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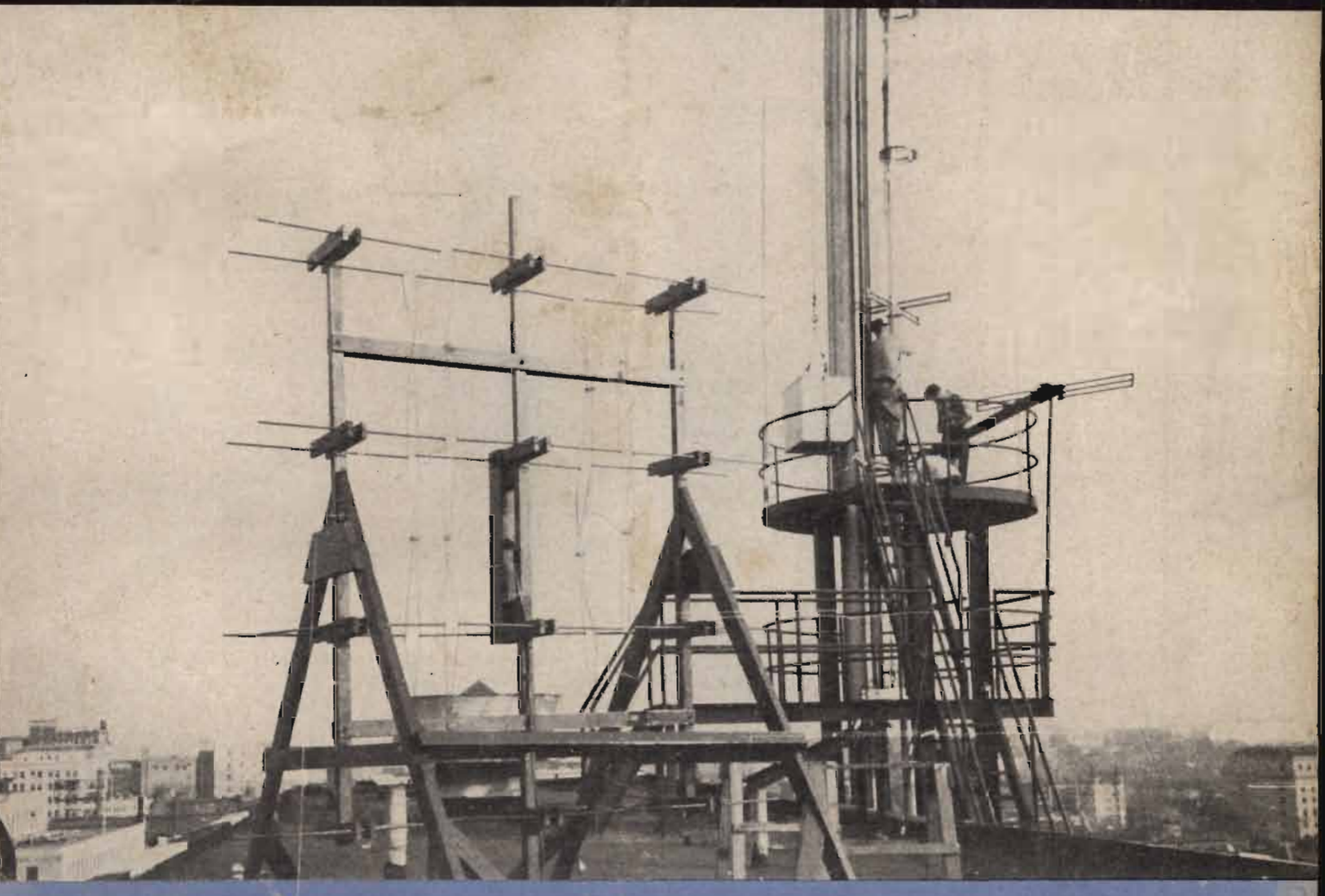

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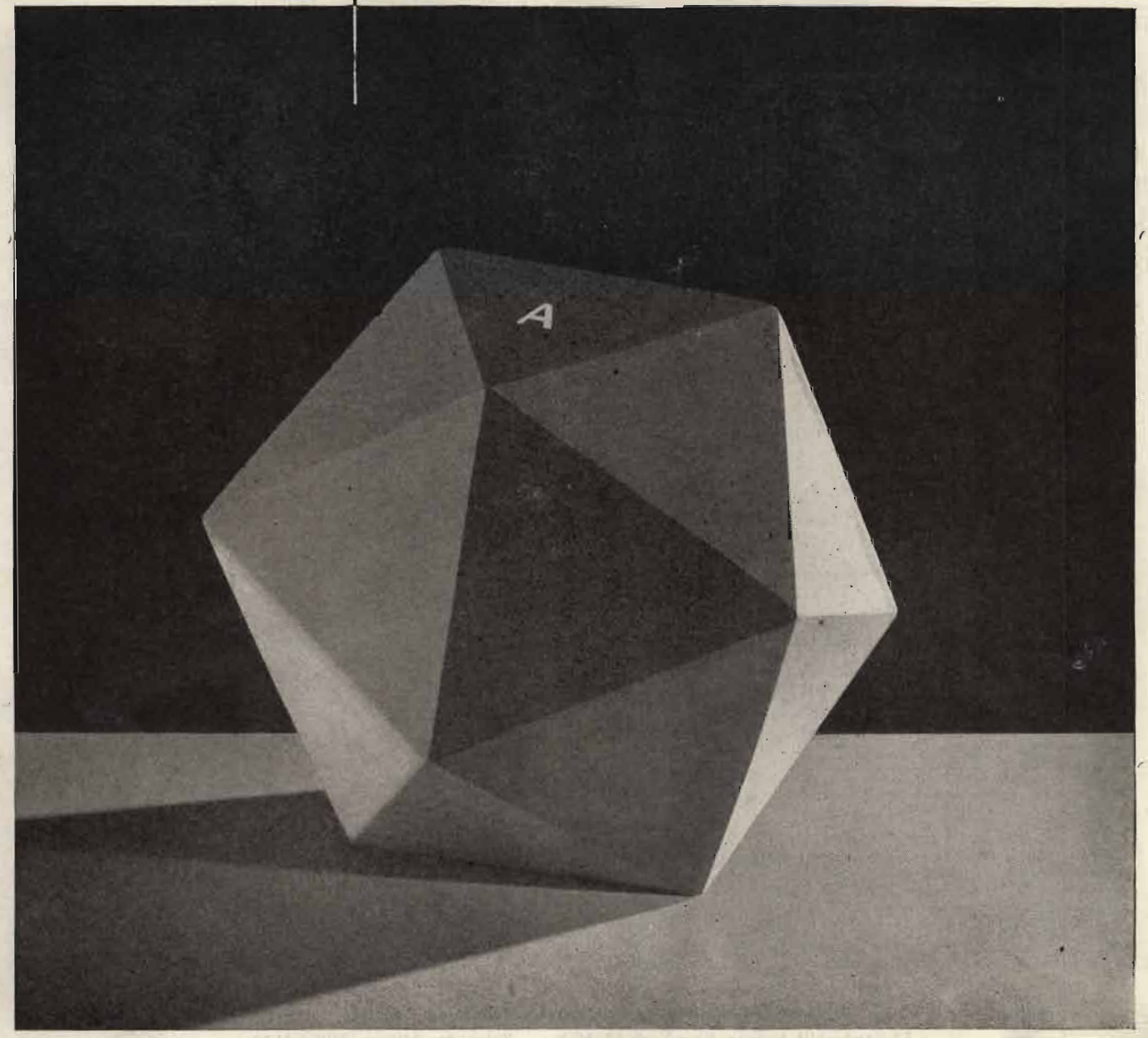

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COMMUNICATIONS

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COVER ILLUSTRATION

View of tv-antenna system used at WTTG, Washington, D. C. At left of tower is a 24-element *bedspring* antenna system designed to operate at about 200 mc. Circular antenna at right is used for sound. Articles explaining the theoretical and practical aspects of these antennas were presented in the January, February and March issues of COMMUNICATIONS.

(Courtesy Allen B. DuMont Labs.)

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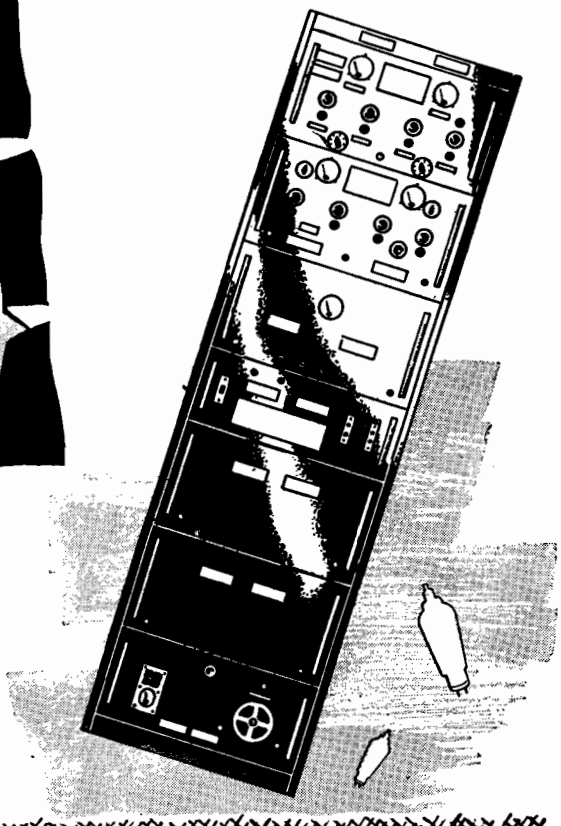

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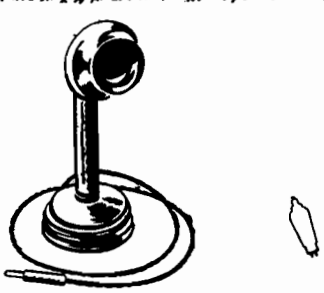

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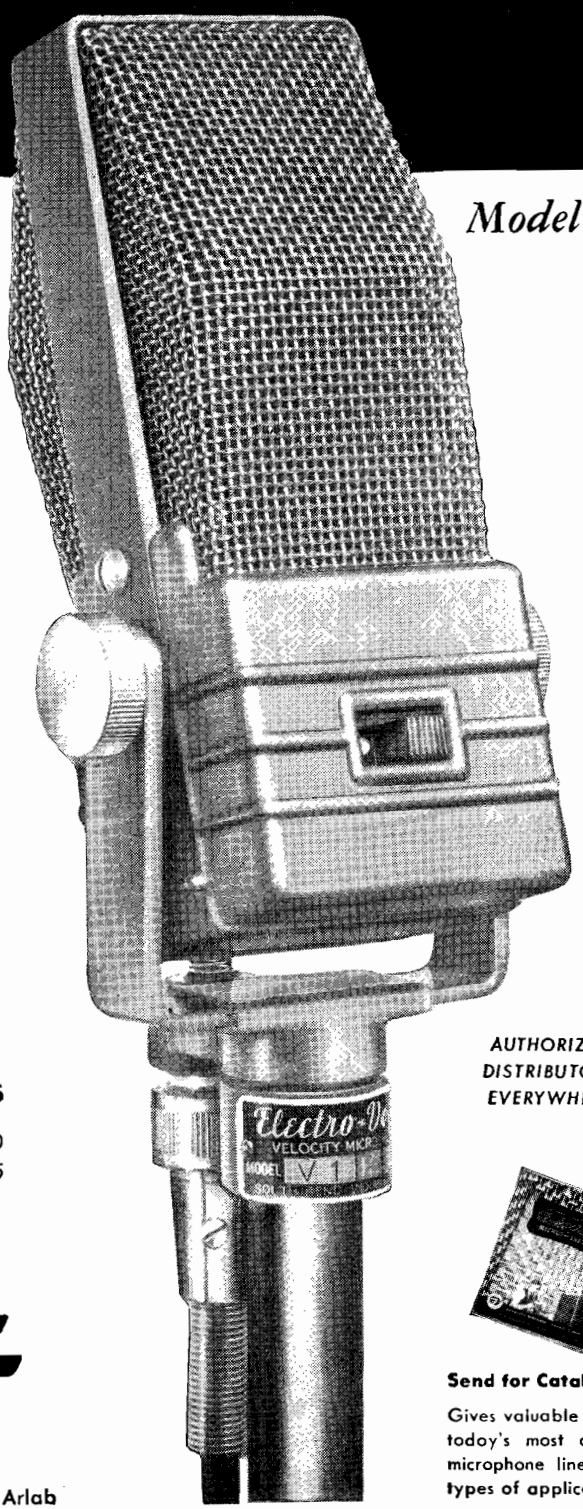

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COMMUNICATIONS

LEWIS WINNER, Editor

JULY, 1947

GREEN LIGHT FOR STATION BUILDING

BROADCASTING STATION CONSTRUCTION will soon hit new highs in activity, in view of the removal of the Federal restrictions on new construction, under the terms of the new Housing and Rent Act of 1947.

No longer will it be necessary to request construction permits from the Office of the Housing Expediter. Bristling action is expected to drive into the tremendous backlog of broadcast and tv construction and improvement projects created by the 15-month construction ban under the VHP-1 rule.

For a time it appeared as if the broadcasters might not fare too well under a ruling issued by OHE, which restricted construction of amusements, recreational or entertainment projects. However, OHE ruled that broadcasting and tv are public functions and do not come under the category of amusement or entertainment.

The ban lifting is expected to prompt construction of millions of dollars of facilities for a-m, f-m and television services.

A-M/F-M/TV STATION INCREASE

THE PAST MONTHS have seen a substantial station increase on the video and aural fronts. There are now 1,298 a-m stations, whereas on July 1, 1946, there were 961, and 497 construction permits have been issued for additional a-m broadcasters. The f-m broadcast scene has been extremely active, too. There are now on the air 238 f-m stations and over 600 have been granted construction permits. A year ago only 107 construction permits had been granted and the number of stations on the air were around a half-hundred.

