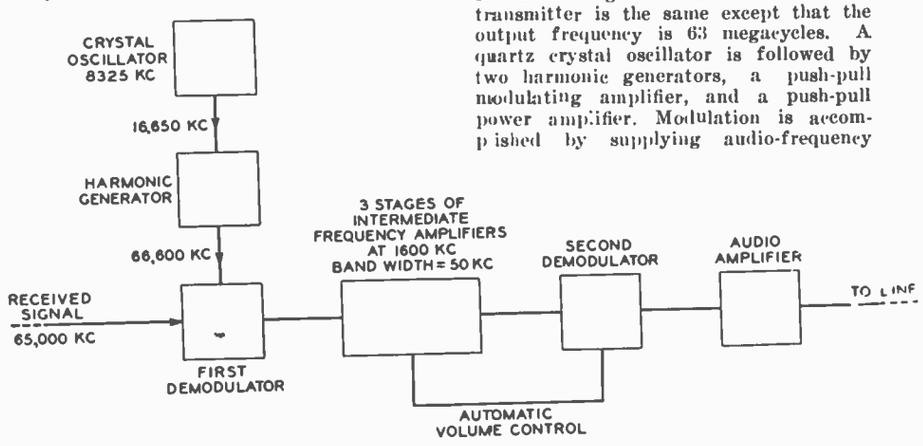


Fig. 2.—*Block schematic of ultra-short-wave-receiver*

Accordingly, the radio link has been established across the bay, as indicated on the map, and extended at Green Harbor by wire to Boston, to form a direct Boston-Provincetown toll circuit. At Boston and at Provincetown the circuit appears at a jack in the switchboard alongside the jacks of other toll circuits. The insertion of a cord into the jack starts the radio transmitter at that end of the radio link. The receivers at both ends are kept in constant operation while the circuit is available for traffic. Ringing is accomplished by sending a 1,000 cycle tone interrupted at twenty cycles over the radio circuit. Since the radio transmitter requires less than one second to start, the operator may ring immediately after inserting the cord. Privacy equipment, similar to that used on the transatlantic short wave channels, is installed.

The receiver is started and stopped by the operation of a key at the local test board. The power supply is arranged so that when the receiver is in operation, current is also applied to some of the filaments of the transmitter. Provision is also made for testing the overall operation of the transmitter and receiver at each end from the local test board. A tone is generated which modulates the transmitter, and if both transmitter and receiver are operating properly a side-tone will be produced in the local receiver which can be heard by the test board operator.

The transmitter, developed by R. W. Friis and L. M. Klenk under the supervision of N. F. Schlaack, is crystal controlled, and is capable of delivering 15 watts of carrier power which can be completely modulated. A block schematic for the Green Harbor transmitter is shown in Figure 1. The Provincetown transmitter is the same except that the output frequency is 63 megacycles. A quartz crystal oscillator is followed by two harmonic generators, a push-pull modulating amplifier, and a push-pull power amplifier. Modulation is accomplished by supplying audio-frequency modulating power to the plate and screen of the modulating amplifier and to the screens of the second harmonic generator and the power amplifier.

Two rectifiers employing hot-cathode mercury-vapor tubes supply plate and

screen potentials for all tubes. Grid bias potentials are obtained from cathode resistors and grid leaks. Grid and plate circuits of each stage are shielded from each other to prevent extraneous coupling and interstage feedback. The transmitter operates entirely on standard commercial 110-volt, 60-cycle current.

The radio receivers, developed by G. Rodwin and C. H. Swannack under the direction of F. A. Polkinghorn, also operate from a 110-volt, 60-cycle circuit, and are of the double detection type. A

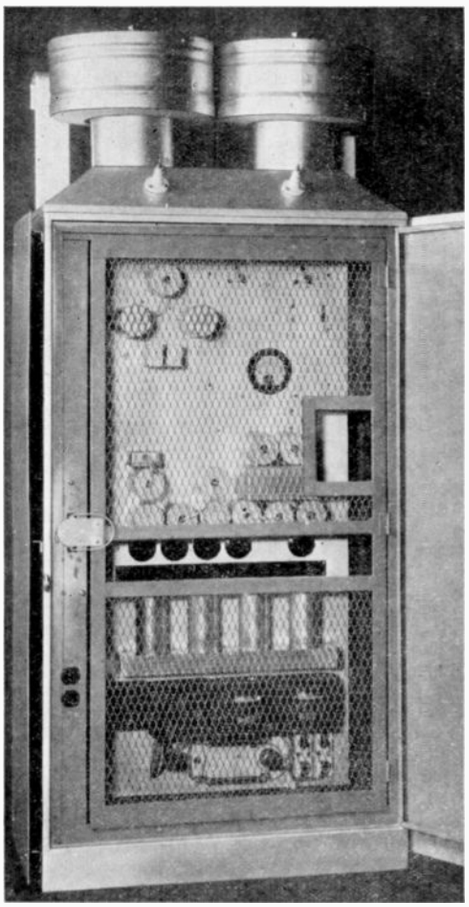


Fig. 3—*The ultra-short-wave transmitter is mounted in a metal container suitable for pole mounting*

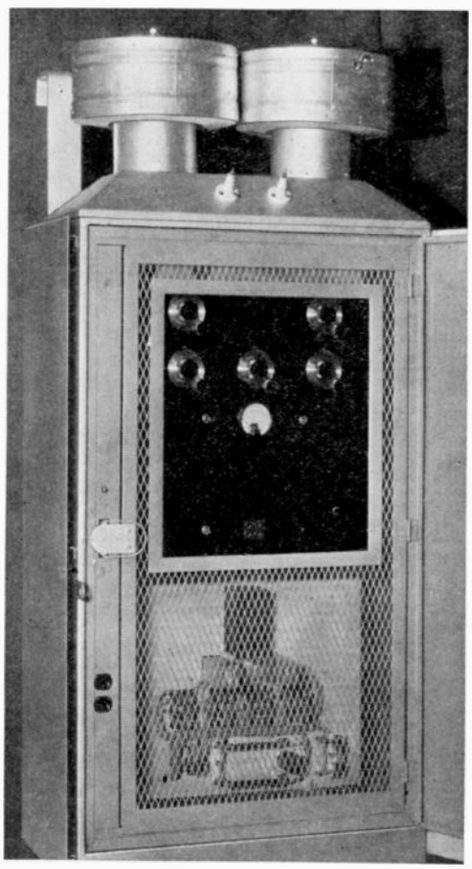


Fig. 4—*The receiver is mounted in a similar container and both incorporate safety provisions to prevent maintenance men from coming in contact with high potentials.*

block schematic is shown in Figure 2. To make unattended operation possible, a crystal oscillator is used as a source of beating frequency. A single-stage harmonic generator produces sufficient voltage of the eighth harmonic of the crystal frequency for satisfactory operation of the detector. The intermediate frequency amplifier consists of three stages of amplification at 1600 kilocycles, and has a band width of approximately 50 kilocycles. A small amount of automatic volume control is provided to compensate for slight variations in received voltage caused by variation in humidity and other factors.

The receiving and transmitting antennas are identical and are mounted on 100 foot poles fifty feet apart. Horizontal exciter and reflector elements are supported on standard cross-arms. Four pairs of half-wave exciter elements, each comprising two half-wavelength conductors, are spaced one-half wavelength apart in a vertical plane on each side of the pole. Reflector elements are similarly arranged on the opposite side of the pole, the spacing between exciters and reflectors being one-quarter wavelength. The transmitter and receiver are each mounted in a metal container suitable for mounting on the antenna poles at a later date. At the present time they are installed in a small building located between the transmitting and receiving antennas. The mechanical design of the transmitters and the station layout were made by M. E. Fultz and J. L. Mathison.

The entire development and installation of the project has been under the direction of A. A. Oswald. The system was put into trial service early in July. It was found to yield a high-grade two-way telephone circuit and is adding to our knowledge of the practical problems and capabilities of such a system.

KCCF Rodeo, Air Service Radio

(Continued from Page 8)

ing of sequence, which is "AT-DPH" or Ardmore-Phoenix, and time, then his own, Dallas and Fort Worth observations, which he receives by teletype. He is followed in rapid succession by Santo, Big Springs, Wink, Frijole and El Paso, Texas, and by Columbus and Rodeo, N. M., and Tucson and Phoenix, Ariz. Just as soon as one station finishes the next starts—sometimes you would almost believe one station was sending the whole sequence. By smooth sounding to an old marine op accustomed to 15 minute calls by certain well-meaning British Ops. And some of our own ships.

All of sequence is copied at each station. Those on teletype lines copy direct to teletype. About 30-35 WPM. Thus each station is in a position to give complete information concerning weather up and down the airline to any plane that might call.

Have to learn how to distinguish between types of clouds, estimate heights of same, operate various specialized weather observational equipment. We use special symbols to indicate weather conditions. A typical report is shown on Page 8 (we have code for all of these symbols, for example, the circle with cross, indicating overcast sky, is sent ———— ..—). The wind directional arrows are okay after you become accustomed to them. My 73 to the OMS who read this.

Men at Reno, Nev., Air Station

W. A. Breniman (in charge) ex-commercial ship's operator.

G. A. Day, ex-navy operator.

B. C. Swaffield, ex-navy and coast and geodotic survey operator.

R. C. Chesmore, ex-commercial ship's operator.

Changes in personnel assigned here are expected soon due to inter-station transfers.

WPEM, WOONSOCKET, POLICE RADIO

By ARTHUR F. O'BRIEN, Chief Operat.r

THIS station went on the air July 2, 1932, and has become the most important factor in the suppression and apprehension of crime being used in this department. During the year of 1933, approximately thirteen thousand messages were sent to cruiser cars, and said cruiser cars made an average run of 2.52 minutes to their destinations. Since the first of the present year the efficiency of handling radio traffic has been increased until it is possible to place a cruiser car, carrying two patrolmen at any needed point in the city, in considerably less

Fig. 1 *Transmitter at left. Center on desk radio receivers. Speakers shown at right.*

than two minutes after the call for police help had come into the station.

The transmitter is a fifty watt composite job, using a temperature controlled crystal on 2466 KC, a 247 oscillator, an 865 buffer and a 242A in Class C. The audio system uses a Peizo-Astatic Crystal microphone with a 56 as mike amplifier, two 56's, resistance coupled and a 2A3 kicking two 242A's as modulators. Two 866's are used for rectifiers.

Figure 1 at left shows the transmitter with the power supply and filter panel not showing. The panel just showing contains the mike switches, volume indicator, gain control and "on-off" switch (buttons). The panel above contains the crystal oven on the left with the thermometer showing in the small cut-out, and to the right; the oscillator and buffer stages. The two modulators and the Class C show through the window and the top panel contains the tank circuits and tuning controls.

A good view of the General Radio electron coupled frequency meter and of the crystal mike may be obtained from this photo. A switch set in the top of the desk cuts the plate supply to the Class C for use when working a two-way hook-up with WMP at Framingham, Mass., as the main "on-off" switch on the panel cuts in a time delay of about twenty seconds. The key switch which is fastened to the edge of the desk top cuts in either the microphone or the warning signal oscillator. This arrangement, of my own design, cuts the crystal mike stage directly into the first speech amplifier by throwing the switch to one side and the opposite position of the switch closes the filament circuit of the signal oscillator tube, connects the output of the oscillator to the double button mike transformer and this transformer to the grid circuit of the first speech amplifier. Provision is made for the use of a double button carbon mike in case of emergency by connecting to an extra mike terminal block in the transmitter and keeping the switch in the center position.

At right side of desk is given a setup of the receivers, RCA speakers, log and State Teletype System map. The receivers used are all National FB-7's and each is keeping watch on one of the police channels of interest to us in New England. The set on the left is kept on 1666 KC for reception of all calls from WMP, the Mass. Constabulary station at Framingham, Mass. The next right is on 1712 KC, on which channel we receive Providence, Boston, New Bedford, Cincinnati and East Providence, while the right hand set is on our own channel, 2466 KC, and on which we hear Cranston, Pawtucket, Worcester, Fitchburg and Bridgeport, Connecticut. Each receiver has its individual power supply located on a shelf under the desk.

Transmission lines are used to feed the RF to the antenna-tuning unit which is housed in a weather-proof coop on the roof of the building. Figure 2-15, a photo of the roof showing the counterpoise and the antenna-tuning coop. For receiving we use two antennas: an untuned doublet for the 2466 KC receiver;

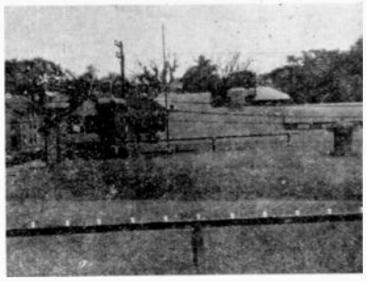


Fig. 2 *Counterpoise on roof and antenna tuning coop.*

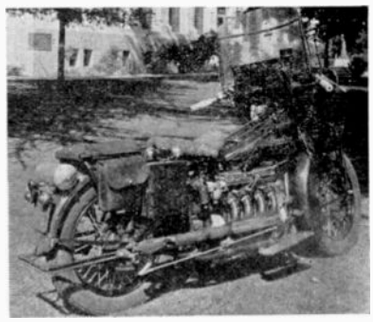
and one which we believe is an innovation for the other two receivers. This trick antenna consists of a twisted pair transmission line running on poles for about four hundred feet to the base of a one hundred and twenty-five foot smoke-

(Continued on Page 18)

BAKERSFIELD POLICE RADIO

By H. Z. MYERS, Chief Operator

I WILL endeavor to give you some news of KGPS and the Bakersfield Police radio system. KGPS went on the air October 1, 1931, being about the fourth or fifth police radio station on the Pacific Coast. We, therefore, consider ourselves pioneers in this phase of the game. We still use the original rig, a composite 50 watt crystal controlled low level modulated rig, which was rebuilt for this service from a ham station by the writer. This transmitter has been in constant twenty-four hour service ever since, with only minor repairs and adjustments.



One of Bakersfield Police Motorcycle Radio Sets. These motorcycle radios have been used for more than two years and Bakersfield Police were first in country to use police motorcycle radio sets.

There is nothing unusual in our transmitter lay-out but the receiver end of our system offers some points of interest. We claim the distinction of having in operation the first fully successful police motorcycle radio and have had our motorcycles one hundred per cent equipped for over two years. The first receiver was put in service November 1, 1931, and has been in continuous operation ever since. Our squad of six motorcycles all carry radios and require as little service as the standard police receiver used in our patrol cars. Space will not permit a history of the development or technical discussion of the receiver used. I will furnish this in a separate article.

The Bakersfield Police radio staff constitutes a chief operator and general technician and eighteen licensed radio telephone third classed operators, all members of the department, who may have occasion to act as desk sergeant. The coaching of the crew for the examination was one of the duties of the chief operator. They were all apt pupils making grades ranging from 85 to 99 8-10%. The chief operator is on call twenty-four hours each day for service to the transmitter and sixteen mobile receivers, checks the logs kept by the operators and radio reports by car and motorcycle patrol, aids and relieves the desk sergeant during rush periods and acts as general utility officer in time of emergency. He holds a radio telephone first class license, third renewal.

We are now experimenting with a two-way high frequency communication, also in the near future we may boost our power for county wide service.

Let me say in closing to my fellow operators and readers of Commercial Radio that police radio is a good berth for an operator to land in. It has plenty of future and lots of excitement. It is here to stay but there is still plenty of development to do.

A "WRINKLE" FROM WHIS

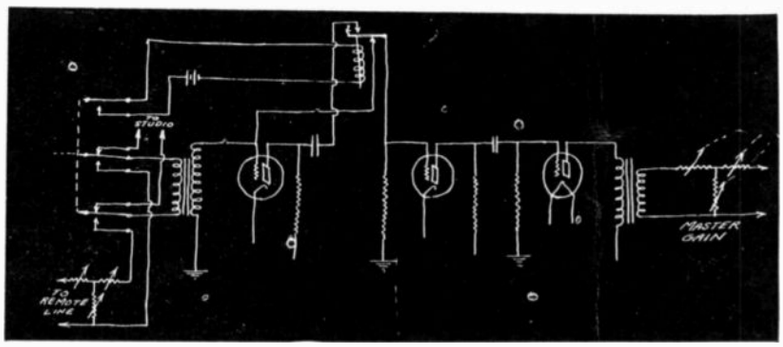
By P. T. FLANIGAN, Engineer

HERE is a wrinkle that may prove helpful to those engineers who are troubled with line noise on remote broadcasts.

In our own case practically all remote lines, especially those looped in for "impromptu" broadcasts, were extremely noisy, the level of which remained the same regardless of the speech level that we fed to our three stage special input panel. If we made the speech level high enough to overcome the noise level, it would overload the amplifier. On the other hand, if the speech level was just sufficient for proper modulation, the noise level would be too high. So you see we really had a problem.

After every other means had failed, I tried the following idea: The diagram of our speech input amplifier shows the manner in which we overcame this difficulty. The diagram is self explanatory, except for one point. At first glance you'll probably say that when the relay cuts out the first audio stage there will be a "blop" going out on the air, but this is prevented by turning the Master Gain off while the switch is being thrown.

I am sure others who have had the same difficulty we encountered will find it well worth their time and effort to try this out.



When relay cuts out first audio, the Master Gain is turned off.

AIRWAY STORY FROM DES MOINES

By F. C. JUSTICE, Operator in Charge

NAMES of radio operator personnel at this point are:

F. C. Justice
B. H. Barker
H. Garsombke
F. J. Dunlap

Dunlap and Garsombke are ex-navy operators and Justice and Barker are ex-navy and ex-merchant marine operators.

The airways communication system is now connected mostly via teletype at present but recently from Fort Worth to Los Angeles including intermediate points teletype has been discontinued and reverted back to radio high frequency communication, no doubt because of enormous expense of teletype lines.

Another new radio circuit has been inaugurated from La Crosse, Wisconsin, and Fargo, N. D., each direct to Butte, Montana, thence to Spokane and Seattle and other new radio circuits are contemplated.

Experiments of radio teletype communication are proceeding very well and this means of communication is not far distant, along the airways, which means that radio experience will always be a requirement for these positions.

Our duties at Des Moines, Iowa, are as follows:

1. Observe and register weather conditions at Des Moines Airport and place same on Chicago to Omaha weather sequence hourly.

2. Keep a 2KW transmitter radio beam (308 kcs) east and west course on the air continuously and courses correct.

3. Report any hazards at the airport and give weather conditions and forecasts to transient flyers and report their ships in and out and where bound from Des Moines.

4. Prepare and draw isobar lines of eastern and central maps received via teletype and make copies for the transport companies.

A new wrinkle in the airways is radio marking of high obstructions to aircraft flying in a congested area or along or close to an established airway. Installation of a 7½ watt radio marker beacon transmitting station at the site of the new broadcasting stations who are now using 700 to 800 foot vertical tower radiators. Although these towers are well obstruction lighted by the standard red lights and 24 inch revolving beacons showing red, it nevertheless presents a serious hazard to flying aircraft in the vicinity, during conditions of poor visibility. These small radio transmitters have been installed in the base of the towers and are in continuous operation on frequency of nearest airways weather broadcasting station emitting a steady unkeyed 120 cycle signal having a range of three miles, thus marking the location of and warning radio equipped aircraft flying the regular airways.

I am former Boston Marconi and RCA operator, started in May, 1913, last assignment 2 years on Boston yacht, "ARCADIA", left her May 1, 1931, for airways. Where is Joe Gately now? Have written him twice but no reply.

Massachusetts State Police Radio

By JOSEPH A. MULLEN
Chief Operator WMP

WMP is owned and operated by the Massachusetts State Police and is one of its three stations operating on 1666 kc. WMP is located at Framingham, about 25 miles outside of Boston. It is a 1000 watt De Forest xmitter operated remote control from the teletype room in the barracks of "A" troop headquarters. The lineup of the xmitter is as follows: 210 oscillator, followed by two stages of 865 buffers, feeding a pair of 511's. The 511's are the moduated stage and they are used to excite a 520-B water cooled final amplifier. Modulation is class B, and starts with a Jenkins and Adair condenser mike feeding a 112 pre-amplifier in the barracks; the speech line feeds the grid of a 56, which in turn feeds a second 56 and the output swings the grids of a pair of 245's. The two 245's excite four 545's in push pull parallel as modulators in the xmitter. The antennae is a T type operating against a counterpoise and is strung between two 150 foot masts.

The staff at Framingham consists of four men; one man detailed permanently to an adjoining troop to take care of the car receivers, while the remaining three men work shifts at the transmitter and take care of the car receivers in "A" troop and from general headquarters at Boston. Two men are on duty through the day and one man stands the night watch.

A sketch as regards the men. Gahm is an old timer having been in the marine end as a commercial in 1920 and after drifting away for a time wound up in Police Radio early this year. Hodgdon was formerly with WBSO at Babson Park and a service man with one of the department stores in Boston. Pierce came off the fish boats onto the police job about a year ago. Mullen was with the Yankee Network on WNAC-WAAB's transmitter for four years prior to coming to WMP. Gahm and Mullen are active in the "ham" game and find a little time to pound a key on 80.

The station at Framingham maintains two standby sets; one for the 1666 kc channel and a second on 2466 kc, keeping schedules with the Woonsocket, R. I. police department. The station is tied in to all sub stations and the various police departments via teletype and in case of an emergency the teletype is used to clear our own channel to get in contact with any of the cars being served from this station.

Schedules were formerly kept with the State Police at East Lansing, Mich., and cars in that state were called by Framingham and vice versa, when contact was not made by their own station. Now, however, the latest addition to our group, WPEW at Northampton, keeps this schedule with East Lansing.

WMP is about to move to its new home some two miles distant from its present location and early in 1935 it is expected she will be on the air with many alterations in her operating gear.