On the television front, there are eleven stations operating and over 60 construction permits have been granted. A year ago but 20 construction permits had been processed.

Engineering station personnel is also at a new high, with networks and independents using the services of over 2,500 chief engineers and supervisors, 5,000 studio engineers and technicians, 6,000 transmitter engineers and some 400 research and development specialists. It is expected that about twice this number of personnel will be required for the growing number of stations before the year is out.

THE ATLANTIC CITY CONFERENCE

STANDARD BROADCAST AND HIGH-FREQUENCY allocations have been the subject of months of debate at the Atlantic City International Telecommunications Conference. After weeks of deliberation, the Conference agreed to widen the broadcast band to include the 540-kc channel. England, India and France had proposed a further widening of the band to include 520 kc. The U. S. delegation stated that 520 kc could not be allocated in this country because of the possible interference that might result from the international distress frequency of 500 kc. A compromise permitted the use of 530 kc by European nations and India, and France proposes to use 520 kc.

The FCC will hold hearings on the use of 540 kc in this country after the North American Regional Meeting in Havana in November. One station, on the continent, is already operating on this frequency, CBK at Watrous, Saskatchewan, Canada, with 50 kw.

The h-f talks were centered on the use of 6 to 12-mc tropical broadcasting bands with bandwidths of 250 and 150 kc. Another allocation problem discussed at the Conference, involves the use of the 200 to 235-mc band, with Great Britain asking that this band be used for international navigational aids. The use of this band would, of course, endanger television channels 11, 12 and 13 which range from 198 to 216 mc. Government and industry specialists have pointed out that the 1,000-mc region is much more satisfactory for this purpose, and proposals analyzing this factor will be presented at the high-frequency sessions scheduled to meet in August.

STILL TRYING

REPRESENTATIVE WILLIAM LEMKE is at it again, trying to secure passage of his bill which would put the new f-m band back to its original 50-mc region.

Congressman Lemke introduced his bill early in January and re-presented it at the July sessions.

In re-presenting his case, Congressman Lemke said that the new band deprives "farmers and rural residents of the opportunity to enjoy the benefits of f-m." The Congressman has criticized the FCC repeatedly for moving f-m up stating that political motives were behind the move.

If no action is taken at the current session, the Congressman says he'll try again at the winter session.

UNIQUE COMMUNICATIONS SERVICES

THE H-F AND V-H-F BANDS continue to appear in many unusual applications. A coal company in Kentucky will soon install a 152.45-mc communications system between its offices and its mines. The 152.75-mc band will be used for spot-reporting by a publishing company in San Antonio, Texas, with a fixed transmitter at the main office and four mobile units assigned to the newspaper's reporters.

Bus and taxicab companies are setting up fixed, mobile and relay v-h-f systems in many areas throughout the country. Thus far, taxicab companies have appropriated over three-million dollars for v-h-f communications equipment, with the bus companies' appropriations approaching a million dollars.

F-M MEETING IN SEPTEMBER

THE FIRST NATIONAL CONVENTION of the F-M Association is expected to be held at the Roosevelt Hotel in New York, September 12 and 13. There will be a number of important technical sessions during which such subjects as relays, channel separations, antennas, etc., will be analyzed.

It will be a meeting well worth attending.—L. W.

TWO-WAY BROADCAST

Via Train-to-Station to Ship-at-Sea Link

Program Originating in G. M. Train of Tomorrow, En Route in Midwest, and Queen Elizabeth, 1800 Miles Out at Sea, Broadcast by WGN and WOR by way of a Two-Way 156.1/161.1-mc Link.

by DANIEL E. NOBLE

Vice President, In Charge of Communications and Electronics Div.
Motorola, Inc.

THE UNUSUAL APPLICATIONS of v-h-f links were effectively demonstrated a few months ago when WGN and WOR participated in a two-way broadcast from the General Motors "Train of Tomorrow" and the Queen Elizabeth at sea, both speeding to their destinations, over a duplex 156.1/161.1-mc link.

The two-way broadcast idea, originated by the Mutual Broadcasting System and General Motors, called for a duplex-channel system setup. Engineers of WGN, headed by George Lang, chief engineer, called in to arrange for the link, contacted our v-h-f group to provide the duplex setup for the 156.1 and 161.1-mc f-m experimental bands. This request was received but six days before broadcast time and two days before the preliminary proposed duplex channel test between our building and WGN about six miles apart.

The problem was unique and a great amount of special equipment and manpower was required. We assigned seven men, headed by Al C. Witt, to follow through.

One of the major items on the procedure calendar was the selection of a location for the equipment and station relay point. The central station had to be near the "Train of Tomorrow's" line of travel and accessible to telephone lines which would carry the broadcast from the relay point to WGN studios. A location that permitted the quick running-in of three telephone lines was found atop an old brewery in Calumet City, south of Chicago.

Extremely close coordination with the WGN crew was maintained to prevent overlooking any detail that might cause delay. The problems of gain control, feeding into and out of broadcast line amplifiers and telephone systems, operational test requirements for emergency communications links, changes in receiver muting requirements, feeding of 500-ohm audio circuits for general listening and public address requirements, break-in tests, duplex operation of emergency communication receivers in the presence of higher power signals from the transmitter, designing of antennas and ground plane to meet train requirements, required equipment that filled our field test station wagon to overflowing. Several pieces had to be tied to the rear of the wagon, and some equipment was taken out at a later date.

Tests were subsequently run to determine whether or not the operation of the transmitter in the immediate vicinity of the receiver would cause interference. It was determined that without antennas the transmitters could be operated at 30 watts output in the same cabinet with receivers, having a sensitivity of approximately one-half microvolt for 20 db quieting, without noticeable interference or desensitization. However, antenna interference was present in the form of biasing off of the grid of the first tube in the receiver due to power fed into the receiving antenna from the transmitter. This resulted in the loss of desired signal sensitivity when the undesired transmitter signal drove the grid of the first receiver amplifier tube too far negative due to rectified grid current.

To eliminate this interference it was necessary to operate the ground-plane quarter-wave antennas approximately 50′ apart. After several installations and operation trials, resulting in some changes, the installation was completed. The major pieces of equipment involved at the train were our frequency-modulated station transmitter and receiver console, WGN field engineers remote-broadcasting equipment, speaker and microphone arrangements in the rear of the observation car, an independent receiver installation on the second car from the rear and antenna installation on the third car from the rear.

At the central-station pickup point in Calumet City were placed two independent quarter-wave ground-plane antennas, a f-m transmitter and receiving console, the WGN broadcast and line amplifiers and the three telephone

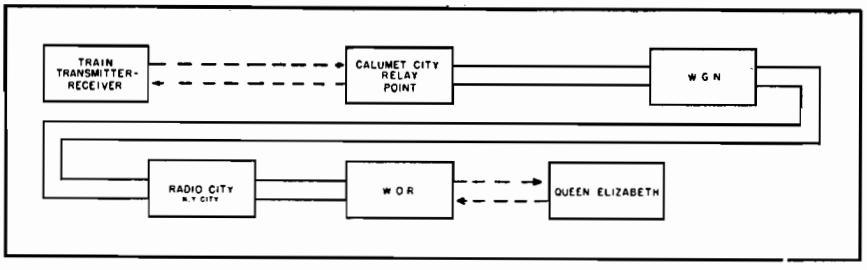


Figure 1

Setup for the train-relay-station-ship broadcast.

lines from the WGN operating studios.

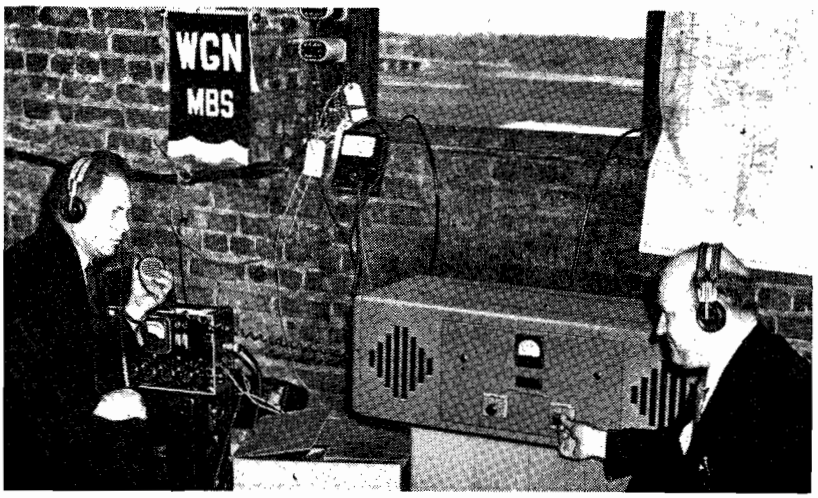
A third receiver was required because there was no place to mount the receiving antenna on the second car from the rear, as had originally been planned by the survey group. The antenna installation had to be secured to hand guard rails that existed. No additional holes or brackets could be added to the train. Special brackets had to be made in the shop to dimensions to fit the hand and ladder rails on the outside of the cars.

The receivers used were double superheterodyne single-crystal units with sensitivities of the order of ½ microvolt for 20 db quieting for quiet locations. The squelch circuits would operate in the region of 0.1 microvolt as the result of a trigger-differential circuit action between limiter potential and a rectified noise amplifier output. The squelch adjustments were such that increased man-made noise or static would not open the squelch, but would instead close tighter. The receiver audio output would feed both low-impedance voice coil speaker or an independent 500-ohm line output for telephone-line operation.

The transmitters employed phase modulation that had been found in combination with the receiver, to give the greatest range consistent with good intelligibility. The phase modulators were followed by frequency multipliers, 4-3-2-2 and a push-pull twin line output r-f tank circuit. Normal 100% modulation to 1,000 cps was about 20 kc at the carrier output. Ten per cent distortion occurred at about 50% overmodulation. The audio network between the microphone input transformer and the modulator was adjusted to give phase modulation from about 300 to 1,600 cycles and shifting towards frequency modulation between 1,600 and 3,000 cycles. Approximately zero level input at 1,000 cycles would produce 100% modulation.

Both transmitters and receivers had detachable power supply sections permitting interchange for a-c or d-c operation.

The course of the communications path from the speeding train to the ship was from the rear of the observation car, where microphones were situated, through amplifiers and cable



WGN engineer J. Claude and Motorola engineer Al Witt monitoring the ship-to-train broadcast at the Calumet City relay junction.

communications, to the transmitter-receiver console at the front end of the observation car and then to the transmitting antenna. Train signals were picked up at the Calumet City receiver. The 500-ohm output circuit of the receiver unit fed into the equalized telephone line to the WGN control room. The signal was monitored and transmitted via A. T. & T. land wires to the control room of WOR. From there it was retransmitted via specially leased ship-to-shore radiotelephone of A. T. & T.

Return communications from the Queen Elizabeth were monitored in the WGN studios before entering telephone circuit and line amplifiers to Calumet City. Signals transmitted from the Calumet relay point were picked up on the train by our f-m receiver and delivered to the receiving units in the observation section.

To meet the low head-room requirements of railroads, we mounted our quarter-wave car-top antennas on metal platforms about two feet square. Six ground-plane radials, in excess of .35 wavelength, were added. The quarter-wave antenna and the radials were made of .04" diameter spring steel wires. One hundred twenty-five feet of precut coaxial antenna cables were required. These unusually long antenna coaxial leads were necessary because the train had no special holes or brackets to allow for this unusual installation. The antenna leads, securely taped, were threaded through the top of the rubber expansion curtains between the cars and between the expansion plates at floor level where they entered the passageway between cars. From here they went up to the top of the next car, passing again through the expansion bellows to a tool compartment housing an f-m receiver in the following car.

The transmitting antenna coaxial cable leadin covered a similar path plus considerable added distance around baseboards and under the carpet of the observation car on its way to the observation car transmitter-receiver console.

The audio line from the receiver was brought into the car through the expansion bellows area between cars, run up to the top of the passageway between cars, across the top of the door-

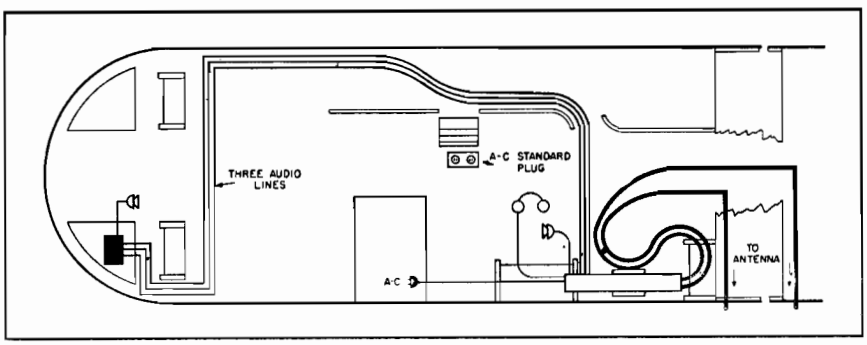


Figure 2

Layout of the observation car installation.