The problems faced by a station staff in this class of police radio are somewhat different than those presented to the city or town using radio in its police department. Our cars are located as

(Continued on Page 15)

Men Who Are Making Radio Today

NO. 2—EDWIN K. COHAN

EDWIN K. Cohan, Technical Director of the Columbia Broadcasting System, has been actively experimenting with radio devices since, at the age of 9, he strung up picture wire between his family's apartment and the apartment house next door, so that he and his crony could talk to each other after the dead line for bedtime.

He was born in New York City, September 7, 1900, named for an uncle who produced many hit shows of that time. Ed's own father was a successful business man, his mother was musically inclined.

An inventor, who lived about a block away, stimulated young Ed's natural interest in mechanical or electrical devices. The youngster spent hours hanging over the inventor's wireless receiving set. He listened to radio reports of the sinking Lusitania, an unforgettably awesome occasion in his life.

When he moved from that first eventful neighborhood and changed public schools, he was fortunate to meet another youngster, equally interested in things mechanical or electrical. In fact, he possessed a radio shop devoted to a wireless receiver and transmitter. Ed's introduction to the shop of the young wizard was sinking—to rise again—into an old armchair that had been specially wired up for the occasion. The identical mischievous youngster is a minister today, and is one of four inseparable school cronies whom Ed still sees.

On November 17, 1914, about twenty years ago, Ed, at 14, received his first radio operator's license. No. 6625 was issued from the Brooklyn Navy Yard and still hangs proudly in Cohan's massive offices in the CBS building, New York. Another proud possession is a license signed by Herbert Hoover, when he was Secretary of Commerce.

War broke out in Europe, and communicated a scare to the U. S. The government formed amateur radio operators into an emergency reserve. They selected one station as key station in each corps area and Ed's was chosen in New York. Four other amateurs were assigned to keep continuous watch on the station in shifs.

In January of 1918, Ed became radio engineer for the Panama Canal Commission. He left New York with $16 in his pocket, and returned in a few months with $500, and some 16,000 miles of travel in Panama and South America behind him.

Ed returned in the midst of excitement. The United States had entered the war and the Navy Department needed trained radio men. So he joined the Naval Radio Laboratories Staff as engineer, working at the base in Brooklyn Navy Yard.

"Radio broadcasting would have taken ten years longer to happen if it hadn't been for emergency progress made in radio telephony during the war," Cohan asserts. "It was developed as a communication channel."

He inspected installations of radio equipment in over 400 vessels, and also supervised the special installation of seven transmitters on the SS George Washingon which conveyed Woodrow Wilson to Europe for the Peace Conference.

When the war was concluded, Ed was engaged in every mercantile phase of the radio industry which was then being formulated, including design and manufacturing of equipment.

But in the summer of 1926, Cohan found the mercantile end of radio pretty slow. So, since he'd had experience in every phase of radio except actual broadcasting, he joined the staff of WOR. And, in 1927, when the Columbia Broadcasting System was formed, and WOR became Manhattan key station for Columbia, he either supervised or personally monitored every program on the young network emanating from WOR. It was during this time that the idea of synchronizing a singer and an orchestra located at remote points first occurred to him, and was introduced to radio.

He worked out the idea through necessity. It happened one night when Ed was on duty at the Vanderbilt hotel to supervise the broadcast of an orchestra of which Leroy Montesanto, one of the first hit crooners, was soloist. Through a misunderstanding, Montesanto arrived at the WOR studios instead of the Vanderbilt, and telephoned Cohan just ten minutes before the program was scheduled to take the air. Obviously, time was too short for Montesanto to reach the Vanderbilt. Cohan held him on the telephone for a moment of fast thinking, then instructed him to remain at the studios. The orchestra music would be "piped" to Montesanto there, and his voice would be synchronized with it. In ten minutes Ed Cohan rigged up the necessary "trick" circuits, and the program was put on the air flawlessly, evoking applause from audience and radio editors, who devoted their entire columns to discussing the possibilities suggested.

Another of Ed Cohan's ideas, which made everybody sit up and take notice, was the night he was responsible for keeping WOR on the air till dawn when the setting-up-exercise director showed up. The purpose was to broadcast reports on the trans-Atlantic flight of Levine and Chamberlain, the first time a radio station ever stayed on the air all night. Heywood Broun and other prominent columnists "went to town" enthusiastically on the action of young Cohan.

Edwin K. Cohan

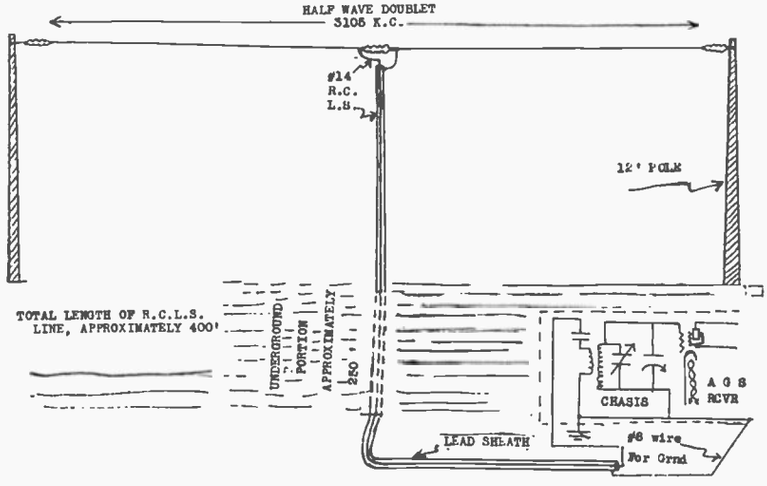
In 1929, Cohan resigned from WOR to design and install the studios for the Judson Radio Program Corp., of which he became managing director. In 1930, he left Judson Studios to become Technical Director of the Columbia Broadcasting System.

During the past four years he has been responsible for many technical feats and steady improvements which

(Continued on Page 22)

WINSLOW AIR STATION SOLVED ITS TROUBLE

EVERY operator knows the advantages of using a double antenna for high frequency reception in noisy localities, but generally the conventional doublet requires impedance matching transformers and transposed or shielded lead-in. At this station, a considerable amount of induction noise was being set up in the high frequency receivers from various motor-generator sets and from teletype machines. A certain amount was also being radiated from the power lines. A conventional half-wave doublet was erected approximately 200 ft. from the



station and single conductor No. 14 lead-sheathed cable was used as a transmission line, by attaching one section of the doublet to the lead sheath and the other section to the wire. The cable was then run to the station underground. All traces of induction noises completely disappeared with barely discernible decrease in signal strength. It has been found that several receivers may be connected to this antenna with no attenuation of signal strength. It is believed that Mr. B. R. Gaines, Radio Electrician of the Air Navigation Division, first tried this system. It really works.

A brief "auto-biography" of the station personnel:

C. W. Rahner entered service May, 1930 from 4 years Navy and 2 years Coast Guard operating. Radio enthusiast and experimenter of no consequence ever since the old gal Enas' sensitive spot was tickled by a cat whisker.

V. J. Gilbert entered service August 1, 1931 from 4 years Naval service. Served on the old USS Procyon (now de-commissioned) and shore duty in "the paradise of the Pacific," the land of grass skirts and three-finger-Poi.

B. Lynch entered service January, 1929. 6 years commercial service as ship operator with R. C. A. and 1 year Coast Guard. Ex-ham 3LF at Philadelphia.

L. D. Coss entered service February, 1929 from 2 years commercial with the Texas Co., and 4 years Navy in Philippines, China and Japan. Present ham W6LDA and ex 50D and W5CZS.

All of the Winslow, Ariz., men send 73's to their friends.

JUST MY IDEA
Others Probably Think The Same

By A. M. HOWERY

AS engineer to the Knoxville, Tenn., Police Radio Station, I believe your magazine can do a great deal of good to the cause of police radio stations.

We are using a commercial 500 watt RCA transmitter and a vertical radiating antenna. It is a typical installation of the RCA and is now reached the place where it will not be of a great interest to the readers like it would have been about a year or more ago. For this reason I am skipping this possibility for a subject.

Now, my suggestion for a topic deals with the Communications Commission and I intend to write the Commission prior to the publication along such lines. This subject is the inter-communication of the police radio stations. You see, the police radio stations began a gross amount of intercommunication work almost over night. Schedules were arranged and the traffic at first was only tests, now it is important and the Commission is looking upon this with slight disfavor seemingly taking the idea that telegrams should be used for such purposes.

In my treatise of the subject, I wish to set forth the importance of such a system, even to be used more universally than is and to point out a system that can be universally adopted by all stations of any size, why the present wave lengths now in use by the police departments are better from every angle than the ultra high frequency wave lengths. I want to stress on such points that may be used to open the eyes of the Commission to the extent of benefits to the police departments.

Airways Radio Station KCAC

By C. R. THRAPP
Acting Operator in Charge

BUTTE, Montana, is located in a valley bounded completely by the Continental Divide, those rugged Rockies that start our western and midwestern rivers on their winding ways to the east or west. The city of Butte extends from near the base of "Gold Hill," (the richest hill in the world and site of the world famous "Anaconda Copper Mines") well down into the valley below. Butte is a typical western mining city of nearly 40,000 population.

KCAC handles weather and other government communications for the Salt Lake City-Great Falls Airway, flown by the "National Parks Airways," and the Spokane-Fargo section of the Northern Transcontinental Airway, flown by "Northwest Airways."

The airport is at slightly over 5500 feet above sea level and one of the coldest points in the United States. To give the boys of warmer climates an idea of our weather: On September 19, 1934, the temperature dropped to 18 degrees above zero and we had a regular old-fashioned blizzard lasting for about eight hours. Winter before last the temperatures frequently dove to 57 and 60 degrees below zero and stayed there for considerable periods according to the natives.

The personnel attached to this station is as follows: Herbert W. Wilson, operator in charge (ex Army), temporarily on sick leave; C. R. Thrapp (ex Navy), acting operator in charge; Karl C. Burley (ex Navy); Ray N. Tripp (ex Marine), and Walter M. J. Klotz (ex Navy), temporarily attached relief operator.

Airways Radio, KCAC, transmitting station is located nine miles south of the city on U. S. Highway 10s, and the remote control and receiving station at the municipal airport, five miles south of the city on the same highway.

The transmitting station is a typical Airways installation comprising two 250 watt high frequency transmitters and one 2KW combined range and broadcast transmitter, similar to the old "Navy TU" transmitters except for the class B modulator unit. The high frequency transmitting antenna are of the single wire feeder Hertz. The range uses the crossed loops for its directional transmission of course signals, and the broadcast antenna is of the inverted L Marconi.

All transmitters are controlled by automatic switches from the airport control station, a single pair of wires being used for speech, switching and keying of all transmitters.

An arrangement of particular interest is the keying system used at this station. It is one of several types being tried out experimentally in the service. The system utilizes a local audio oscillator whose output is keyed and switched to the control line through the local speech amplifier at the control station. It is then switched through an additional amplifier at the transmitting station which has a revamped telegraph relay for its output coupling device. This relay in turn operates the regular keying relay of the transmitter selected. Both high frequency transmitters may be keyed simultaneously or individually.

A peculiar condition developed when

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WPVG BOSTON POLICE RADIO STATION

By HARRY R. CHETHAM, Chief Operator, Somerville Police

WPVG Boston Police Radio operates on a frequency of 1712 kilocycles and an output power of 500 watts. The transmitter was loaned by the General Electric Company to be used until the "Two Way" system has been developed. This transmitter consists of three units, rectifier, modulator, and RF, and is of course crystal controlled. The 3000 volt plate supply is rectified by three UV 872s and the final stage of the modulator consists of three 851s in parallel and the RF output one 851 tube. Heising system of modulation is used. A fine well modulated signal is radiated. The last frequency check showed only 19 cycles high.

A special telephone line is used. Any one wanting police assistance calls Devonshire 1212. Automatic switching precludes any possibility of a busy line. The call goes to the "dispatcher" who with assistants are located in a sound proof room. The mike is also in this room. There are 62 heavily armored cruisers. In the first hour of operation three burglars were captured.

The cars are equipped with slightly modified GE C41 receivers. The cruisers are Plymouth Sedans. On twenty-four hour duty very little trouble is found. Lieut. Thomas F. Conley is in charge of the Bureau of Operations. The Chief Operator, Arthur H. Vickerson, is in charge of the transmitter and has had many years of experience. The staff consists of three regular control operators, three regular repairmen. They stand a regular eight hour watch and are relieved by a patrolman who alternates between the transmitter and repair department. The transmitter is located on the seventh floor of Police Headquarters on Berkeley Street. It was installed by the General Electric Company. Engineers Smith, Goodhue, Tyler and Ketchie.

Both Police Commissioner Eugene C. Hultman and Commissioner of Signal Apparatus Mr. Timothy A. J. Hayes of the Boston Police Department deserve great credit for their work in having Boston equipped with a "two-way" system. In about nine months more this system will be developed and installed. No dead spots have been found in the city.

WHAT ARE RADIO BEACONS?

IF visibility were so poor that we could not depend upon the lights, we would not have cause for anxiety about losing our way, because the airplane is radio-equipped. The pilot is tuning in now on the radio range beacon, and we will put on earphones so that we can hear it.

The range signal is coming in very clearly—a long drawn out hum. Suddenly it breaks off and we hear a code signal, given twice in rapid succession. Then the steady hum is resumed, to be interrupted presently by a repetition of the code signal, and this goes on as long as we keep our receiver tuned in, or unless it is interrupted for voice communication. The hum is the on-course signal; the code tells us that we are listening to the range beacon near the airport from which we have just departed.

The pilot is steering away from the airway now to show us what happens when an airplane strays from its true course. The steady hum is breaking up, and we hear dot dash, dot dash, dot dash. Had we moved to the other side of the course, the signal would have been dash dot, dash dot, dash dot.

We head back to the true course. Presently, the range signals stop, and we hear a voice giving the call letters and city of the radio communication station. The announcer continues with weather reports for points along the airway, giving ceiling height, visibility, wind direction and velocity, temperature and barometric pressure for each one. At the end of the broadcast, which requires only a minute or two, the range signals are resumed.

Intermediate Landing Fields

Continuing on our way until we have proceeded about 50 miles along the route, we come to a beacon with green course lights. Near it we see a large oblong area marked out by clear white lights on the ground, and with green lights at each end. It is a Department of Commerce intermediate landing field, and the green lights are located at the end of the runways. We could descend at the field if there were any necessity for it. There is not, but we do talk to the airways keeper by radio. This is an important field, equipped with a radio marker beacon. This low-powered transmitter can broadcast radio range signals for about 25 miles (the big radio range is dependable up to 100 miles) and is also used for 2-way communication with airplanes. Another type of marker beacon emits a simple signal, received not more than 5 miles away, which gives the pilot a check on his position, and also engages in 2-way radio communication.

The airways keeper gets teletypewriter reports on weather, so is able to assure us that conditions still are favorable. We proceed on our course, watching the beacons and listening to the radio, occasionally passing a cluster of lights that represents a town.

At length a pronounced glow appears over a wide section of the horizon, which quickly resolves itself into the twinkling lights of a great city. It is our destination. We go on to the airport and land, and once more look for the Department of Commerce communication station where we shall learn of something else that is concerned with our trip.

The operator runs through the sheets of communications that he has taken from his teletypewriter during the past 2 or 3 hours, and checks off several for us to read. Each one begins with PX, and consists of a few abbreviated words and figures. Our pilot understands these cryptic messages readily enough. Each one is a report of our progress along the airway. Before leaving, the pilot informed the Department of Commerce operator of our plans. As soon as we had taken off, a message to that effect went out on the teletypewriter circuit, and each time we passed over a station along the way, the operator there reported it, so that our whereabouts was known to those on the ground during our entire journey.

Future Possibilities

Should we repeat this flight four or five years hence, many of the aids to air navigation would be different in their methods of operation. The radio range beacon, for example, might give directions by means of a dial and pointer on the instrument board instead of in our radio earphones. If necessary, we might land blind, that is, come down through fog without ever seeing the ground until the airplane's wheel touched the surface of the airport, guided by radio or other signals. These and other possible future developments are being studied by the Aeronautics Branch to the end that the aids to air navigation on the Federal airways system will be the most dependable guides that it is practicable to supply.

The Air Navigation Division on January 1, 1933, was operating 18,655 miles of lighted airways and 1,337 miles of routes equipped for day operations. Beacon lights marking the routes numbered 1,510 of the rotaing type and 286 flashing beacons. There were 68 radio communication stations and 94 radio-range beacons, and supplementary radio service, both communication and directional, over short distances, was given by 77 radio-marker beacons. There were 242 lighted intermediate landing fields and 19 unlighted fields on day airways. Weather data, maps, and other information were transmitted over 13,000 miles of teletypewriter circuits. Routes under construction totaled 2,368, this new construction having been made possible by allotments of Public Works Administration funds.

MASSACHUSETTS STATE POLICE RADIO

(Continued from Page 12)

much as 75 to 90 miles away from the transmitter at times and if the sets are the slightest bit out of tune the signal is not heard. On the other hand the transmitter must be set up to lay a heavy ground wave and still cover these large areas. The town and city cars do not have this to contend with, as their sets can be well off their frequency (receiver) and still get their calls. However, the staff keeps after its cars and as a result about one in fifty cars is missed the first time unless the set has blown a fuse or is dead from some other canse. Good spare sets are always on hand and the design is such that the four units of which the installation consists can be changed in less than five minutes, resulting in constant operation about 95 per cent of the time. The big headache experienced in this type of work is common to any service where car sets are in use. That is ignition noise. Most of the problems so far have been licked but every so often the ghost returns to haunt the staff. Cars in use in this department are Fords, Plymouths, Chryslers, Studebakers and Oldsmobiles, and are equipped with Bosch and Philco car sets.

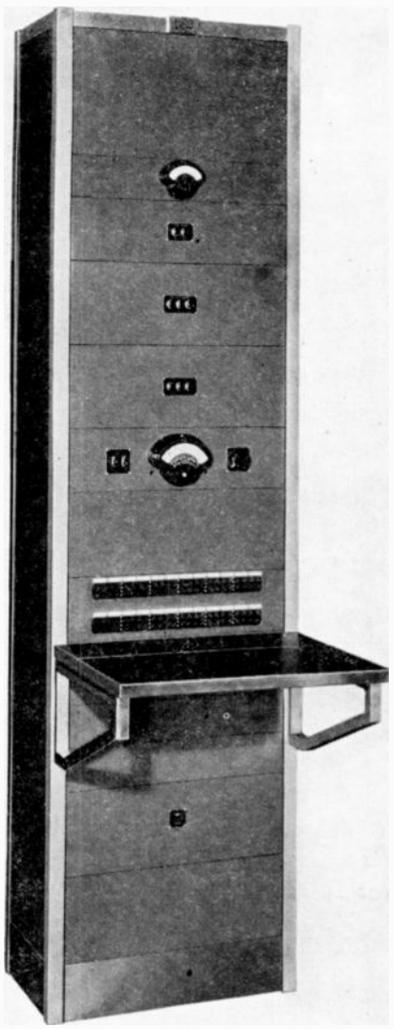

Fig. 7—The Western Electric 701A Speech Input Bay is installed in the studio control room

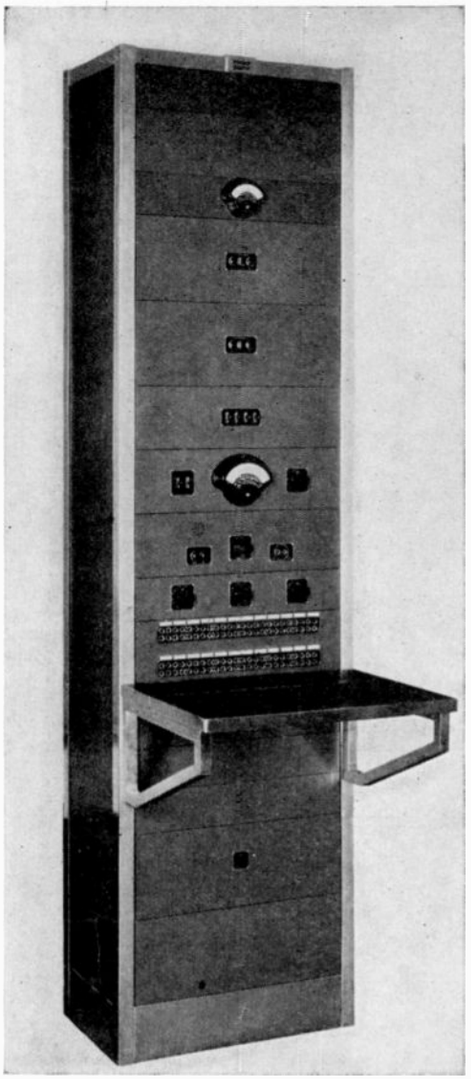

Fig 8—A program enters this radio-transmitting station through this Western Electric 700A Bay

Speech Input Equipment for Radio Broadcasting

(Continued from Page 6)

hearsal time may be from six to ten times as great as the time required for final presentation to the radio audience. In addition, most stations depend upon commercial advertising for their continued existence. This necessitates auditions of typical programs for prospective advertising clients. Such auditions are most effective when presented in a studio and observed by means of a loud speaker, and so are auditions for selecting new broadcasting talent. Consequently it is not uncommon in the larger stations for as many as fifteen or twenty studios to be available and for all to be in practically constant use.

When a number of studios are employed, it is of course difficult, if not impossible, to observe the several different programs originating simultaneously in them by means of loud speakers unless the speakers are located in separate rooms. Further, the satisfactory control of the program by the operator practically necessitates his location away from extraneous distractions. These requirements, together with the fact that the more comprehensive programs such as dramatizations, especially those with musical background, can be controlled better when the operator can observe what is occurring in the studio, has led to the use of individual control rooms adjacent to each of the several studios. The operator in one of these rooms has a full view of the associated studio through a large plate glass window and is ordinarily responsible only for the program originating in that studio.

Directly in front of him is a control cabinet which houses keys for switching programs, mixing potentiometers, controls for the main and monitoring amplifier, and indicating lamps. In the back of the room is a speech input bay in which are the amplifiers, a volume indicator, and jacks for testing. Space is also available to mount the panel of the control cabinet if desired.