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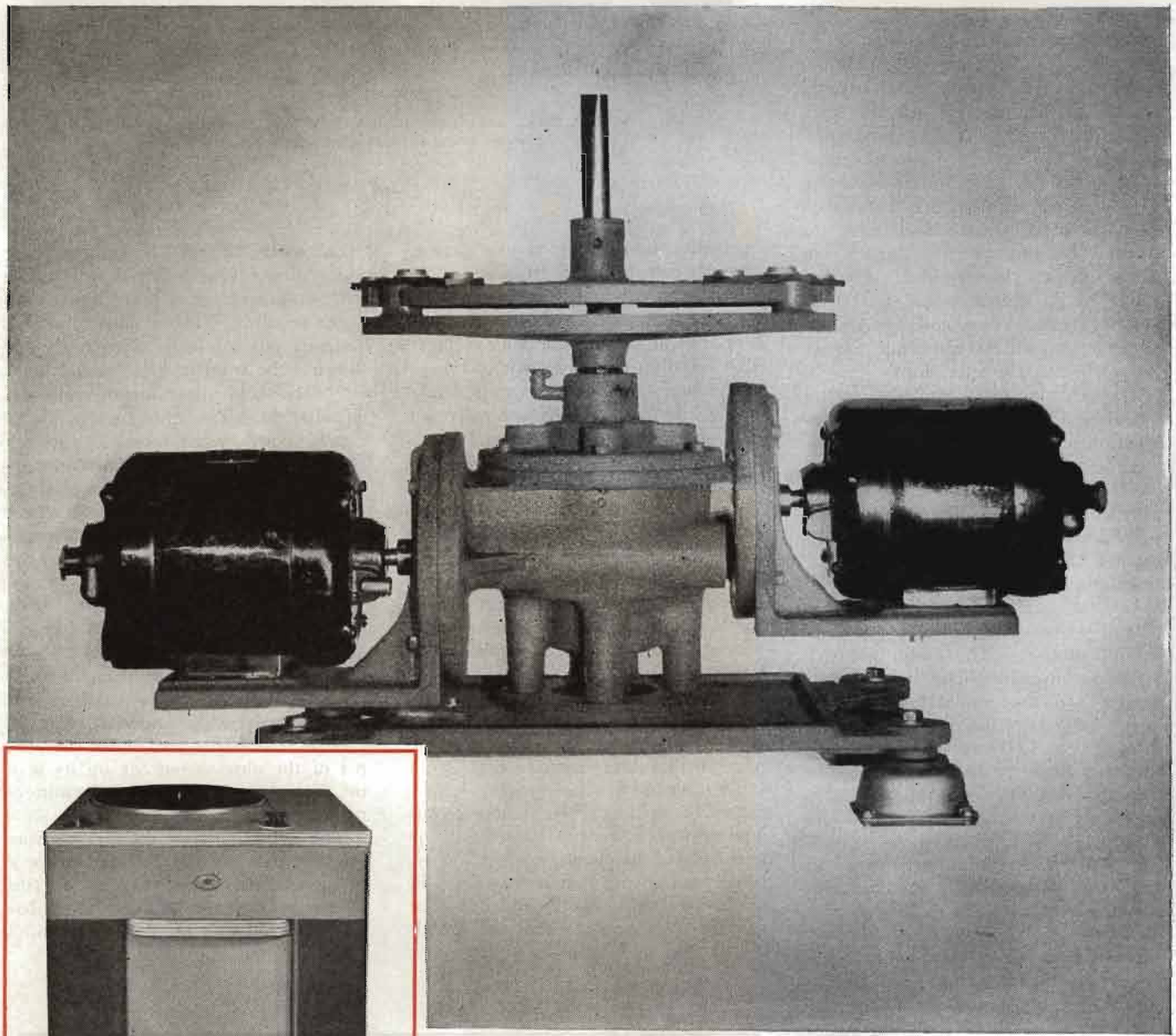
▶The new Presto 64-A transcription unit combines a number of radical improvements which are of first importance to broadcast stations, recording studios, and industrial and wired music operators.

▶The turntable is directly gear-driven at both 33⅓ and 78.26 rpm and two separate motors are employed — one for each speed. Speed may be changed instantly at any time by turning a mercury switch, without damage to the mechanism. *No frictional, planetary, or belt operated elements are used in this new drive mechanism.*

▶The following points are of interest: *Motors*—Two 1800 rpm synchronous. *Speed*—Total speed error is zero. *Noise*—At least 50 db below program. *Starting*—Table on speed in less than one-eighth revolution at 33⅓ rpm. *Adjustment*—Construction is very rugged and no attention whatsoever is required—except lubrication.



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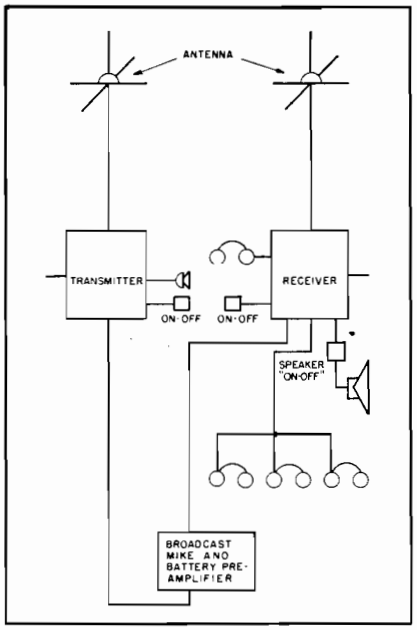
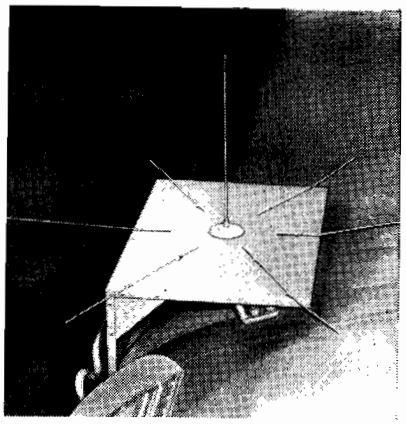


Figure 3
Preliminary layout proposed for the *Train of Tomorrow* broadcast. The proposal for the central station at Calumet City was basically similar to the setup shown here.



Roof-top ground-plane antenna with ¼-wave whip specially constructed for the *Train of Tomorrow* broadcast. The antenna was designed to meet the low headroom requirements of the railroad cars.

way, down the opposite side of the passageway, then under the carpets to the rear end of the car where it had to again pass through the passageway and through the observation car.

There was no time nor facilities for getting into any of the train circuits. Power and all circuits sometimes took long and devious routes to get to control and power circuits so as not to interfere with train operations or free access to all points.

Provisions were made so that in case of necessity the transmitting antenna on the front end of the observation car could also be used as a receiving antenna, operating simplex, and switched to receive and transmit by a coaxial relay built into the transmitter.

Antenna installations, somewhat similar to those on the train, were made at the Calumet central station.

Provisions were made in both our consoles on the train and at Calumet City to permit a break-in operation with microphone and loudspeaker. A special control panel was placed under the top cover of each console for various control and terminal functions. Terminal boards were provided on the control panel for the 500-ohm input circuits to the transmitter from the WGN line amplifiers and for the 500-ohm output from the receiver which fed the line directly. A variable 500-ohm input control pad and a 500-ohm output control pad were also supplied.

Since the plans were for 2-way continuous duplex operation it was necessary to provide bypass provisions for maintaining the transmitter in the *on* position, when desired. A switch was provided for the speaker circuit so communications could be tapped during the broadcast. For special testing, a microphone and speaker were provided at each transmitter-receiver console connected so that immediate radio break-in could be effected whenever desired. A switch was also provided to bypass the conventional muting circuit of the transmitter-receiver combination and to permit turning on a receiver for continuous operation preceding contact with the Queen Elizabeth, and for testing.

Such controls made for convenience and time saving during the setup operations, and permitted flexibility in making rests and running gain setting checks. Jumper connectors were supplied to permit simplex operation in case of emergency. This also permitted the use of transmitter antenna for receiving in the event the cars were uncoupled, breaking the circuits from the receiving antenna.

From time to time during the setup of the apparatus it became necessary to change the original plan somewhat and make a new and different attack to a particular phase of the many problems that arose. As an example, it was found that on the last day of the setup another receiver was required in the car ahead of the observation car, and an antenna was required on the third car from the rear. It was necessary to obtain from the production and crystal departments the necessary equipment for a third receiver. It was also found that because of the order of the cars entrained, one antenna had to be moved from a point originally considered. In another case it became necessary to remove a part completely of one installation and reinstall in a different manner to permit more freedom of action between interconnecting cables and antenna leads. It became necessary to add additional coupling means to part of the leads to permit uncoupling cars and meet other requirements.

During the course of the operation the train was moved from one location to another because of certain operational requirements at the car shops. Special care had to be applied to the laying of temporary cables, control, and audio circuit so as not to mar the finish or appearance of this new and extremly well-appointed train.

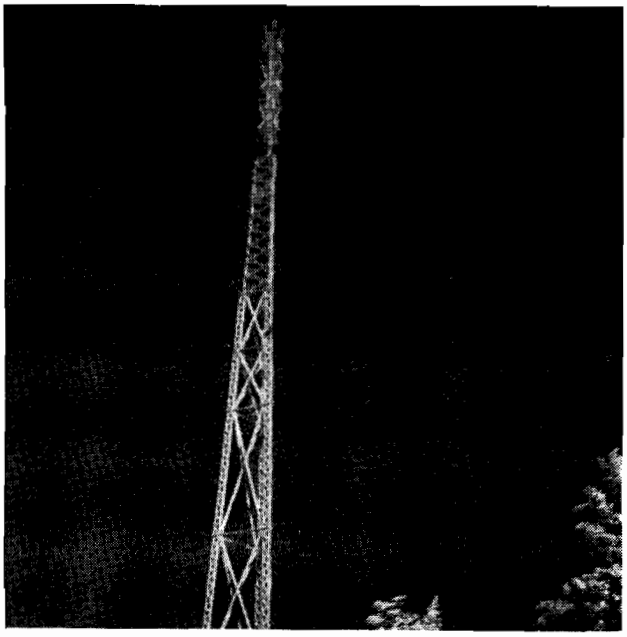
The communications field test station wagon had emergency communications equipment installed and could maintain contact with our labs, about fifteen miles away, through the central station and a technician. An operator was kept at the lab to take care of any emergencies which might arise or to make any special deliveries.

Power for the entire system was supplied by the 110-volt 60-cycle lines of the train. No interference of any type was experienced from the three independent car generators or the diesel engines.

Final inspections and alterations were made the day before the train left Chicago for French Lick, Indiana. All standard gain settings were checked and positions recorded for optimum overall conditions between the train and the WGN operating control rooms. Overall levels were adequate and closely maintained.

The next day preliminary running tests were made as the train left Chicago for French Lick. Contact was maintained for approximately fifteen miles beyond the Calumet pickup point. As the train approached St. John, Indiana, the following day, on its return to Chicago, contact was made with the Queen Elizabeth.

Credit for the first interchange of words between a ship at sea and a moving land train goes to WGN newscaster, Bob Hurleigh, and chief purser Carine of the Queen Elizabeth.



View of the ice-coated WOPI-FM antenna.

Atop White Top Mountain where the WOPI-FM antenna and transmitter were installed. At right is the antenna tower base and at left the 11,000 gallon reservoir.

MOUNTAIN-TOP F-M Installation

EIGHT YEARS AGO W. A. Wilson, WOPI-FM president and general manager, conceived the idea of erecting an f-m transmitter on White Top mountain, 5,643 feet above sea level and 33 air-line miles northeast of Bristol. War years, which followed, postponed a follow through on this idea. And it wasn't until the early part of 1946 that it was possible to secure a lease, for 99 years, at the tip of the mountain.

After the lease was secured, negotiations were begun for filing an f-m application. The services of McNairy and Wrathall, consulting engineers, were secured, and the application drawn up. On August 15, 1946 Leonard H. Marks, Washington, attorney advised us that WOPI had been granted a frequency-modulation construction permit.

These legal proceedings were a bit more complicated than when Mr. Wilson met the then chairman of the Federal Radio Commission, Judge Sykes, in 1929 and asked his permission to erect a 100-watt station in Bristol. The Judge's reply was, "Yes, it's all right. But you'd better fill out this 2-page questionnaire."

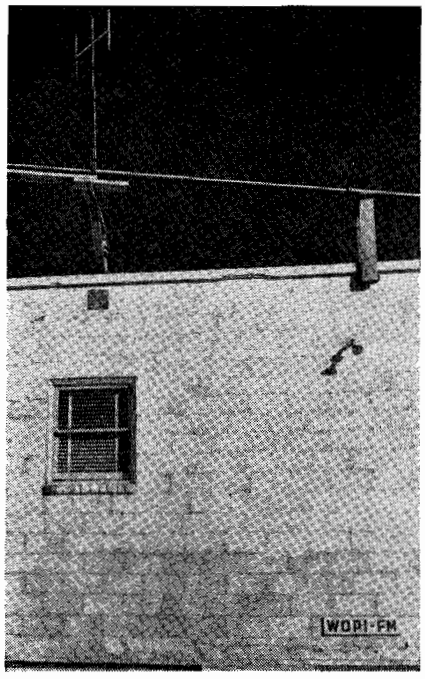
On August 16, 1946, construction of WOPI-FM was begun. Innumerable difficulties had to be faced. There were no power lines within six miles of the transmitter site. All material for the transmitter building and all equipment had to be trucked from 20 to 150 miles over roads that were often impassable in bad weather. The transmitter tower had to be erected in weather that sometimes offered winds of 50 to 90 miles an hour, a temperature of 5° below zero and snow that was 10′ to 15′ deep. The transmitter building had to be living quarters as well, since the nearest habitation was at the foot of the mountain, 8 miles away.

It was first necessary to build a road to the actual transmitter site. A bulldozer, hauled up the mountain in a truck, cleared the proposed transmitter site, a distance of some 500′ from the main road. During this clearing operation, a crew of eight men dug 700′ down the mountain to a spring for the water supply. This spring was cemented up into a 24′ by 24′ basin and a 300-gallon concrete tank was erected just below it. Then pipe was laid to the transmitter site so that water could be pumped electrically for use in construction. Eventually, an 11,000-gallon reservoir of steel and concrete, using some 600 tons of material, was built 200′ above the transmitter building.