During rehearsals the control operator can talk to those in the studio by throwing a key which connects his microphone to the amplifier in place of the studio microphones and connects a loud-speaker in the studio in place of the monitoring loud-speaker in the control room.

The use of more than one studio further complicates the technical problem as it is necessary for each studio to be entirely independent of all others both acoustically and electrically so that a program originating in one studio will not be superimposed on another. At the same time it is essential that the outputs of all the individual amplifier systems be brought together at some point for supervision and switching. This supervisory activity, together with testing, distribution and observation of program circuits extending outside of the studio is ordinarily exercised in a central control room. Here are also ordinarily located amplifiers for each of several outgoing lines when it is necessary to send the same program to several destinations simultaneously. These amplifiers isolate each line from the others and also make possible the use of varying amounts of amplification for each outgoing circuit as desired.

When it is considered that during one broadcasting period a large station may, for example, be supplying a program to its own transmitter and to separate branches of the network and during the next broadcasting period may be required to supply one program to its own station and two entirely different programs to each of the two branches of the network simultaneously, it is appreciated that the precise changeover from one condition to the other imposes severe operating requirements on both the equipment and operating personnel.

In the interest of speed, accuracy and quietness, these circuit changes are made by keys rather than by cords and plugs. When the cue is given for the switch, only one key need be thrown to put in effect a circuit combination previously set up by other keys. Provision must also be made for the optional selection of one or more of a number of incoming telephone lines, for the selection of the various spare microphone outlets in the studios, for the interchange of the various amplifier circuits for testing and other purposes, and for the setting up of special circuit arrangements for auditions and rehearsals. This type of switching, which does not impose as severe time limitations, is ordinarily accomplished by the use of jacks and patching cords similar to those used in toll test boards.

So far, it has been assumed that the radio transmitter is immediately adjacent to the studio location with which it is associated. However, the use of higher power has necessitated the location of the transmitter in a sparsely populated section while the studio remains in the city where it is readily accessible to artists and advertising clients. Under these conditions, the program is transmitted

(Continued ou Page 20)

The Lansing, WPDL, Police Radio

By A. H. BENNETT
Chief Operator

THE transmitter at our station in Lansing, Mich., was built by DeForest in 1930 and installed in December of that year. It is of 50 watts power, built in a frame 30 inches by 30 inches, 70 inches high, using a 510 crystal stage with dual crystals in a G. R. oven, an 865 buffer and a 511 output class C amplifier, high level modulated by two 545 tubes in parallel. Power is furnished from 220 AC using two 66' for bias, two for oscillator and two for buffer amp and modulators. The speech equipment is mounted on a relay rack and has a three stage impedance coupled amplifier having input from a 500 ohm line, two carbon microphones, one condenser, a modulated tone and a pickup, all being controlled by relays, operated from a control panel at the operating desk. Inasmuch as the transmitter proper is at the operator's back, a repeater circuit coupled to an RF meter on the control panel indicates that the transmitter is operating properly.

There is a microphone at the dispatcher's desk at police headquarters, and a condenser at the operator's desk. The procedure for sending a call is as follows: When a call is to be broadcast the dispatcher throws a regular toggle switch which turns on the power, his microphone and a monitoring speaker in the radio room. It also operates the relays that open the voice coils in all the receivers in the radio room. The call is heard in the radio room through the monitor, the operator throws his switch and the microphone in the radio room is ready for operation as soon as the remote (dispatchers) switch is opened, these operations are indicated at both ends by means of signal lights. If the transmitter is being operated from the radio room and the dispatcher wants to put out a call, his switch will "take it away" from the operator.

Contrary to the general practice of most police radio stations we do not give a test announcement each 15 minutes, but use a modulated tone operated automatically by a telechron clock motor, which turns on the power, gives the signal, and shuts it off, the entire cycle being less than 7 seconds.

In the radio room with the transmitting equipment is our regular police telegraph and telephone system, where all men on the beat make their regular reports. This enables the operators to be in touch with the men on the beat as well as in the cars. There is also a fire alarm ticker and burglar alarms, so in all the entire signal and communication of the department is centrally located.

We have seven cars, two motorcycles, and two fire department cars radio equipped, using the Bosch police radios, with Jannette "B" power units.

The antenna used for transmission is a special design to meet the difficulties encountered by having a local broadcast station with a 171 foot vertical radiator within half a block. It consists of an inverted L, the vertical portion being about 100 feet, the flat portion 160 feet long, between 18 inch isolantite insulators. At the base is a tuning unit consisting of an inductance 3½ in. diam.

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Highest Government Air Service Station

By H. F. ZIMMER

Radio Operator in Charge

THIS intermediate field is the highest and one of the most important in the ole U. S., being on the Salt Lake-Omaha mail run. It is approximately one half mile wide and one mile long and sits up in the ozone 7,615 feet above sea level.

We have two teletype machines here, one regularly used and one for a spare. We also have a radiotelephone set, one 150 watts output, one speech amplifier, one mike, two high frequency receivers and one intermediate receiver. The set is used for a marker beacon twenty-four hours per day and is remotely controlled from the operating room. There are three garages here, one radio range building, radio room, and three houses for the operators.

We take hourly weather observations here and transmit them to various points via teletype. This station is so isolated from the rest of the world that it is self maintaining; that is, the personnel here has to repair teletype and radio facilities as well as all other equipment incidental to this station. I was sent to a government Teletype School in Salt Lake City for three weeks so as to be able to repair the machines.

As to experience, the other fellow here is not a real radio man. As for myself, I have been in the game one way or the other since 1919. That includes building sets commercially, ship board operator for a number of years, and broadcast technician and announcer. I have been in this outfit four years. I am to be transferred to Strevell, Idaho, as radio operator in charge in the near future and will be glad to give you all the dope as to the lay out there as soon as I get established there. Incidentally, we do not work code here but will there.

We are 14 miles from town here and we get real Arctic weather, 40 to 57 below zero, and get snowed in completely six months at a stretch. We have servicing facilities here for aircraft such as rope stakes to tie them down and 1,000 gallons each of aviation and commercial automobile gas; oil for planes also.

The only technical dope we get is from a bulletin called Air Commerce Bulletin, which I am sure is sold for five cents per copy to those interested in our phase of work. Issued by U.S. Department of Air Commerce, Washington, D. C.

KGZP—Coffeyville, Kan., Police Radio

By JOHN A. LINDQUIST, Chief Engineer

THE transmitter is crystal controlled and is a fifty watt job using Class B modulation and the antenna system employed is a Marconi quarter wave. Our chief operator holds a radio telephone first class license. He is a graduate of the First National Radio Schools in Kansas City, Mo., and has served relief duty at police radio KGZF in Chanute, Kansas, and some of the broadcasting stations in Kansas City. The other five operators are third class men who have been trained by the chief operator and were policemen who were regularly employed on the department before the police radio was installed. The operators here work on eight hour shift which leaves three third class men for relief duty at the station in case one of the regular operators wants off.

Officers Say KGZP's Time Is Coming

Police radio station KGZP still is awaiting its big chance.

Each night and day for the past few months officers have patrolled the streets in radio equipped cars and have heard the voice of their brother officers at the microphone.

Some day, they all declare, the big moment is coming, when the police radio will really make the headlines of the local newspapers,—that moment when a big bold bank robber, or perhaps a murderer, is caught at the scene of his crime.

Meanwhile, improvements are being made, logs of activities are being kept, training in getting to the scene is being made useful and averages so far indicate police will be right there when the big moment comes.

As chief engineer and one of the three announcers on duty, I know that the police have maintained an average of one minute on all calls made. He says, in other words, that on an average, police were on the scene of activity within one minute after the call went out.

The station has been heard very distinctly in police cars fifty miles away, a factor which will be of assistance in bandit hunts. Reception has been good in the radio cars all over the city with no "dead spots" showing up so far.

The cars are now equipped with selective sets, which are powerful enough to pick up other police calls on the same wave length, 2450 kilocycles. However, whenever the local station is on, all others fade out.

Which recalls to one officer's mind a recent incident, which caused considerable laughter among his fellow officers and considerable embarrassment to himself because of his error in having his car radio tuned on 2422 kilocycles. It seems officers were riding around on a rather quiet evening when suddenly from the loud speaker came the words: "Go to the corner of 12th and Walnut Streets, a fight in progress."

The patrol car swung into action and hastened to the scene, which was found as peaceful as a village church yard. Then they realized that they had heard, not their own station, but one in Kansas City, directing officers there to "Twelfth and Walnut streets."

WPEM, Woonsocket, Police Radio

(Continued from Page 11)

stack and the transmission lines coupled fifteen feet apart to one of the lightning rods. This makes a highly efficient vertical antenna which feeds two receivers beautifully.

The transmitter has given very good service, having been off the air only four times in three years and those times from periods of fifteen minutes to three quarters of an hour. In view of the fact that the station is not on continually but goes on for a period of a few seconds between fifty-five and seventy-five times a day, we believe that this record is good.

This station forms a unit in the Police Communications Network organized and maintained by WRDS, East Lansing, Michigan, through which police information and allied traffic can be handled over an area including: Alabama, Connecticut, Indiana, Kentucky, Maryland, Massachusetts, Michigan, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, Tennessee, and West Virginia. WPEM acts as key station for the state of Rhode Island. Traffic for other states being relayed from all Rhode Island stations to WMP and incoming traffic being relayed from WMP through WPEM to the various police stations in Rhode Island including the State Police who, while they have no station, have a receiver in Headquarters for the purpose of picking up broadcasts from WPEM.

Of operators there are four; two regular assistance operators, Stanley Horbarenko (W1EHW) and Roland H. Bourre of which we can give no history as they were newly graduated from the Rhode Island Radio School when they came on the job. A fill-in operator, Peter Mostecki, also a recent graduate of the same school and lastly, chief, yours truly, graduate of the Air Corps Technical School at Chanute Field, Illinois, ex-chief of KFUL, Galveston, Texas; WPAW, Pawtucket, Rhode Island, and WUY, Post Radio Station, Third Attack Group, Air Corps, Fort Crockett, Galveston, Texas. I am now studying Radio Engineering through the Capital Radio Engineering Institute correspondence course.

Due to the fact that we have had some difficulty in hooking WMP at times, we have recently written to the field office of the Federal Communications Commission requesting permission to use tone-telegraph in our point-to-point work. During an emergency, I have used the switch on the edge of the table in Figure 1 to key the warning signal for the purpose of calling WMP, and Chief Operator Mullen at that station tells me that it cuts through their very heavy local QRM, remarkably well. Perhaps the permission to use this type of transmission would be more easily obtained if other Police Radio Stations doing point-to-point work would request it as well.

Airways Radio Station KCAC

(Continued from Page 14)

this keying system was first placed in service and remote control work attempted. Operation of the automatic switches and keying was completely nil for considerable periods until it was found that a considerable voltage and current was being induced to the control line from the electrified "Milwaukee Railroad" which parallels our control line for about two miles. This fault could be avoided in either of two ways; to construct an additional metallic circuit and thus avoid working the switches to ground; or apply an equalizing or bucking voltage to offset the effects of the induced current. Neither of these methods was used unfortunately but a compromise was obtained by the reduced adjustment of the switches so that they required a greater current to operate them and thus partially neutralizing the effects of the induced current. The compromise arrangement is not a complete success, but interruptions from the induced current has been reduced to a couple of minutes duration while the trains are passing the two mile stretch. Now only trains bound upgrade over the divide interfere, while trains coming down grade have no effect.