At the same time, some 20 additional workmen constructed a steel and concrete septic tank, requiring a pipe line of 700′ long. All of this material, of course, had to be hauled a distance of at least 20 to 40 miles, not even a screw being available at any closer point. Some material was hauled 900 miles. The cost per load averaged from $18.75 to $200.00, with hauling costs alone amounting to over $5,000.

It was decided to make the transmitter building a two-story, three-car garage affair, using cement, steel and cinder blocks, with two bedrooms, dinette, studio control room, transmitter room and bath on the second floor, and heating unit, power unit and room for two cars on the first floor. The foundation of concrete, 35′ by 36′, was covered by a floor of cement blocks, with 6″ steel and concrete slab for the second floor. Inlaid-asphalt flooring or cork blocks were used on the floors of the second story. Hall, bathroom and dinette wainscoating was black square linoleum. Fluorescent lighting was used on the second floor.

When finally completed, the first floor contained a 50-kw diesel engine, furnace, laundry tray, washer and storage room, with sufficient space remaining for a jeep and passenger car. The jeep, incidentally, proved to be the only practical means of transportation during construction and when heavy snows fell. And even the jeep stalled for ten days during the worst weather,



Left: The dipole antenna on the roof of the transmitter building, used to pickup link-transmitter signals from the Bristol studio of WOPI. Above: Engineer-announcer Warren Gilpin at the control panel of the WOPI-FM transmitter atop White Top Mountain.

3-Kw Transmitter, Using 3-Bay Super-Turnstile Antenna, Installed During Sub-Zero Weather. Two-Story Three-Car Garage Building Constructed Atop Mountain Provides Studio, Control Room, Transmitting and Power Room, and Complete Living Facilities.

by MIKE CADY

WOPI-FM
Bristol, Tennessee-Virginia

food and other supplies having to be dropped by plane.

The building uses hot water heat, furnished through a fuel oil stoker. Three 550-gallon tanks located underground outside the building feed the furnace, with two additional 550 gallon tanks supplying the diesel, which is primarily used to supply three-phase power for the transmitter, a 3-kw unit.[1]

The power company had to erect poles and string lines for 6 miles to supply power for lighting and cooking. However, a switch was installed so that, in case of power failure, the diesel would furnish electricity for lighting and heating as well. Incidentally, it was necessary to mount the diesel on a separate concrete floor, to avoid vibration problems.

Antenna Installation

A special antenna crew was hired to erect a 150′ self-supporting 3-bay, super-turnstile antenna,[2] standing 2,210′ above the average terrain. The foundation used hundreds of tons of steel, rock and cement that took about eighteen hours to pour. Water had to be hauled 2½ miles by truck, since the reservoir had not been constructed. Both the foundation and tower were erected in weather which several times chilled the men working in the air so much that other crewmen had to climb up and help them down.

Another major problem was the running of the 3⅛″ transmission line from the transmitter building to the antenna. This transmission line was larger than would ordinarily be used with a radiated power of 10,400 watts, but was installed to allow further power increase without changing the size of the line. Heavy winds and ice made it mandatory to have the line securely mounted and protected. The horizontal run rested on a catwalk built across the tops of six telephone poles sunk five feet in the ground. A box was built around the line to prevent damage by ice falling from the tower. To add to installation difficulties, clouds closed in at the time the transmission line arrived, freezing a coating of ice on the tower and catwalk. High winds during one of the winter storms worked the inside conductor of the transmission line loose at the juncture of the transmission line and turnstile.

All audio equipment and the operating console were installed in the studio control room, adjacent to the transmitter room. Incidentally, the blower fans which supply air for cooling the amplifier tubes, were designed to run at twice the speed of those supplied as standard equipment, to insure sufficient volume of the rarified air at the high altitude for cooling the tubes.

Just 90 days after the first ground was turned, on Christmas Day, 1946,

[1]RCA 3 BTF.

[2]RCA.

(Continued on page 39)

Sync Generator Frequency Stability and TV REMOTE PICKUPS

A tv remote-pickup setup.

An Analysis[1] of the Relationship of Synchronized Generator Control and Field Pickup Setups in Television.

by W. J. POCH

Manager, Television Terminal Equipment Section
Engineering Products Department, RCA

IN MOST TELEVISION-STUDIO INSTALLATIONS at present the synchronizing generator is locked in by means of an automatic-frequency control circuit to the 60-cycle power supply system. There are three advantages to this procedure:

(1)—By using a synchronous motor to drive the television film projector, synchronization between the projector and the synchronizing generator is accomplished automatically.

(2)—Cross-talk from the 60-cycle power supply into the circuits at the studio, at the transmitter, or at the receiver will appear to be stationary and will, therefore, be less noticeable.

(3)—In any one area it is expected that all of the television stations in the area will receive power from the same source and it will therefore be possible to arrange the lock-in circuits of the synchronizing generator at each transmitter in such a way that the phase of the vertical blanking signal with respect to the 60-cycle power wave, will be the same for each station. If this is done then a television receiver in this area can be switched from one station to another without the possible annoyance of having the vertical blanking signal appear in the center of the picture.

However, there may be television stations located in areas where the variation in power supply frequency may be excessive. If the synchronizing generator maintains synchronization with the power supply it is necessary that the television receivers in this area have lock-in circuits for both horizontal and vertical scanning frequencies which will stay in synchronism over a considerable range of speed. This puts an additional burden on the receiver designer and may result in an increase in cost and inferior operation in areas which have more stable power supplies. If a station of this type originates a network program, then it will also be necessary for receivers in areas which have a stable power supply to hold in synchronism over a wide range of frequencies. This may mean a sufficient difference in frequency between the power supply frequency and the vertical scanning frequency of the incoming signal to a receiver, so that hum due to the receiver power supply may become quite noticeable. For this condition the overall operation of the system would probably be improved if the synchronizing generator in the location having the unstable power supply frequency were crystal controlled, so that the frequency of its synchronizing signal would be maintained at 60 cycles within a very close tolerance. This means, however, that it will be necessary to develop a satisfactory method for synchronizing the television film projector with the vertical synchronizing signal developed by the synchronizing generator. It is believed that this can be done, although some development work is necessary.

When a television system is not locked in with the power supply frequency but with a more stable reference such as a suitable crystal oscillator, then it will become more difficult for stations in the same area to maintain a close phase relationship between vertical blanking signals. If it is considered sufficiently desirable, wire or radio links could be used for maintaining this relationship in any one area. It may actually be desirable to require that the scanning frequencies at each studio location be crystal controlled. At the present time this requirement is not justified because of the problems of synchronizing the television film projector. It will also mean that there will normally be a slight difference in frequency between the power supply and the vertical scanning frequency. This may cause some objectionable effects at the receiver. However, this situation may be expected to occur whenever a net-

(*Continued on page* 38)

[1]*From a paper presented at the RMA Spring Meeting, Syracuse, N. Y.*

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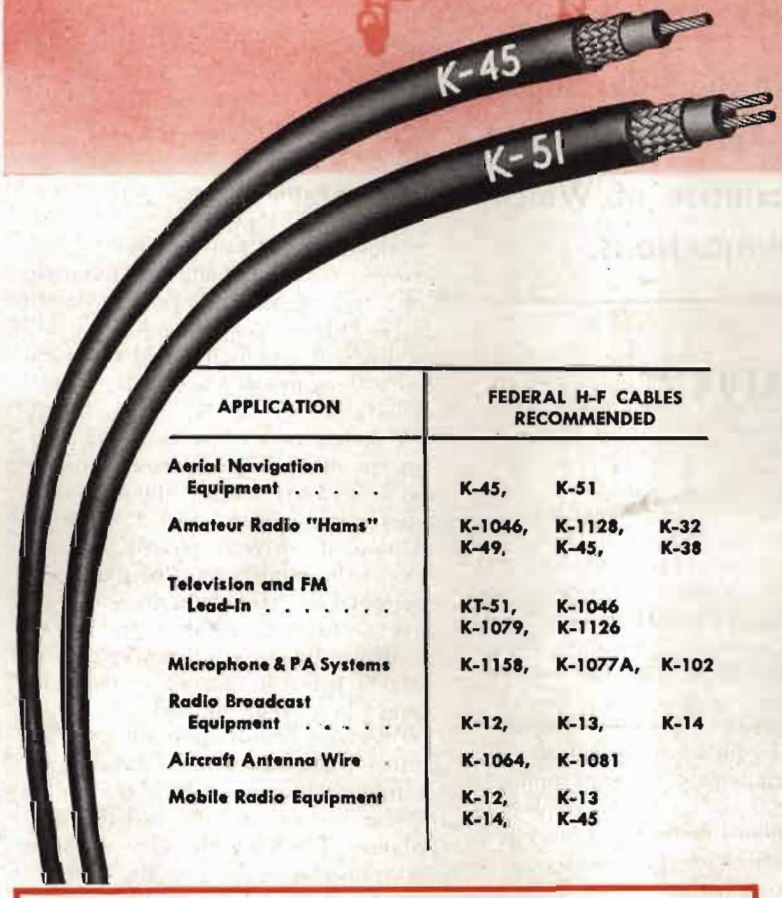

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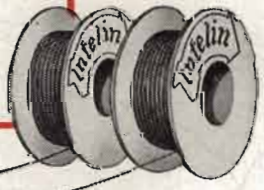

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Performance Characteristics of the WABD TV ANTENNA SYSTEM

A Report on the Results Obtained with the 3-Bay Super-Turnstile Batwing Antenna System, Recently Installed Atop N. Y. City Skyscraper, a Description of Which Appeared in the May Issue of COMMUNICATIONS.

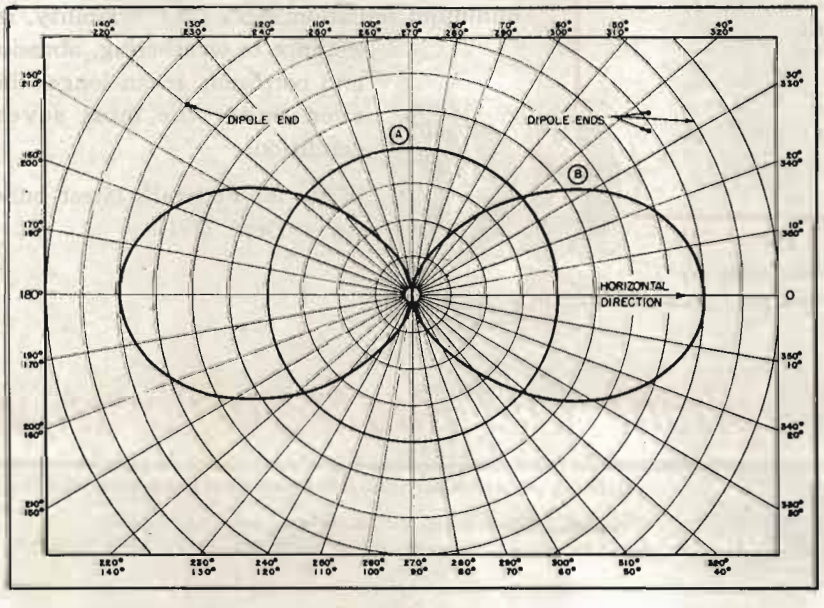
by G. EDWARD HAMILTON

Senior Engineer, Development Section
Allen B. Du Mont Laboratories

ANTENNA SYSTEMS SHOWING a gain over their simpler counterparts have long been desirable. On the lower frequencies, they are needed to *beam* or concentrate energy in desired directions for purposes of *protection* in the case of multichannel broadcast stations, or to direct the signal to serve the greatest population area. Intensive array systems also find application for transcontinental telephone and telegraph service. The foregoing, however, serve primarily to alter the normal radiation patterns from the *circular* since they are, in most cases, vertically polarized and the primary interest is in ground-wave propagation. Further, at the lower frequencies, little difficulty is experienced in tubes and circuit components. Operation above 50 mc, however, imposes tube, circuit component and propagation difficulties not encountered at the lower frequencies: high-frequency propagation follows, essentially, laws of optics; lumped constants can no longer be employed with maximum efficiency and tubes are not yet available for comparable power handling capability.

One of the most economical means of increasing the effective radiated power, therefore, is to design an antenna system to give a high power gain, such as the super-turnstile.[1]

Figures 1 and 2
In 1 (*a*) appears the relative vertical field strength for a simple single-bay antenna system. In 2 (*b*) we have the relative vertical field strength of a two-bay horizontal dipole system.



Radiation Patterns

Television and f-m have been standardized for horizontal polarization. Most tv and f-m stations are located on the highest possible positions, tall buildings or mountains, and the usual desire is to produce a circularly-radiated signal.

A comparison of vertical radiation patterns of a simple horizontal dipole and of a 2-bay stacked dipole system appears in Figures 1 and 2. Further addition of correctly phased *bays* results in beaming more energy in the horizontal direction. In Figure 3 we have a curve, as obtained by Dr. G. H. Brown,[2] for vertical power gain of a dipole turnstile antenna system with respect to a simple dipole.

Television transmitting antennas are further complicated by the broad band of frequencies over which they must present a non-varying resistive impedance. The standing-wave ratio on the transmission line to the antenna must be under 1.1 for faithful picture transmission.

The 3-bay super-turnstile antenna system meets the demand for power gain with a calculated gain of *4* over a simple dipole, and a bandwidth in excess of 4 mc.

From Figure 4 it will be noted that each of the three segments is approximately a half-wavelength long from top to bottom. The top and bottom of each unit is grounded securely to the spur pole and it is excited at the midpoint.

Antenna Features

The antenna uses a number of features, from four distinct fundamental concepts: (*1*), Broad-banded dipole; (*2*), slot antenna; (*3*), constant-current sheet; and (*4*), quarter-wave stub section.

The electrical length between the point of excitation and the grounded top and bottom fastenings is a quarter wave. This factor tends to reduce the reactive component to a minimum since as the antenna becomes inductive

[1] RCA.

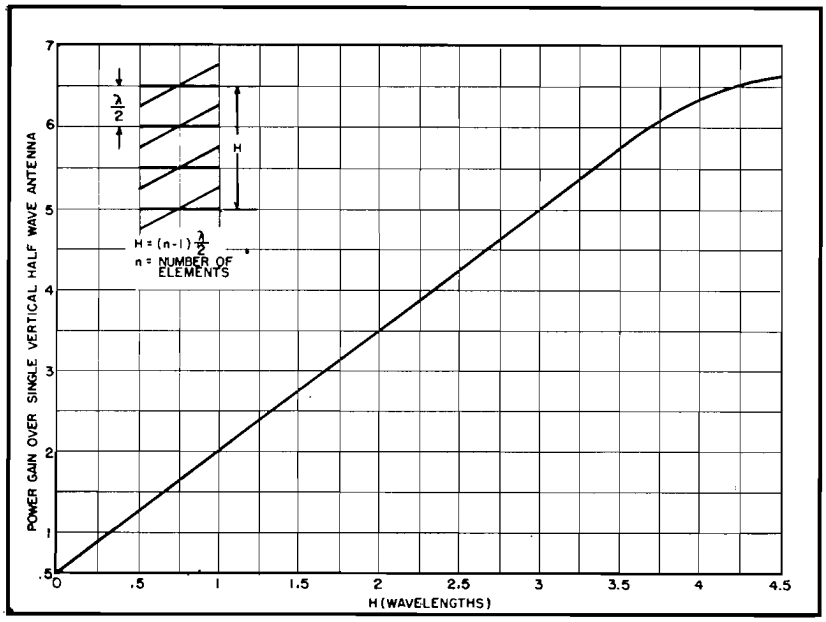


Figure 3
A plot of the theoretical power gain of a turnstile antenna in comparison to a simple dipole system.

(with respect to frequency), the *quarter-wave stub* becomes capacitive, a factor which has been used to broadband dipoles.

Since, to this *quarter-wave stub* are connected horizontal bars, the area described by the *batwing* looks like a surface which is slotted with a half-wave slot and excited in the mid-point. The radiated polarization from a vertical slot is in a horizontal direction, and further, by changing the spacing from spur pole to vertical bar, the driving point impedance is varied, which is also a characteristic of the slot antenna.

Dipoles may be made more *broad band* by increasing the dipole diameter, i. e., making the ratio of length to diameter smaller. This is accomplished by making the effective area large by virtue of the paralleled horizontal tubing.

If the *batwing* is considered as being a generated surface by considering that the elementary dipole moves parallel to itself through the full length of the quarter-wave stubs, we find that lateral currents are excited in the surface by the voltages which exist along the dipole end surface. These currents then radiate.[3] Current is induced in the end of the element (where voltage is a minimum), by close coupling to the center currents. Therefore, there is the tendency to have current of essentially constant magnitude the full length of the radiator. The *batwing* shape is necessary in order to properly proportion current distribution within the surface.

Figure 6 shows the standing-wave ratio of the *batwing* antenna system over the *entire* bandpass spectrum. To produce a circular-radiation pattern, the transmission line from one pair of elements (*N S*) is different in phase by one-quarter wave from the line feeding the remaining elements (*EW*). This method of connection produces a rotating radiation vector resulting in an essentially circular pattern. This is shown by a review of the elementary equation of radiated field strength:

$$F_1 = I_1 \sin(wt) \sin\Theta$$
$$F_2 = I_2 \cos(wt) \cos\Theta$$
$$F_1 + F_2 = I_1 \sin(wt) \sin\Theta + I_2 \cos(wt) \cos\Theta;$$

But $I_1 = I_2$,

therefore $F_1 + F_2 = I \cos(wt - \Theta)$

It is obvious from Figure 6 that if either the sound carrier or picture carrier were applied, the results would be satisfactory, so far as adequate bandwith is concerned. Therefore, a method for connecting both signals into the system without cross interference would be desirable. Such a system is available and is known as a *diplexer*. Figure 7 shows an electrical schematic of the diplexer.

There are three major factors involved in the input and output connections to the diplexer:

(*1*) The output is a *balanced* system feeding into a pair of 51.5-ohm transmission lines.

(*2*) The input to the system is *unbalanced* and each input to the diplexer presents a 72-ohm impedance.

(*3*) It is necessary in both cases (aural and visual inputs) to go from an unbalanced to a balanced system.

The aural signal is fed into the diplexer at point *A* (in Figure 7)

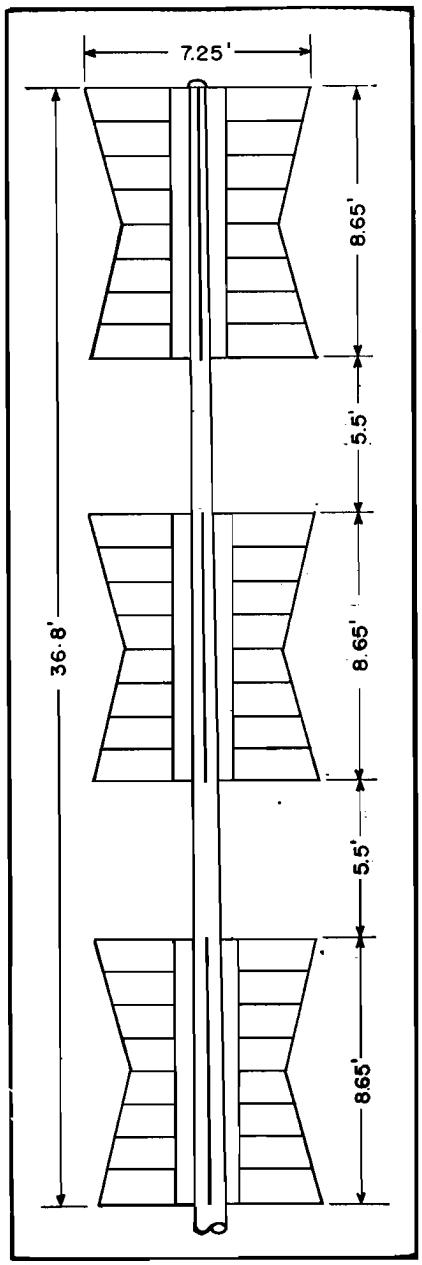
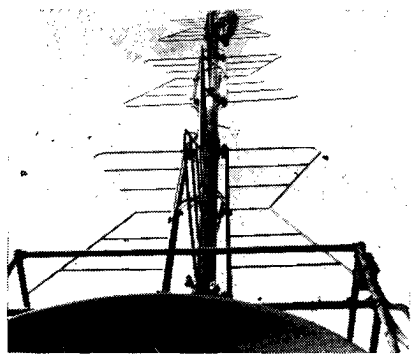


Figure 4
Approximate details of the elements and spacings for the three-bay *batwing* antenna used at WABD.

Figure 5
The *batwing* antenna in position.



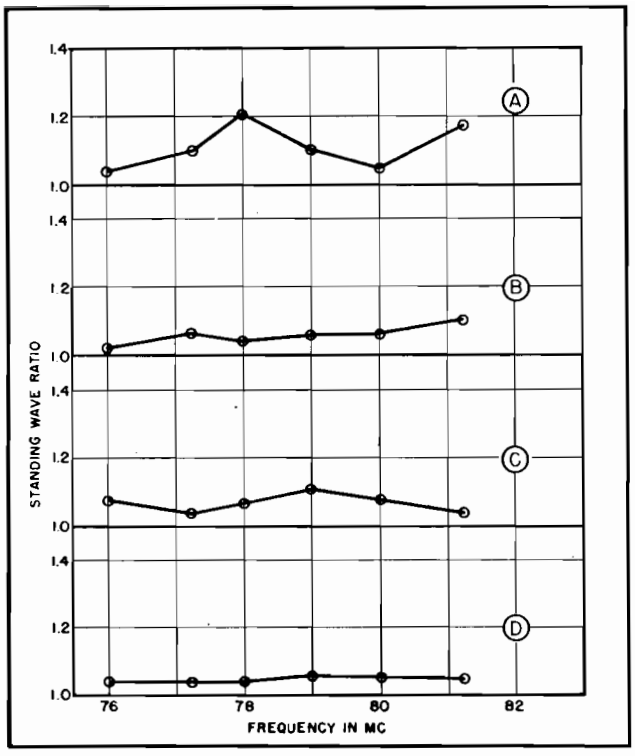
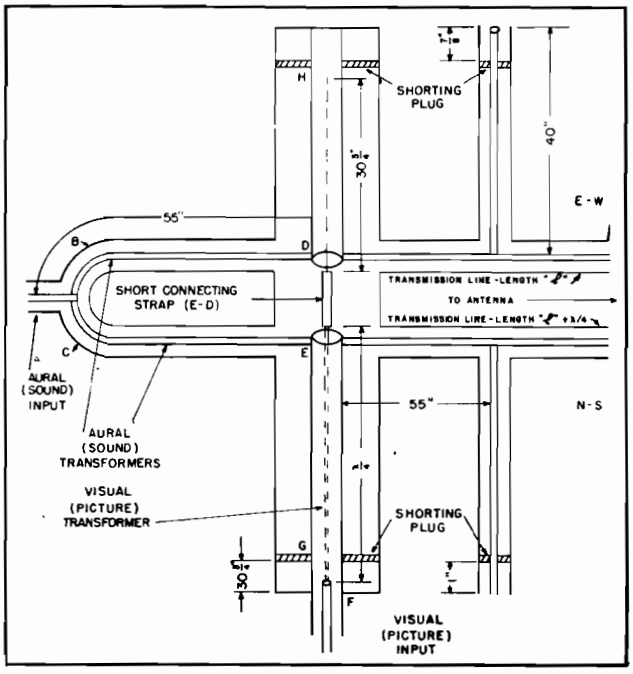


Figure 7
The low-frequency diplexer for channel 5 (76 to 82 mc) used at WABD.

Figure 6*a*, *b*, *c* and *d* (left)
Curves showing standing-wave ratio versus frequency for the batwing antenna; impedance equal to 51.5 ohms. In *a* we have a DuMont slotted-line measurement of the *EW* radiators. In *b* appears an RCA wobbulator measurement of the *EW* radiators. A DuMont slotted-line measurement of the *NS* radiators appears in *c*. The RCA wobbulator measurement of the *NS* radiators is shown in *d*.



from a 72-ohm transmission line. At this point, the signal divides into a pair of transmission lines, *B-C*, which act as transformers between points *D*, *E* and *A*. Since the input impedance at *A* is 72 ohms each line, *B-C*, must look like 144 ohms at this point and 51.5 ohms at points *D* and *E*. By use of equation

$$Z_t = \sqrt{Z_{in} Z_{out}}$$

Where: Z_t = transformer impedance
Z_{in} = input impedance (144 ohms)
Z_{out} = output impedance (51.5 ohms)
Z_t = 86 ohms

Since points *D* and *E* are connected to the output of the diplexer, the signal proceeds out the diplexer in phase and is shifted 90° by virtue of the added quarter wave in the output transmission line.

The visual input is shown at point *F* where it enters a balancing section, *G-E*. Since the length, *G-E*, is a quarter wave an unbalance-to-balance transformation takes place. One output transmission line connects to the outer conductor of the input line and through point *A* to *D*. The inner conductor of the input line connects to the inner conductor of line *D-H* through a very short strap, *E-D*. Section *D-H* is an open circuited quarter-wave section which results in a 0° phase shift, placing the outer conductor at *D*, 180° removed in phase from that at the outer conductor, *E*. Therefore, the video signal proceeds from points *D* and *E*, 180° out of phase into the balanced transmission line output of the diplexer. Since a quarter-wave differential of length exists between the transmission lines, a further phase shift of 90° is obtained. This results in sound and video signals producing rotating field vectors of opposite direction.

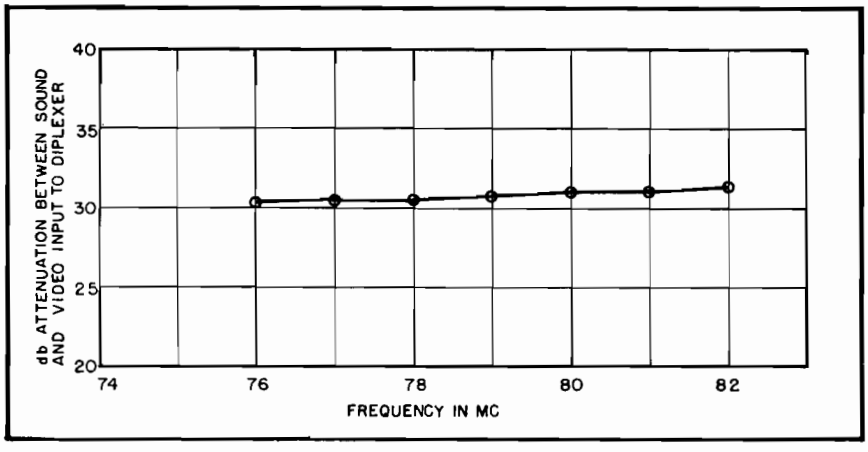
Video signal is kept from entering the sound input since out of phase signals from the outer conductors of *D* and *E* cancel at *A*.

Sound signal is suppressed from the video input by virtue of section *D-H*, which produces a 0° phase shift between inner and outer conductors at *D*, resulting in cancellation across inner and outer conductors at *E*.

The driving point impedance at points *D-E* into the transmission lines is 103 ohms. Therefore, the impedance of section *G-E*, the picture transformer, is equal to $\sqrt{103 \times 72} = 86$ ohms.