The control and receiving station is situated in a room on top of the National Parks hangar at the airport. The equipment consists of two National AGS high frequency receivers and one National AGU intermediate frequency receiver and of course the necessary remote control automatic switches; a duplicate of the equipment at the transmitting station. No teletype is maintained at this station, all traffic and weather data being handled by high frequency telegraph.

The KCAC gang will be glad to hear from any of their old shipmates or buddies.

The Lansing, WPDL, Police Radio

(Continued from Page 17)

and wound with 30 turns of no. 10, with a 350 mmf Cardwell condenser on each end to ground, the feeder to this unit being capacity coupled to the plate tank of the transmitter through a .002 fixed condenser.

This radio station was the first one to be installed by a city of less than 100,000 population and one of the first 28 police radio systems in the U. S. An average of 35,000 messages are broadcast each year. Included are about 1500 fires, 2500 accidents, 5500 calls of the general run, average time on runs is 1.9 minutes.

The personnel of the station are A. H. Bennett, first operator; Chas. Wolfe, second; Carter McCormick, third, and Orlo Mead, relief, all of whom have been here since the opening of the service.

WLW Solves Lightning Problem

Cincinnati—At the base of the 831-foot vertical radiator steel antenna tower of 500,000-watt WLW, a tiny "electric eye" stands guard against interruption in their program.

This unique device developed by WLW engineers protects valuable equipment against lightning and prevents loss of broadcasting power through follow-up arcs across the safety gap that carries lightning discharges from the tower into the earth.

It was soon discovered the huge 450-ton steel tower also served as a giant lightning rod. It became the problem to ground the electrical energy thus collected from the atmosphere while at the same time preventing the grounding of the power generated by the transmitter.

The use of the photo-electric cell was resorted to after the method of providing a direct lightning path to the ground by means of a safety gap across the base of the tower was found to be unsuccessful. In adjusting the gap it was discovered that one wider than two inches failed to provide complete protection while with one less than two inches the normal peak voltages due to modulation on the 500,000-watt carrier would, on occasion, cause discharge across the gap.

It was found that once the arc was started across this gap, either by lightning discharge or by an abnormally high voltage, the arc could not be extinguished as power from the 500,000-watt transmitter kept it "alive" draining practically all of the station's power from the antenna into the ground.

After various types of gaps, current transformers and rectifiers were tried unsuccessfully, a Weston photronic cell, with its associated relays, was installed in a double shielded box on the brick wall surrounding the antenna base insulator. A long tube containing light baffles was installed so that only light from a point directly in the safety gap could strike the photo-electric cell. The relay operated by the "electric eye" was connected in such a manner as to remove the station's plate voltage to the final amplifier whenever the photo-electric cell was excited and to reapply it the instant the arc was extinguished. Due to the high speed of the control circuits, the interruption to service is so slight as to be barely perceptible to the ear.

Tulare, Calif., Police Radio

By J. D. HOSSACK

MANY persons are surprised when they learn that the city of Tulare is equipped with a police radio system. Although it is a small city with a population of slightly over six thousand it lays claim to being the fourth city in the United States to have police radio and the first city west of the Big River to be so equipped.

When I took over the station three years ago we had two cars radio equipped working them with a 150 watt modulated oscillator transmitter. Since that time the station has been rebuilt into a modern designed transmitter with the same power rating. We now have four police and constable cars, one motor-cycle and one state highway patrol car equipped with receivers. A few of the small cities in Tulare county have equipped their departments with receivers and receive the broadcasts from our station. We also work two-way with KGZA in Fresno to receive emergency bulletins as this county has not as yet installed a police teletype. As Tulare is on the intersection of the main state and county highways we are in a strategic position to stop cars coming from any direction.

Two months ago, Mr. George Maxey, police clerk, obtained an operator's license and we now have the station on the air twenty hours per day and are so equipped that we can operate the full twenty four hours in cases of emergency. In the near future it is hoped that the sheriff's office will equip their cars as we are prepared to extend our service to that department.

Both ops here are dyed-in-the-wool hams and while off duty are usually found pounding on amateur CW. Geo. Maxey followed radio as a hobby for several years and is quite well known in amateur circles. I graduated from the Pacific Radio School in San Francisco in 1931 after getting my 2nd C. commercial ticket and have been working on police radio since and expect to stay with it as it seems to be an up and coming thing. . . . That's all.

MARINE ASSIGNMENTS

NEW YORK RADIOMARINE

Vessel	Radio Officer
Steel Exporter	Hultquist, J. A.
Oriente	Winterer, A. C.
Siboney	Dzuri, A.
Siboney	Hendleman, A.
Moana	Cuthbert, R.
Santa Paula	Goodwin, C. E.
Santa Paula	Velsor, J. E.
Santa Paula	Haack, F.
Swiftlight	Thompson, E.
Andrea F. Luckenbach	Roberts, R. H.
Gulfhawk	Abrams, H.
Standard	Evans, Omar
Nourmahal	Hallen, Edw.
Santa Barbara	Penner, R. A.
American Shipper	Swallow, J. H.
Southern Cross	Ellis, V. C.
Santa Barbara	Cook, L. L.
A. C. Bedford	Hirsch, F.
Dungannon	Hofman, W.
George Washington	Porter, Chas.
Chas. L. O'Connor	Knox, G. F.
Robert E. Lee	Bland, G.
Granada	Winocour, M.
Imlay	Moir, D.
Harold Walker	Cornman, F.
American Oriole	Brown, L.
George G. Henry	Kleinklaus, L. J.
Chilcop	Petit, E. L.
Charles H. Cramp	Horton, J. R.
California	Nugent, T.
Christy Payne	Reilly, M. J.
American Banker	Melville, C. J.
American Banker	Siglin, T. L.
Excelsior	Grosser, F. D.
Excelsior	Lerner, M.
Amapala	Drenchko, J. D.
Amapala	Vernocke, R.
Dixie Arrow	Golden, S.
Santa Rita	Foster, R.
Princeton	Evans, O. D.
Scanstates	Mathison, R. P.
Bessemer City	Uhl, H. W.
Watertown	McGaffin, D. K.
Pipestone County	Quinlan, J. A.
Gatun	Hamel, Edw.
Santa Clara	Byrne, J. A.
Paul H. Harwood	Wolfskiel, W. H.
Steel Traveler	Schroth, W. E.
Knoxville City	Hancock, R. E.
Tachira	Bailey, C. F.
Altair	Warner, C. H.
E. J. Sadler	Currie, D.
John D. Archbold	Hazan, S.
American Legion	Beck, N. J.
Argosy	Cabasin, C. A.
American Legion	Egan, W. S.
M. F. Elliott	Westervelt, C. J.
American Legion	Perry, E.
San Juan	Darlington, A.
San Juan	Sutner, G. R.
Atlantida	Spence, J. E.
Santa Clara	Benfer, H. L.
Oriente	Annis, C. P.
Hadnot	Basen, C. J.
Willet	Zafft, A.
H. M. Flagler	Ellis, G. H.
Beaconhill	McKinley, W. L.
Robert E. Lee	Haack, F. C.
Seanmail	Wolff, S.
George Washington	Cohen, A.
Buenaventura	Develez, M.
Samuel L. Fuller	Woodmansee
Florence Luckenbach	Meister, G.
Mobile City	Foster, Edgar P.
Potter	Howe, F.
Cristobal	Ehrensperger, C. O.
Santa Elisa	Jensen, A. J.
Orient	Loya
Cerro Ebano	Stengard, J.
Santa Maria	Ault, T. C.
Western World	Stewart, C.
Western World	Cooke, R. H.
Paul H. Harwood	Hakam, S.
Pennsylvania	Dove, B.
Watertown	Sonyk, J.
Steel Mariner	Delaney, J. J.
Benj. Brewster	Musgrave, H. A.
Siboney	Smith, W. A.
Santa Cecelia	Potts, J.
George Washington	Dzuri, A.

Paulsboro—Berger, C. C.
R. G. Stewart—Reynolds, T. F.
City of New York—McGaffin, D. K.
Pan Boliver—Witowski, Edw.
Pan Boliver—Baxter, H.
Gulfwax—Gordon, W.
George Washington—Fitzimmons, G. E.

WEST COAST

H. F. Alexander—Wheeler, H.
Lurline—Carthy, Wm.
Los Mar—Cyle, N. R.
K T K—Spiegel, Louis

Stateline

Gen. Pershing—Welbon, Roy
Gen. Pershing—McMahon, John
Gen. Sherman—Henry, E. G.
Gen. Sherman—Steiner, Karl
Gen. Lee—Myrick, R. E.
Gen. Lee—Harvey, Wm.
Wisconsin—Mee, W. F.
Michigan, Toppi, T. A.
Illinois—Crouse, J. W.
Washington—Whittington, R. J.
Pennsylvania—Bradley, L. K.
Oregon—McMahon, H. E.
California—Cohen, Ben
Texas—Walker, J. G.
Iowa—Bean, R. S.
New York—Anderson, C. E.

Quaker Line

San Angelo—Caldwell, F.
San Simeon—Oliver, H.
San Bernardino—Hughes, D. L.
San Lucas—Norgard, R. L.
San Rafael—Burt, C. P.
Peter Kerr—Peck, G.
San Pedro—Ferguson, S.
San Julian—Betts, E.
Jeff. Myers—Dernbach, R.
San Clemente—Youngberg, D.
San Diego—Wareham, C.
San Domingo—Peterson, F. G.
San Marcos—Risley, J.
San Anselmo—Garrick, E.
San Felipe—Darby, M. R.
San Gabriel—Dinsdale, J.
San Vincente—Shultrich, T.

NEW ORLEANS RADIOMARINE CORP.

Katrine Luckenbach—Simmon, J. H.
Tegucigalpa—Dusenbery, C.
Polarine—Fisher, T. R.
James Dougherty—Trouby, L. E.
Commercial Guide—Stolf, J.
Munplace—Tomaskovic, J. S.
Dannedike—Neel, W. J.
West Ekonk—Beaver, E. A.
Nosa King—Blunt, G. S.
H. C. Cadmus—Rabalais, L. E.
Dryden—Fleming, C. G.
Meanticut—Pawkett, L. E.
Cody—Chase, Harry
Delsud—Owen, I. G.

NEW ORLEANS MACKAY RADIO

Cardinal—Calhoun, E. D.
Afel—Rose, C. E.
City of Fairbury—Gillian, James R.

NEW ORLEANS STANDARD FRUIT

Contessa—Smith, Willard G. (Chf)
Contessa—Coldwell, James (2nd)
Contessa—Lentini, Claude J. (3d)
Morazan—Gross, Joseph E. (2nd)
Morazan—Dobbs, N. R. (3rd

NEW ORLEANS UNITED FRUIT CO.