Since the visual input and aural inputs are phased in a manner so that no energy is transferred, one to the

Figure 8
Plot of attenuation in db versus frequency in mc between the sound and video diplexer input.



(*Continued on page* 40)

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A Developmental F-M BROADCAST STATION

Figure 1
M. A. Honnell with the converted 1-kw f-m transmitter.

DURING THE SUMMER of 1944, it was decided to conduct a program of research in f-m propagation to be operated as one of the regular research projects of our engineering experiment station. Subsequently we applied for a construction permit for a developmental broadcast f-m station. Authorization was granted under the call W4XAG, with an operating frequency of 49.5 mc.

Our transmitter, a 1-kw[1] unit, was installed on the third floor of the electrical engineering building, next to the electronics laboratories and shop, to provide easy access to any special test equipment that might be needed in the research work.

Antenna System

The main condition to be fulfilled by an experimental antenna system is that it be readily accessible for experimental modifications. It was planned to install a tall steel tower to meet this requirement. It was found, however, that a small tower would suffice, since Georgia Tech is located on a point of high elevation. We selected a standard windmill tower 45′ high and installed it on the roof of the electrical engineering building, with a few additional braces added to strengthen the base of the tower.

Since a vertical half-wave antenna is used as a reference in the computation of the field gain of other antenna types, it was decided to erect, initially, a vertical half-wave antenna of the coaxial type. The center of the antenna was exactly 100′ above ground. Since the average elevation of the Georgia Tech campus is 980′, the center of the antenna was 1,080′ above sea level.

The coaxial antenna originally employed on 49.5 mc. was fabricated from a piece of 2½″ brass tubing forming a sleeve at the end of a ⅞″ coaxial transmission line, terminated in a low-capacitance glass-end seal. A small micalex platform above the end seal supported a piece of ⅜″ brass tubing, one-quarter wavelength long.

Antenna Location

To test the antenna for proper dimensioning, it was extended out of a third floor window well away from reflecting objects. The antenna was excited through a slotted transmission line connected to a laboratory oscillator tuned to the operating frequency. The dimensions of the antenna were changed in small increments until the standing wave ratio within the line was within 5% of unity. This was considered reasonable, since the overall length of the transmission line from transmitter to antenna was only 80′.

Ground System

An extensive ground system was provided to minimize any trouble from lightning and stray fields. The tower was bonded to a metal roof at four points with copper strips 4″ wide and 0.021″ thick. Each corner of the roof was, in turn, grounded by means of 4″ copper strips which extended down the corners of the building. The strips were buried for a distance of 15′ at a depth of 2′ to 3′. The roof was also grounded at its mid-point with a conductor consisting of seven strands of No. 12 copper wire.

Internal Ground

The internal ground system was made up of a 4″ copper strip extending from the transmitter to the ground, where the strip was buried for a distance of 15′ at a depth of 3′. All conduits, rails and pipes in the building were strapped to this ground strip.

The extensive ground system was required because of the wood and brick

[1] W.E. 503A-1.

Vertical Half-Wave Antenna Installed. External and Internal Grounds Used to Minimize Trouble from Stray Fields and Lightning. Transmitter Converted from 49.5 to 99 Megacycles.

by M. A. HONNELL

Faculty Research Associate
Engineering Experiment Station
Georgia School of Technology

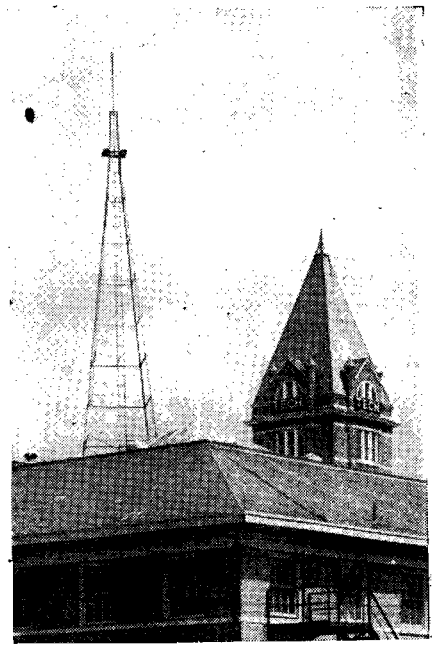

Figure 2
The 99-mc coaxial antenna as mounted atop a standard windmill tower.

construction of the electrical-engineering building. The external ground system has served to protect the building against lightning, the internal ground system providing the necessary r-f ground.

Studio and Speech Input Equipment

The studio, 11′ wide, 12′ long and 10′ high, was designed to provide a relatively quiet place in which to make station announcements and for critical listening of the transmitted signals. The studio walls and the ceiling were treated to reduce the reverberation time to an acceptable value.

The floor of the studio was covered with asphalt tile. All walls and doors were covered with celotex with the rough side outward. The ceiling and a band 3′ wide at the top of the walls were covered with *acousti-celotex* fastened to 3″ furring strips. The studio window was made of two pieces of glass separated 2″.

Converson to New Band

In June, 1946, the transmitter was converted for 99-mc operation, which happens to be a split-channel frequency in the new band. A standard modification kit was used to convert the transmitter.[2] A buffer amplifier was changed to a doubler driving a line-tuned push-pull driver stage, employing a pair of 4-125A tetrodes. The latter tubes drive a pair of 357As in a push-pull line-tuned amplifier.

Temperature Control

It was feared that the high ambient temperature in the transmitter room during the summer months might cause overheating and possible failure of circuit components at the new operating frequency. Accordingly we placed a ply-wood duct on top of the transmitter to conduct the transmitter exhaust air to the attic. In spite of the fact that the transmitter room has only one window, it is now the most comfortable room in the building. The blower in the transmitter constantly draws a large volume of fresh air into the room before it passes through the transmitter to be exhausted into the attic.

Although W4XAG is operated only while propagation tests are in progress, it has served to stimulate interest in frequency modulation in the Southeast. The overall installation with its low antenna height represents the minimum facilities which would provide f-m service in a small community. The advantages obtainable through the use of multi-element antennas of high elevation are well known.

[2]Converted to W.E. type 503B-1.

Terrain Problems

The propagation problem in the Atlanta area is unique in that the terrain is very hilly and thickly covered with trees. To date, no open fields have been found in this vicinity, which are reasonably free from standing waves. It was gratifying to find, however, that the measured field-strength on top of a 3,200′ mountain, 57 miles from the transmitter, was over one millivolt. Extensive propagation measurements are still in progress to determine what coverage may be expected from f-m in this region, where a-m is at a disadvantage during the summer due to heavy static.

Figure 3
Speech input equipment and turntable.

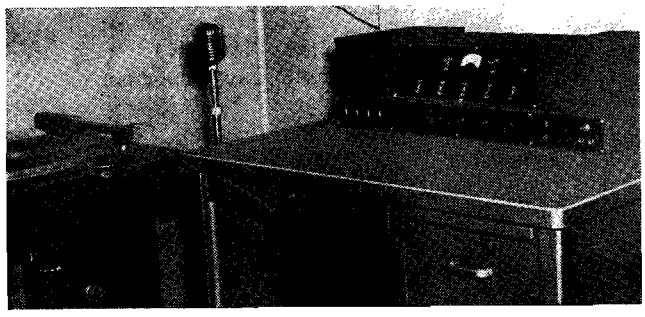

Figure 4
View of large tree area which faces transmitter location.

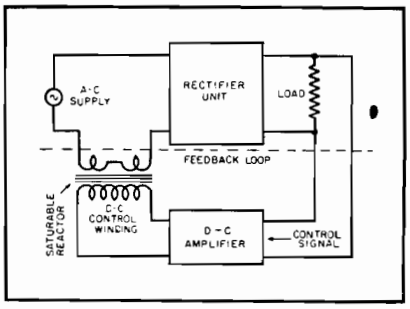

Figure 1
Saturable reactor-controlled d-c supply.

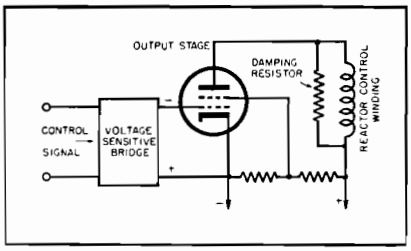

Figure 2
Basic elements of a d-c amplifier in a negative feedback loop.

LOW-VOLTAGE REGULATED Power Supplies

Discussion of Saturable Reactor-Controlled D-C Supplies with D-C Amplifiers, and Voltage-Sensitive Bridges Which Can Be Used in Supply Systems.

by FREDERICK W. SMITH, Jr.
RCA Institutes

and MARCEL C. THIENPONT
Dept. of Neurology, Neurological Institute, Columbia University

IN BROADCAST STATION and commercial communications systems, there is often required a regulated source of d-c voltage of from 1 to 100 which will supply appreciable quantities of power.

Such a power source, if it is to be truly voltage regulated, will provide a constant-output potential regardless of variations which occur in the power consumed by the load, or in the line voltage or line frequency.

High-Voltage Low-Current Stabilization

Electronic voltage stabilization of high voltages at relatively low currents by means of degeneratively-controlled, series-connected vacuum tubes is well known.[1] The power output of such circuits is limited by the current-carrying capacity of the tube types employed. This limitation makes direct electronic control of *low-voltage, high-current* supplies infeasible. The use of thyratrons as control elements for this purpose has also been suggested, but again, the maximum average anode currents permissible are too low, and in addition, the waveform of thyratron output is poor.

Low-Voltage High-Current Design

The problem of d-c voltage regulation can also be solved successfully by a slightly different approach by controlling the alternating voltage supplied to the rectifier which is acting as the source of direct current. Such control may be conveniently obtained by means of a saturable reactor which is placed in series with the a-c voltage supply,[2] as in Figure 1.

In this circuit, the d-c voltage developed across the load resistance is amplified and then used to energize the control winding of the reactor. The phase relation or polarity of the feedback voltage is adjusted to be negative or degenerative so that a drop in the output voltage will be compensated for by an increase in the a-c voltage applied to the rectifier, etc.

The a-c voltage drop across the reactor primary at full saturation can be made very small, permitting 95% or more of the line voltage to be applied to the rectifier unit. On the other hand, when little or no direct current is energizing the control winding, the primary reactance is very high, and the voltage applied to the rectifier unit can be reduced by more than 50%. Reactor control thus provides a wide range of variation which is relatively smooth, and which is accomplished at a high efficiency, even at light loads.

Because the power-control ratio is quite high, i.e. from 10 to 100 dependent on the reactor design,[3, 4] the required direct-saturation current is small enough so that it may be supplied by a d-c amplifier which has in its output stage, a beam power or pentode tube type, such as a 6V6, 6L6, or 6F6.

The high plate resistances of these types tend to make the response of the d-c control circuit very rapid, although the reduced damping across the control winding necessitates that it be shunted with a resistance, preferably of the non-linear type (thyrite), which will absorb the inductive voltage surges which accompany rapid changes in the control current.

The D-C Amplifier

In Figure 2 are shown the basic elements of the d-c amplifier used to

(*Continued on page 25*)

CAPABILITIES.....25 kw zero to 110 Mc.

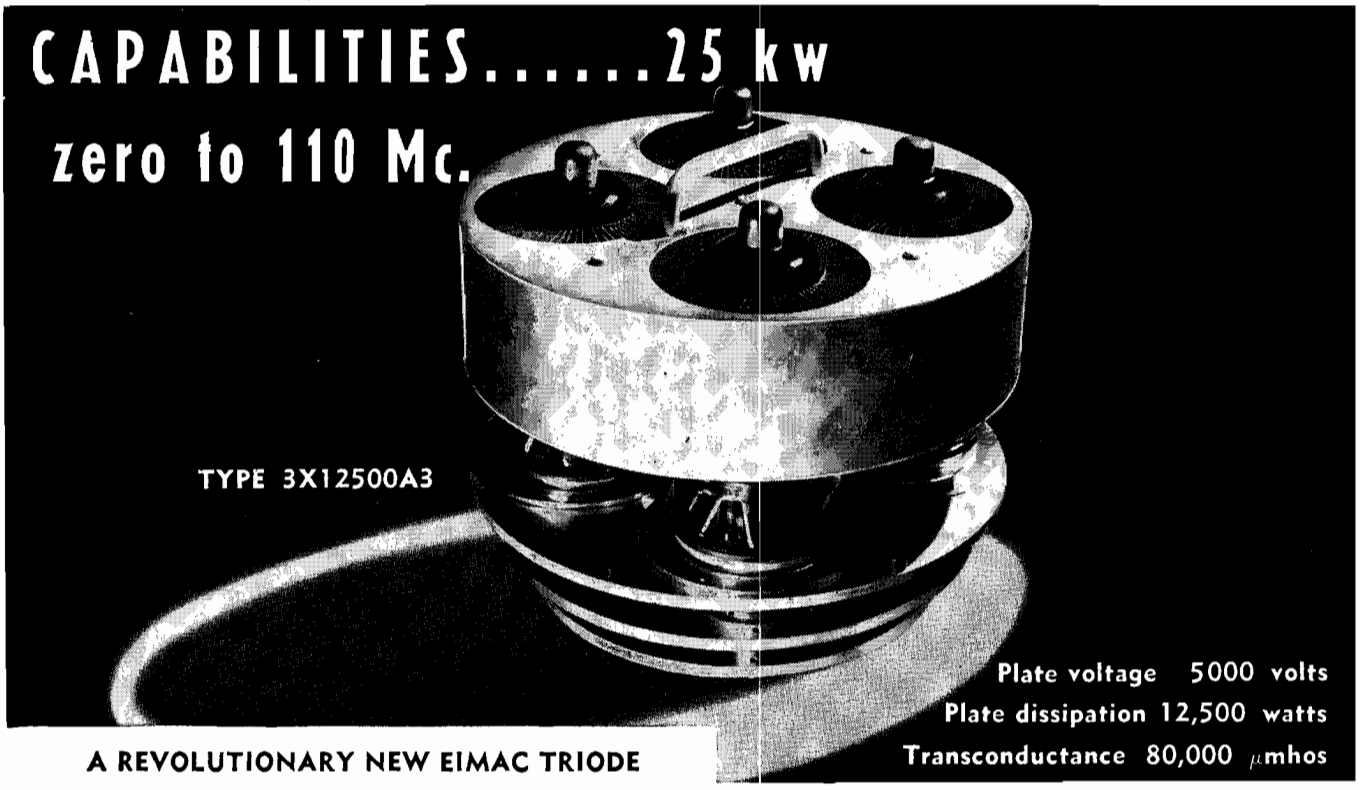

Plate voltage 5000 volts
Plate dissipation 12,500 watts
Transconductance 80,000 μmhos

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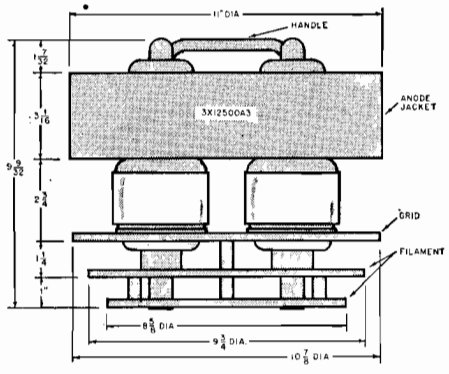
Research



RADIO FREQUENCY POWER AMPLIFIER
Grounded-Filament Circuit

Class-C Telegraphy (Key-down conditions, per tube)

MAXIMUM RATINGS (Frequencies below 85 Mc.)

D-C PLATE VOLTAGE	5000 MAX. VOLTS
D-C PLATE CURRENT	8 MAX. AMPS.
PLATE DISSIPATION	12,500 MAX. WATTS
GRID DISSIPATION	600 MAX. WATTS

TYPICAL OPERATION (Frequencies below 50 Mc., per tube)

D-C Plate Voltage	3500	4000	5000 volts
D-C Grid Voltage	−420	−360	−400 volts
D-C Plate Current	7.2	6.4	8 amps
D-C Grid Current	2	1.7	1.9 amps
Peak R-F Grid Input Voltage	735	630	710 volts
Driving Power (Approx.)	1.3	0.95	1.35 kw
Grid Dissipation	480	350	590 watts
Plate Input	25.2	25.6	40 kw
Plate Dissipation	5.2	5.6	10 kw
Plate Power Output	20	20	30 kw

RADIO FREQUENCY POWER AMPLIFIER
Grounded-Grid Circuit

Class-C FM Telephony or Telegraphy

MAXIMUM RATINGS (Frequencies below 110 Mc.)

D-C PLATE VOLTAGE	4000 MAX. VOLTS
D-C PLATE CURRENT	8 MAX. AMPS.
PLATE DISSIPATION	12,500 MAX. WATTS
GRID DISSIPATION	600 MAX. WATTS

TYPICAL OPERATION (110 Mc., per tube)

D-C Plate Voltage	3700	4000 volts
D-C Grid Voltage	−450	−550 volts
D-C Plate Current	7.2	7.4 amps.
D-C Grid Current	0.9	1.1 amps.
Driving Power (approx.)	6.4	7.6 kw
Useful Power Output	27.4	30 kw
Apparent Overall Efficiency	102	101 per cent

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THE Treasury Department and the banks of America are making it possible for farmers, doctors, and other self-employed people to participate in "automatic" Bond buying by special arrangement with their banks. This extension of the Savings Bonds program is not a partial payment plan and is intended *only* for people who are not in a position to take advantage of the Payroll Savings Plan.

The Treasury Department acknowledges with appreciation the publication of this message by

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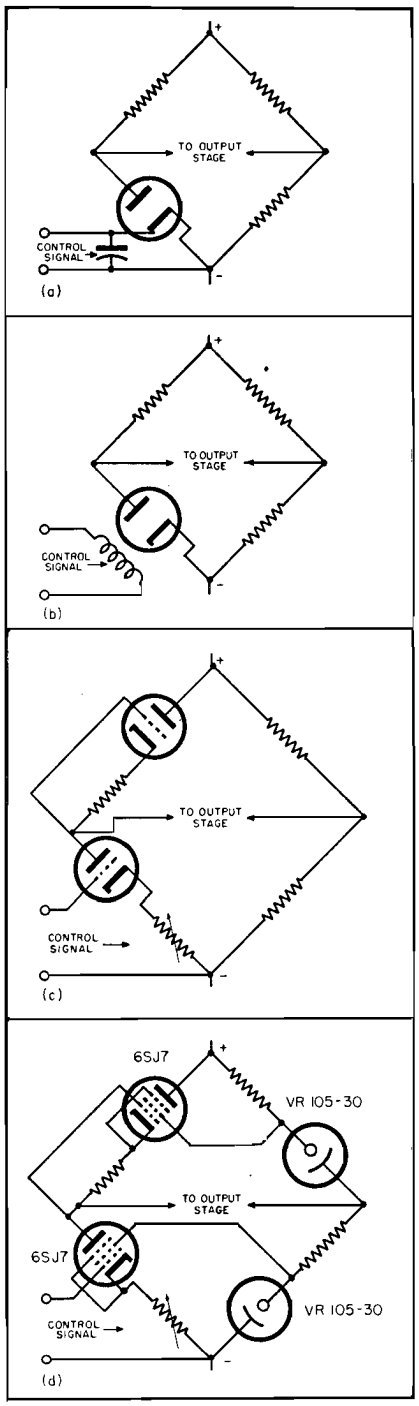


Figure 3*a*, *b*, *c* and *d*

Four types of voltage-sensitive bridges. In *a* appears a circuit of a temperature-limited diode. In *b* we have a magnetically-controlled diode circuit. A series-balanced d-c amplifier bridge circuit is shown in *c*. In *d* appears a modification of the bridge shown in *c*, using pentodes. The circuit shown in *a* is similar to the type used in the Nobatron made by Sorenson.

energize the control winding of the reactor. The control signal is obtained directly or through a voltage divider from the rectifier load and is then fed to a voltage-sensitive bridge, which in turn produces the required changes in the plate current of the output stage. In addition to providing adequate gain for the purpose, the combination of a voltage-sensitive bridge and a single direct-coupled stage of amplification is simpler, more economical, and less subject to drift than the usual multi-stage d-c amplifier.

The voltage-sensitive bridge is actually a conventional bridge circuit, in which one of the resistive arms has been replaced by the plate resistance of a vacuum tube.

In Figure 3*a* appears a very effective bridge arrangement. Here, the variable arm of the bridge consists of a specially constructed emission or temperature limited diode.[5] The control signal from the load is used to energize the tungsten filament of the tube and thus will control its plate resistance. Since the emission of a tungsten filament varies as the seventh power of the filament voltage, the control signal will be considerably amplified at the output of the bridge.

Oscillation or hunting of the load voltage is sometimes experienced with this circuit depending, on the gain of the feedback loop and the overall circuit arrangement, and can be prevented by slightly increasing the response time of the bridge.[6] This can be accomplished by shunting the filament of the diode with a small capacitor of .01 to .1 mfd, Figure 3*a*.

Isolated Feedback Loop

The bridge circuit in 3*b* employs a newly developed magnetically controlled diode[7, 8] as its variable element, and is very useful in applications in which the feedback loop must be isolated from the load circuit. In this case, the control signal is used to energize a solenoid mounted coaxially on the diode, and the changes in the magnetic field of the solenoid resulting from signal variations are thus amplified and appear at the output of the bridge. An additional advantage of this arrangement is the fact that a wide range of control signal voltages can be accommodated merely by selecting the proper control solenoid.

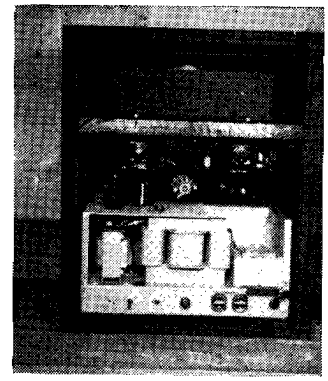


Figure 5

Front view of a low-voltage regulated supply constructed by Smith and Thienpont.

Series-Balanced D-C Unit

A voltage-sensitive bridge having an extremely rapid response time may also be based on the series balanced type of direct-current amplifier.[9] In this circuit, 3*c*, two of the resistive arms of the bridge circuit are replaced with identical triodes. The triode in the upper arm stabilizes the bridge for changes in both the supply voltage of the bridge and the plate resistances of

(*Continued on page 43*)

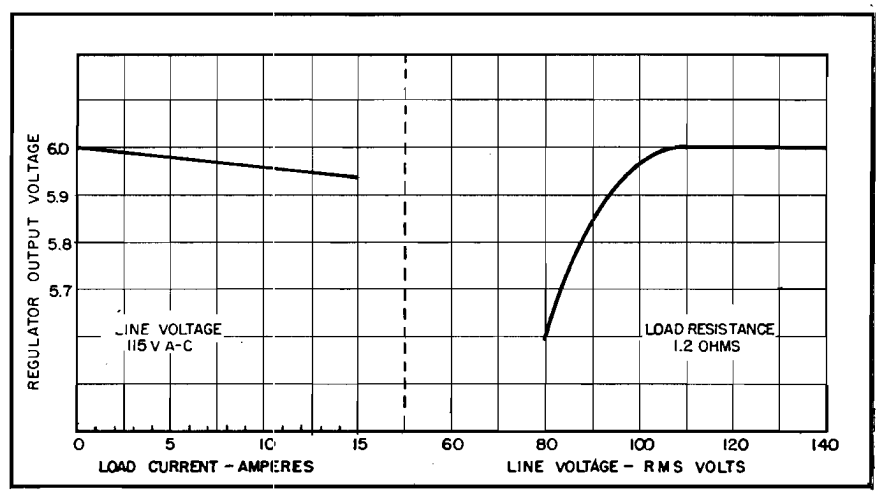


Figure 4

Regulation characteristics of a typical low-voltage regulated power supply.

News Briefs

INDUSTRY ACTIVITIES

Max F. Balcom, vice president and treasurer of Sylvania Electric Products, Inc., has been elected president of RMA to succeed Ray C. Cosgrove, general manager of the Crosley Division, who concluded three years of service as RMA head.

Leslie F. Muter, of the Muter Co., has been reelected RMA treasurer for his thirteenth term.

Dr. W. R. G. Baker, vice president of General Electric Co., has been reappointed director of the RMA engineering department and remains a member of the board of directors.

R. E. Carlson, vice president of Tung-Sol Lamp Works, and **W. J. Barkley,** executive vice president of the Collins Radio Company, have been elected vice presidents of RMA.

The directors also reelected three other vice presidents: **Paul V. Galvin,** president of Motorola, Inc.; **J. J. Kahn,** president of Standard Transformer Corp.; and **Allen Shoup,** president of Sound, Inc., all of Chicago.

Uniform f-m receiver dial marking, using mc listings instead of FCC channel numbers, was recommended to the RMA set division by chairman Paul Galvin. This recommendation concurs with that of the RMA engineering department. Its adoption by set manufacturers is optional.

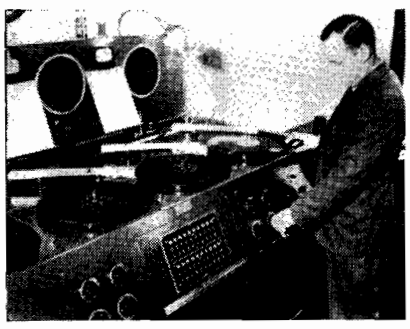
A one-way tv-relay circuit, operating in the 2,000-mc region between New York City and Schenectady, N. Y., has been proposed by G. E. to the FCC.

G. E. has been relaying tv programs from New York City for the past 7 years on an experimental basis. Signals have been beamed from a transmitter atop the G. E. office building at 570 Lexington Avenue, New York City, to a relay station on Beacon Mountain, 55 miles north from New York, and then on to Round Top Mountain, 55 miles away, where another relay tower transmits them 29 miles to the Helderberg mountains. Picked up by a third relay tower there, the signals are sent 14 miles to the Schenectady terminus.

At present the microwave relay circuit uses separate carriers for the sound and picture components of the signal but it is planned to convert the present system so as to require use of only one of the microwave channels for handling both aural and visual signals.

A turntable console with a bank of four Fairchild turntables equipped with vertical-lateral pickups, each pickup having its own filter network and built-in cue circuit with separate cueing loudspeaker, has been developed by technicians of WJR, Detroit, under direction of control chief Fred Friedenthal.

The console, custom built by Fairchild Camera and Instrument Corp., also has built in talk-back equipment connected directly to the announcers' standby and spot studios. Console is so designed that each table can be fed to a different circuit or mixed on one channel. Two separate amplifiers have been wired in, one handling the left two tables, the other the right pair.



Four-turntables in operation at WJR with audio supervisor Fran Jennings adjusting filter pads prior to cueing station break transcribed spot announcement.

Relay manufacturers have formed a national association, NARM. President is Ralph T. Brengle, of Potter & Brumfield Sales Company, Chicago.

Initial goal of the organization is the establishment of a code of standards by which electrical relays may be tested and rated.

C. P. Clare, of C. P. Clare and Company, has been named vice president; and J. J. Rowell, of Guardian Electric Manufacturing Company, secretary-treasurer.

The E. F. Johnson Company, Waseca, Minnesota, has purchased the *Speedx* line from the Les Logan Company, 530 Gough St., San Francisco 2, California. The line includes *Speedx* bakelite and metal hand keys, high-speed semi-automatic keys, and practice sets and buzzers for amateur and commercial work.

Magna-Metal Products Co., manufacturers of powdered iron cores, have moved their offices from New York to 4 South Street, Stamford, Conn.