Zacapa—Borland, James (Chf)
Zacapa—Dobbs, Merrill G. (2nd)
Zacapa—Freret, L. D. (3rd)
Macab:—Maxwell, L. O.
Metapan—Guilot, A. J. (Chf)
Olancho—Dobyns, T. A. (Chf)

NEW ORLEANS TROPICAL RADIO TEL. CO.

Panama City (RXC) Luscomb, C.
Panama City (RXC)—Dittmore, W. B.
Panama City (RXC)—Buras, Norman

GALVESTON RADIOMARINE CORP.

Whippel—Furrh, R. C.
Joseph M. Cudahy—Crowder, S.
Glenpool—Richardson, R.
Oakwood—Couch, R. A.
Miraflores—Van Eeken, G.

BALTIMORE RADIOMARINE CORP.

E. J. Nicklos—Kares, J. J.
Malay—Simon, O. P.
Beaconlight—Carroll, F.
Oakmar—Holland, J. B.
Dorchester—Gladgelter, S. L.
Bethore—Craig, J. B.
Capulin—Shaw, J. C.
Meton—Huestis, P.
Vermar—Purvis, W. W.
Juniata—Miller, R. H.
Chatham—Blum, M. H.
Somerset—Bell, H.
Algonquin—McIlvain, R.
Willmoto—Readey, W. J.
Somerset—Goldbach, A. C.
Alleghany—Argabright, M.
Gargoyle—Hess, C. H.
Quantico—Nusbaum, F.

Speech Input Equipment for Radio Broadcasting

(Continued from Page 16)

from the studio to the transmitter over a telephone line. This ordinarily necessitates an amplifier which is in effect a telephone repeater at the transmitter. It is also necessary to provide both a volume indicator and a monitoring loud speaker at the radio transmitter so that the attending operators may observe the quality, volume level and continuity of the program. Furthermore, a microphone is ordinarily provided at the transmitter location so that in the event that emergency announcements are necessary they may be made with a minimum of delay.

These facilities are available in the new Western Electric No. 15A speech input equipment. Except for a three-cell battery in the operator's telephone circuit, power is supplied entirely from the commercial alternating current service. The receiving end of the telephone line is bridged by an equalizing network designed to make the frequency characteristic of the circuit suitable for program transmission, and an attenuation network is provided to bring the level of the incoming program at the broadcast transmitter down to that of the local announcing microphone. Testing jacks give access to the circuit at all important points.

In addition to the basic requirements for speech input equipment, namely, high gain, high quality amplifiers having an extremely high signal-to-noise ratio, it may be seen that the precise and accurate control of programs, both studio and remote, the satisfactory conduct of rehearsals and the impressive presentation of auditions for advertising clients necessitates an elaborate installation of supplementary technical apparatus. Further,

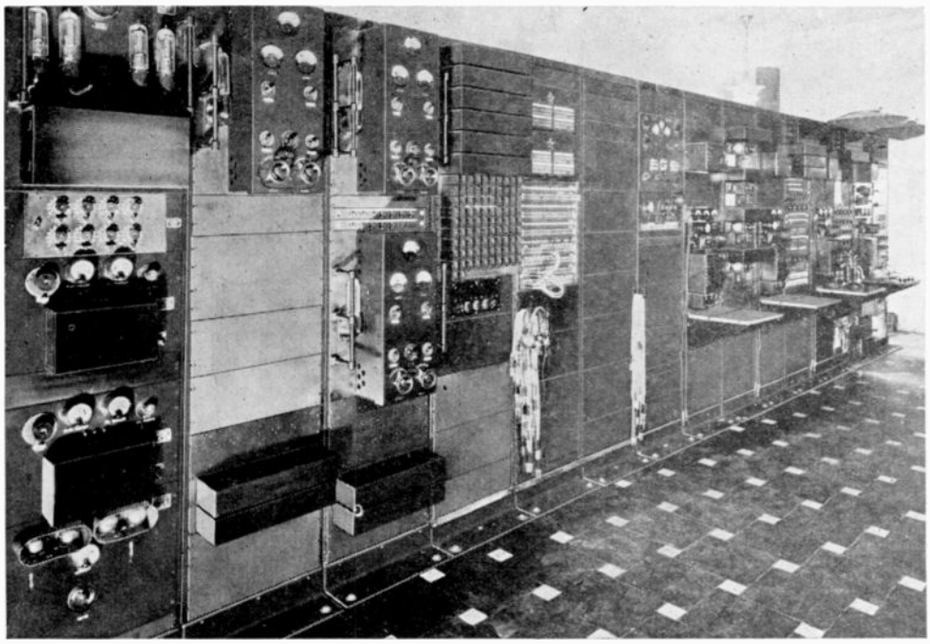


Fig. 9—Supervisory control equipment in the studios of WMAQ, Chicago

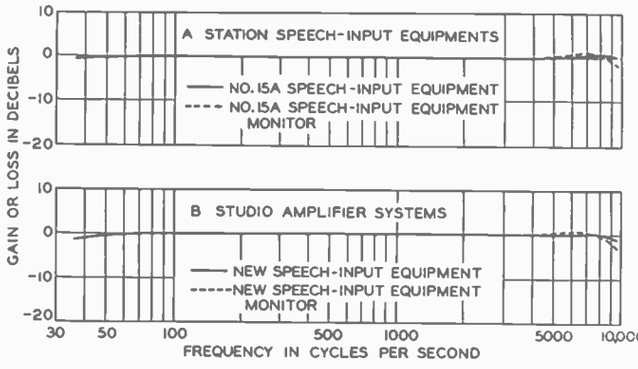


Fig. 10 — Overall characteristics of New Western Electric Speech Input equipments: above, the No. 700A Speech Input Bay for transmitting stations; below, the No. 701A Speech Input Bay for studios

it should be noted that advances in communication, superficially as remote from one another as the development of permalloy on one hand and of the moving coil microphone on the other hand, are all taken into account in the design of a modern speech input equipment, and that such diverse techniques as toll test board operation and the proper use of loud speakers are involved in this highly specialized branch of radio engineering.

Commercial in Radio Business

Mr. G. Voight, a former commercial man is doing a fine radio business under the name of L. I. Marine & Electric Co., at 163-18 Jamaica Ave., Jamaica, N. Y.

He will be glad to hear from other men in the commercial field on their radio material requirements.

One feature of his business is the publication of an interesting pamphlet called "Amateur Transmitter," in which will be found many items of information and interest on transmitting tubes, sets and parts. This is sent free upon request.

It is good to see a commercial man making good in business for himself, and we should all back him up.

Tests Show Microphonism

(Continued from Page 7)

firmly supported at the top than is possible with the shorter tungsten filament. The nickel base wire is also much less elastic at operating temperature than the thoriated tungsten filament. Also, since the apex of the "V" is supported with a hook, proper tension can be secured by the choice of a hook of the proper size. With these changes in structure, tests conducted on the apparatus described show that type 99 can be made quite free from microphonism. Figure 2 shows the microphonic response of an average tube of the thoriated filament structure and the practically negligible response of a type 99 with the oxide-coated nickel ribbon construction. When additional tests are made under average conditions existing in a radio receiver, it is found that the redesigned 99 is entirely unaffected by a tap of the finger on the bulb. On tubes of the thoriated filament constructions, tapping causes a very loud "ping" in the loud speaker, often sustained into the familiar microphonic howl, one of the serious difficulties that impaired the early popularity of type 99.

4-Station Hook-up

Time on a newly formed super-network of radio stations—including WLW, Cincinnati, WGN, Chicago, WXYZ, Detroit, and WOR, Newark — has just been signed to carry Horlick's Malted Milk.

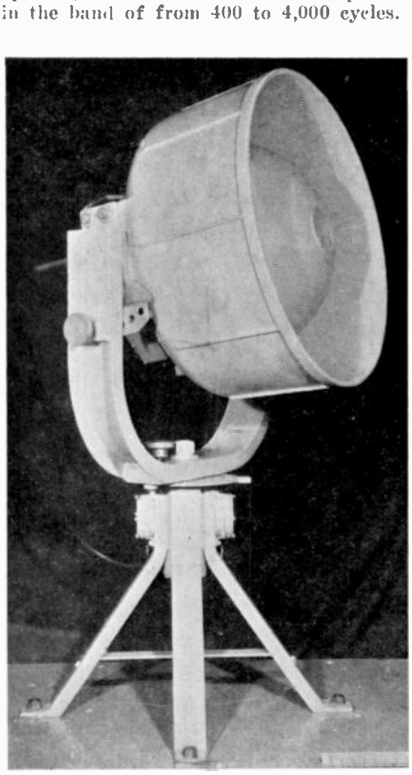
NEW SPEAKER

A NEW loudspeaker has been developed which is so powerful that it can amplify the human voice 1,000,000 times and over flat country in still air be heard at a distance of several miles.

Compared to the results obtained with loudspeakers now in general use, this one is a giant among Pygmies. It is 500 times more powerful than the average and is intended primarily for outdoor use, as such sound power is usually too great for an enclosed space. Through the vibration of the diaphragm, words spoken in a conversational tone are hurled into the air with a total force equal to that of a fifty pound hammer blow.

The speaker has been developed by engineers of Bell Telephone Laboratories for Western Electric Company. It follows the general principles of those used in talking pictures and public address systems. However, in addition it embodies other unique features aimed to increase its penetration and intelligibility in the presence of other sound.

Speech projected over the speaker is sharpened in such a way as to penetrate other noise more easily. It can actually cut through a din, which itself borders on the deafening, and reach the ear intelligibly without adding appreciably to the ear's burden. The speaker accomplishes this by sacrificing naturalness of reproduction and throwing its maximum energy into that part of the voice frequency range which is most essential to intelligibiliy. Speakers designed for fidelity reproduce sound frequencies ranging from 40 to 10,000 cycles. This new speaker, however, concentrates its power in the band of from 400 to 4,000 cycles.



The amplifier and microphone are also designed to emphasize the desired frequencies of sound. The microphone, of the "moving coil" type is virtually a miniature of the loudspeaker operating in reverse. It does not respond efficiently to low frequencies and consequently transmits into the system only those frequencies most vital to intelligible speech.

The purpose of the speaker is both to shout long distances and to out-shout a tumult of noise, thus making it possible to give instructions, warnings, etc., where the spoken word even as amplified by previously existing speakers would be completely drowned out.

Few sounds produced by nature and classically associated with loudness can match the volume of the new speaker. It can make the voice louder than a clap of thunder. Measured at the mouth of its horn, the sound it produces is about 1,000 times louder than the roar at the foot of Niagara Falls.

Large crowds which stretch beyond the range of existing loudspeakers or are in the presence of enough din to drown them out could be handled by means of the new speaker, as could mass movements of people or soldiers. Fire fighters within burning buildings or deafened by the crackle of flames could be directed by the giant voice.

In rescues at sea instructions could be bellowed from the rescuing vessel to the distressed crew or to those in life boats, and if substituted for the usual fog horn the giant voice could give detailed advice rather than a simple warning.

The loud speaking system consists of three parts: an amplifier, a microphone and the loudspeaker itself, which is of the "moving coil" type. A coil of wire attached to the diaphragm is suspended in a powerful, steady magnetic field. Electric current, whose variations duplicate the voice waves, flows through the coil setting up a corresponding magnetic field around it which interacts with the field of the fixed magnet, forcing the diaphragm to move back and forth in syncronism with the variations in the current and therefore reproduces on a gigantic scale the vibrations of the voice. The coil is eight inches in diameter and is made of fine metal ribbon tightly coiled to a height of about an inch and a quarter.

The diaphragm is made of duralumin, .01 of an inch thick. Though driven by great power the diaphragm actually moves no more than about .025 of an inch in either direction. When so moving, it generates a sound pressure of about one pound per square inch. The mechanical force required to set up those pressures is about 50 lbs.

The amplifier of the new system is capable of delivering 1,000 watts of speech current to the loud speaker and the speaker of delivering 500 watts of energy to the air. Thus the efficiency is 50 per cent as compared to 25 per cent in the best commercial devices. When operating at full capacity the diaphragm coil dissipates about the same amount of heat as an electric flat-iron. This is radiated through an air gap to the magnet which in turn passes it off to the outer air.

The speaker and horn combined are 30 inches in diameter by 30 inches deep. The horn is of the folder type, and is made of cast aluminum and weighs about 125 pounds as compared to 375 pounds for the speaker unit itself.

The speaker and horn are mounted on a swivel mast and can be pointed in any direction. The entire system is controlled at the microphone by a single push-button which through a series of relays performs all the various operations necessary to start up or shut off the amplifier.

The system is the outgrowth of a steady evolution in the reinforcement of sound which had one of its first public demonstrations on Victory Way, Park Avenue, New York, during the 1919 Liberty Loan Drive. In the public address system used at the Republican National Convention in Chicago the following year the horns were ten feet long. They were designed with four flat sides enlarging uniformly towards the mouth. Later the "morning glory" type of horn with the flaring mouth was adopted. Subsequently, the folded horn, considerably more compact, was found to be superior.

The first commercial loudspeakers were about one per cent efficient. Their

(Continued on Page 22)

Men Who Are Making Radio Today

(Continued from Page 13)

have sent radio booming ahead as one of the world's greatest industries. Among his many jobs, he directed the installation of experimental television station W2XAB, the first to transmit sight and sound simultaneously.

Ed Cohan claims that once every two years comes an opportunity for him to perpetrate a radio "scoop." The last time such an opportunity presented itself, he was vacationing in Miami, and was on hand during the attempted assassination of President Roosevelt. The disastrous event, during which Mayor Cermak was fatally wounded, occurred about twenty minutes to ten. At ten o'clock Ed Cohan had the Columbia Studios in New York on the wire, and personally delivered to Edwin C. Hill all details. Edwin C. Hill incorporated the report into his program (incidentally the first news of the fatal wounding of Mayor Cermak to reach Chicago) and at ten thirty the wires were reversed, and Ed Cohan put on an eye-witness account from Miami for fifteen minutes less than an hour after the attempted assassination.

The success of the Byrd Expedition broadcasts from Little America, Antarctica, is greatly due to the planning and enthusiasm of Columbia's Technical Director, who spent long hours at his desk at night, personally testing and perfecting the equipment, and talking to Little America to advise improved methods of broadcasting procedure from their base.

Edwin K. Cohan is a Lieutenant in the Naval Reserve, member of the Institute of Radio Engineers, Society of Motion Picture Engineers, American Academy of Air Lore, and National Advisory Council on Radio in Education.

His four-year-old daughter, Jane, thinks that A-B-C means her father's station. Mrs. Cohan knows her little girl's father much better, and is not so easily fooled.

New Broadcast Station License Applications

Philip J. Wiseman, Lewiston, Me., for construction permit for 100 w, 1210 kc station.

Valley Broadcasting Service, Inc., Chattanooga, Tenn., for construction permit for 100 w daytime, 1210 kc station.

Leo J. Blanchard, Fredericksburg, Tex., for construction permit, 250 w, 1120 kc station.

Jackson D. Magenau, Erie, Pa., for construction permit, 100 w, 1370 kc station.

Herbert H. Fette, Meriden, Minn., for construction permit, 100 w, 1310 kc daytime station.

Helena Broadcasting Co., Helena, Mont., for construction permit, 100 w, 1420 kc station.

David H. Cannon, Pasadena, Cal., for construction permit 100 w, 1480 kc daytime station.

James M. Patterson, Jr., Stillwater, Okla., for construction permit, 100 w, 1290 kc daytime station.

E. B. Gish, Abiline, Texas, for construction permit, 100 w, 1420 kc station.

Pacific Acceptance Corp., San Diego, Cal., for construction permit, 100 w, 1420 kc station.

William Schall, Omaha, Nebr., for construction permit, 100 w, 1420 kc station.

Brothers and England, Wellington, Ohio, for construction permit 20 w, 1500 kc station.

Educational Radio, Inc., Spartanburg, S. Car., for construction permit, 100 w, night, 250 w days, 1420 kc station.

The Radio Division of Westinghouse Electric and Manufacturing Co., Chicopee Falls, Mass., has issued several interesting booklets on their Type CQ Police Radio Transmitter which will be sent free to any interested party.

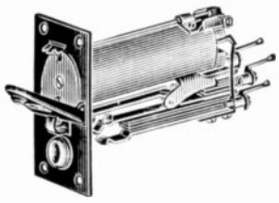
New Speaker

(Continued from Page 21)

diaphragms were made of bakelized linen and were 1¾ inches in diameter.

The system which was used to shout across the Hudson River, a distance of about a mile, from the roof of Bell Telephone Laboratories' building early in 1928 consisted of ten loudspeakers hooked into one horn. The new giant voice with its single speaker is many times more powerful.

Army & Navy Surplus



Relay and Jac's combination, 350 ohms, 6 volt, $1.00
INDUCTION COILS. Battery Telephone Type $1.25

NEW—Edison Storage Battery Type BB-1, 10 volt, 37 amp., contains 7 cells. Complete in steel portable case.....$10.00

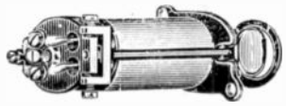
Magnavox anti-noise microphone, good for home broadcasting $1.50
CONDENSERS, Mica, op. volts 12,500 cap. .004
Dubilier, new $9.50
Dubilier, used 6.00
Wireless spec., new 6.00
Wireless spec., used 3.50
Condenser, Dubilier, mica, volts 40,000, cap. .0012-.001-.0008 or .003 .....12.00
Condenser, Dubilier, mica, op. volts 8,500 cap. .004 ..... 7.00
Condensers, Dubilier, mica, op. volts 8,500 capacity .0004 mfd. 7.00
Condensers, Murdock .002 mfd. 5000 volt 1.50

Anti-Capacity Switches W. E. 12 and 14 Terminals, all with Platinum Contacts, value $3.50 each. Our price ..$1.25 each

MOTOR GENERATORS

120 d.c., 110 or 220 a.c., 500 cycle 250 watt $35.00
120 d.c., 110 or 220 ac., 500 cycle 500 watt .....$50.00 to $80.00
120 d.c., 110 or 220 a.c., 500 cycle 1 kw. .....$80.00 to $110.00
120 d. c., 110 or 220 a.c., 500 cycle 2 kw .....$60.00 to $170.00
120 d. c., 110 or 220 a. c., 500 cycle 5 kw. .....$95.00 to $250.00
120 d.c., to 20 d.c., 2 kw. 70.00
120 d.c., to 400 d.c., 2 kw. 55.00
120 d.c., to 600 d.c., 2 kw. 75.00

You Know the High Quality



SPECIAL

Can be used with the new Vacuum Contact when operated on 45 volts. Western Electric Signal "Drops," 1000 ohm, type D-12 ..... $2.00

U.S. Navy Oxidized Brass Running Lights, 15 inches high overall—12 lbs. Either red or green. $7.50 each or $12.00 per pair. Kerosene type, easily converted to electric.

GENERATORS

110 volt a. c. 900 cycle self-excited 500 watts $12.00
165 volt a.c. 600 cycle self-excited 250 watts 17.00
110 volt a.c. 600 cycle, self-excited 250 watts 28.00
1500 volt d.c. 660 mills, 1 kw., Esco 1750 r.p.m. 50.00
240 volt 500 cycle, self-excited 2500 r.p.m. 250 watt, (also hand drive) 28.00
120 volt d.c., 5 kw. 65.00
120 volt d.c., 20 kw. 125.00
600 volt d.c., 2 kw. 50.00
220 volt a.c., 500 cycle 1 kw..... 50.00
220 volt a.c., 500 cycle 2 kw. 70.00
12 volt d.c., 60 amp. 18.00
12 volt d.c., 33 amp. 9.50

Postage and deposit of 20 per cent. required on C. O. D. orders

No orders shipped for less than $1

WE DO NOT ISSUE CATALOGS

JOHN REARDON

SURPLUS SPECIALIST
725 Longacre Bldg.
1457 Broadway
NEW YORK, N. Y.

Baldwin Headphones, Genuine Mica Diaphragm 2000 ohm. Regular $15 val. $3.50

VOLTMETERS, D. C. portable new Weston model 45, 3 scale 0-3-15-150 guaranteed 1-4 of 1 per cent accurate ..$50.00
Ammeters, D.C., portable, new Weston model 45; 3 scale 0-1-5-15-150 with 3 scale external shunt and leads 1-4 of 1 per cent accurate $40.00

EDISON STORAGE BATTERIES

All Types
1.2 Volts per Cell

A-4 Amps. 175 per cell $4.50
A-6 Amps. 225. per cell 5.00
A-8 Amps. 300. per cell 6.00
B-4 Amps. 90. per cell 4.50
M-8 Amps. 11. per cell 2.00
L-40 Amps. 25. per cell 2.50
J-3 Amps. 37. per cell 4.00

Ampere hour meter, Sangamo, battery charge and discharge, type MS 0-500 scale, capacity 15 amp. ...$12.00

NAVY AIRCRAFT DYNAMOTOR, Gen. Elec. new 24-1000 volts, 1 amp. extended shaft with pulley, can be driven by motor or propeller, giving 24 volts output for filament and 1000 volts for plate or driven by its own input of 24 volts. Value $250.00. Our special price. $60.00

DYNAMOTORS

24-750 volt Gen. Electric 200 mills..$30.00
24-1000 Gen. Elec. 1000 mills 60.00
24-1500 Gen. Elec. 2½ kw. output....105.00
12-350 volt 80 mills 20.00
12-750 volt 200 mills 33.00
32-350 volt 80 mills 10.00
32-300 volt 60 mills 8.00
Dynamotor Armatures, General Electric triple commutators, d.c. 24-1500 v.. 14.00

CLASSIFIED ADS

Commercial Radio will accept classified advertising at the special rate of five cents per word.

Remittance in full must accompany copy, closing date for classified advertisements is the 15th of the month preceding publication date.

FOR SALE—Radio Model Vibroplex, heavy contacts, $10.50. Like new. Guaranteed. John Morgan, 54 Harding Drive, Glen Oaks, Rye, N. Y.

WHAT EVERY ELECTRICIAN WANTS TO KNOW!

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