Solar Manufacturing Corp. and its wholly owned subsidiary, Solar Capacitor Sales Corp., has moved its general offices to its main eastern plant at 1445 Hudson Boulevard, North Bergen, N. J.

Airadio, Inc., has developed a variable-capacitor test jig consisting of a dual-modified Schering bridge with built-in minimum compensators, which permits, simultaneously, electrical indexing of the oscillator section and the tracking of the antenna section. Bridge is sensitive to capacitance changes of 0.1 mmfd. It can be calibrated to ±0.1 mmfd and will retain its calibration to ±0.3 mmfd for four hours.

* * *

PERSONALS

Karl Kramer, Jensen Mfg. Co., has been elected chairman of the Chicago section of the Institute of Radio Engineers. **Kenneth Jarvis,** consulting engineer, has been named vice chairman, and **Don Haines,** Hytron Radio Corp., secretary-treasurer.

J. B. Minter, chief engineer of Measurements Corporation, recently delivered a paper on a *Megacycle Meter* before the Radio Club of America meeting held in Pupin Hall, Columbia University.

S. P. Taylor, distributor sales manager, radio division, Western Electric Company, has been reelected chairman of the transmitter division of the RMA.

Richard B. Carland has been appointed sales promotion manager of the wire and cable department of United States Rubber Company, 1230 Avenue of the Americas, New York.

C. W. Henderson has joined Clarostat Mfg. Co., Inc., as sales engineer in the Philadelphia area.

Joseph M. Weldon has been appointed assistant to vice president H. J. French, of The International Nickel Company, Inc.

Charles H. Singer has been named vice president and secretary of WMID, a new 250-watt a-m station in Atlantic City, N. J. Station operates on 1340 kc.

John D. Woodward is now manager of the RCA aviation equipment engineering group. Mr. Woodward will supervise the development and engineering of aviation radio communication and navigation equipment for both commercial and military aircraft.

A. M. Wiggins, research director of Electro-Voice, Inc., Buchanan, Michigan, returned recently from a survey of electro-acoustic developments in Germany.

Herbert C. Elwes has become manager of commercial sound sales in the RCA engineering products department.

Terry P. Cunningham has been appointed advertising manager of the radio tube, electronics and international divisions of Sylvania Electric Products, Inc.

Harold Wengler has rejoined Altec Lansing Corporation, 250 West 57th Street, New York 19, N. Y., and has been named manager of advertising and publicity.

Daniel E. Noble and **Donald H. Mitchell** recently received War Department Certificates of Appreciation.

The certificate presented to Noble, vice president of the communications and electronics division of Motorola, Inc., expressed appreciation for his "outstanding contribution to the war effort in the development of Radio Set SCR-300 and VHF radio teletype communications." Mitchell, director of Motorola engineering, was commended for his service "in a position of trust and responsibility" in "assisting in the research, development and production of Radio Set SCR-536."

Harry M. Dexter has become sales manager of the Continental-Diamond Fibre Company, Newark, Delaware. He was formerly in charge of the Cleveland sales office.

W. Austin Ellmore has been appointed sales manager and chief engineer of Cresent Industries, Inc.

Ellmore was formerly with Utah Radio as vice president in charge of sales and engineering.

Andrew A. Foley, 1518 Walnut Street, Philadelphia, will cover Philadelphia for Astatic as a manufacturer's representative.

Richard W. Bellew has become manager of the amateur sales department of Collins Radio Company, Cedar Rapids, Iowa.

(Continued on page 37)

R. W. Bellew

Antenna Tower Design

A Review of the Features of Self-Supporting and Guyed-Wire Towers Used for A-M, F-M and TV.

by RALPH G. PETERS

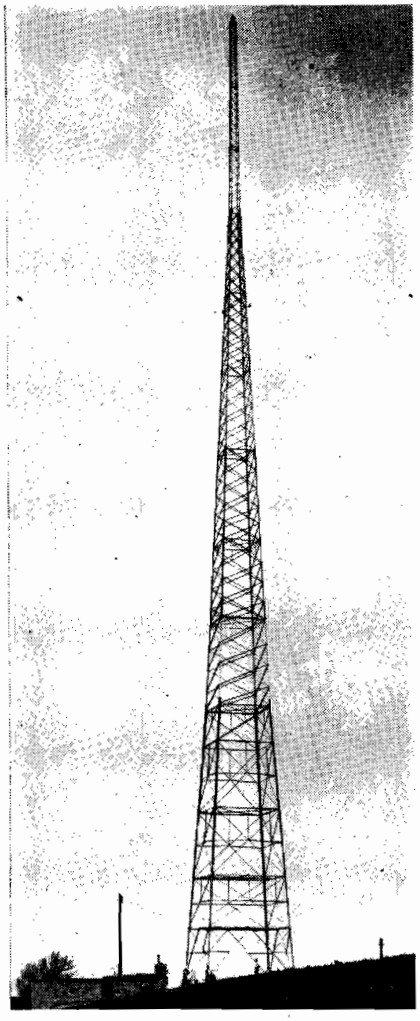


Figure 4

The 300′ antenna recently installed by WPIT Pittsburgh. Antenna, built by Blaw-Knox, is of the self-supporting type and was built to accommodate an f-m antenna on top of the tower.

THE PAST FEW YEARS have seen significant progress in the development of self-supporting and guyed antenna towers for aural and video services.

Self-Supporting Types

Self-supporting structures available today will withstand wind pressures of 20 to 30 pounds. For a-m,[1] heights of 120′ to over 400′ are available.

F-M/TV Antennas

For the support of f-m or television antennas or combinations of both,[2] towers that are up to 575′ in height are available. These towers, which will also stand a 20- to 30-pound wind pressure, will support antennas weighing from 1,600 to 4,000 pounds. These towers will accommodate antennas from 20′ to 35′ above the top of the tower.

Ladders

Inside climbing ladders with rest and lighting platforms are features of these towers. The platforms are so arranged that transmission line, used with f-m and television systems, can be installed and serviced from an inside climbing ladder.

Standardzation

Tower design today has reached the age of standardization with the result that the RMA has set up a series of proposed standards for self-supporting structures. In these standards, RMA states that structures up to 600′ in height should be designed for a horizontal wind pressure of 20 pounds per square foot on flat surfaces and 13.3 pounds per square foot on cylindrical surfaces, where the antenna is not to be located within city limits. Structures of more than 600′ in height, as well as those of any height located within city limits should, according to RMA, withstand a horizontal wind pressure of 30 pounds per square foot on flat surfaces and 20 pounds per square foot on cylindrical surfaces.

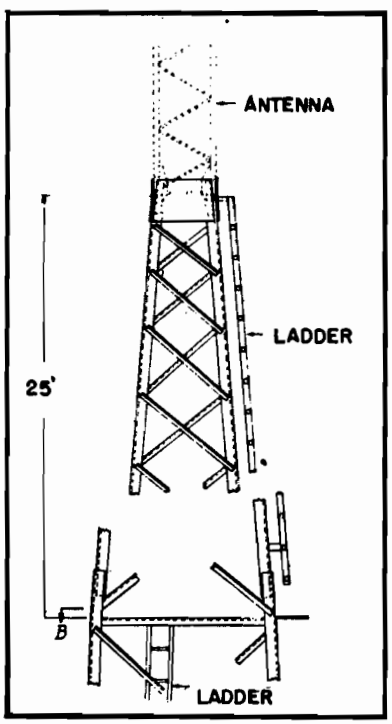


Figure 2a

Details of the *butt-type* antenna mounting used on the f-m or television antenna tower.

Guyed Towers

Substantial developments have also been made in the guyed type of tower.[3] Towers, with single or double guys, are available without insulators for the support of an f-m or television antenna, or with suitable base and guy insulation to permit its use as a vertical a-m radiator. Because of the custom-built characteristics of guyed structures it has not been possible to standardize on these types of towers.

[1]Blaw-Knox types CN and CH for a-m.

[2]Blaw-Knox N16, N28, H21 and H40, self-supporting towers for f-m and tv; N16 tower available in 100′ to 550′ heights; H21, 100′ to 575′ heights; N28, 100′ to 525′ heights, and H40, 100′ to 550′ heights. Towers will stand loads of 1600, 2100, 2800 and 4000 pounds, respectively.

[3]Blaw-Knox types DGN and SGN.

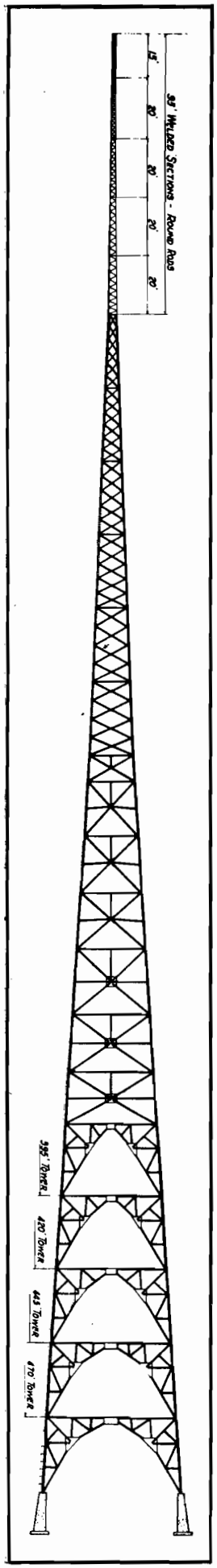


Figure 1
Self-supporting a-m vertical radiators available in heights from 120' to 495'.

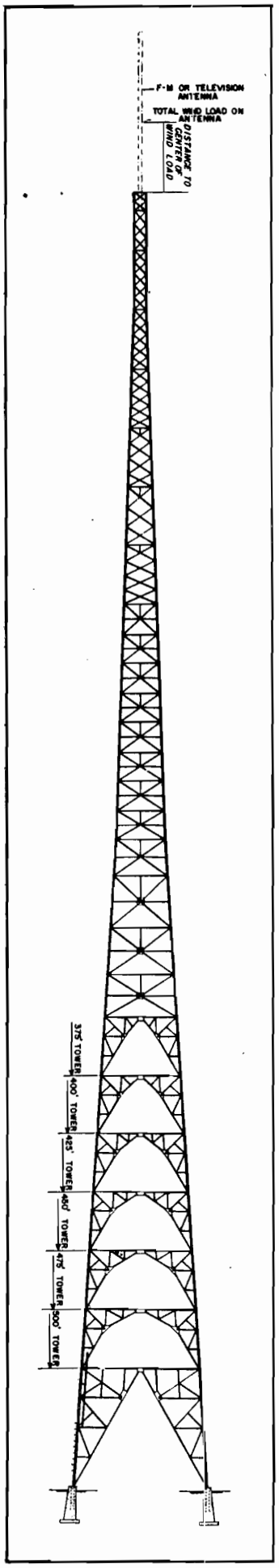


Figure 2
Self-supporting tower (100' to 550') for f-m or television antenna.

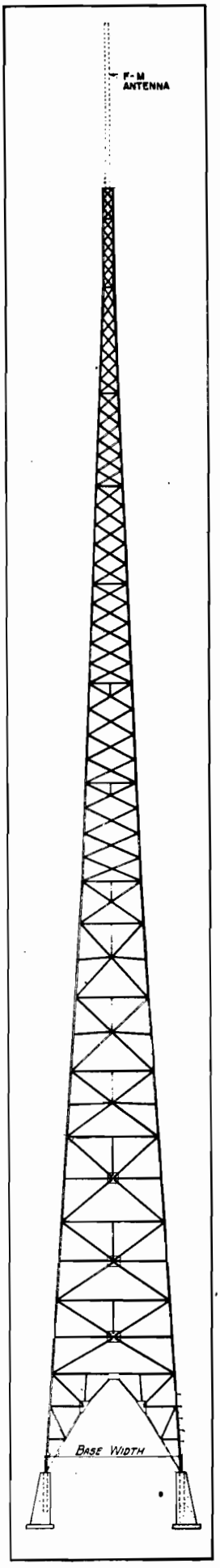


Figure 3 (right)
Construction of self-supporting tower for an f-m antenna.

VETERAN WIRELESS OPERATORS ASSOCIATION NEWS

W. J. McGONIGLE, President RCA BUILDING, 30 Rockefeller Plaza, New York, N. Y. GEORGE H. CLARK, Secretary

Personals

CONGRATULATIONS to Major General Harry C. Ingles, former Chief Signal Officer of the Army, and a veteran honorary member of VWOA, on his recent election as president and a director of RCA Institutes. VWOA presented the Marconi Memorial Medal of Service to General Ingles at the 1946 dinner-cruise. General Ingles holds the Distinguished Service Medal with Oak Leaf Cluster and many foreign government decorations. After several years service on the general staff, starting in 1935, General Ingles was assigned as Signal Officer of the Caribbean area. He then saw service in the ETO and later as Chief Signal Officer. He is the founder of the Army Signal Association. . . . Veteran member Walter C. Evans was recently elected president of the broadcasting subsidiary of the Westinghouse Electric Corp. In addition to his new duties WCE continues as vice president in charge of all Westinghouse radio activities. . . . Our good wishes to honorary member Alfred J. McCosker on his retirement as board chairman of the Bamberger Broadcasting Service and the Mutual Broadcasting System. Mr. McCosker, chairman of the board of MBS since 1934, has always been helpful in VWOA affairs. Good luck, AJM. . . . 'Jack' Poppele, life member and president of the Television Broadcasters Association, and vice president and chief engineer of WOR, has been elected a member of the board of directors of the Mutual Broadcasting System. . . . 'Bill' Simon tells us that there are some who have not yet sent in the necessary revenue for 1947. Give him a hand and send it in immediately. . . . George H. Clark, VWOA secretary, is spending most of his time up at his summer residence in New Jersey. . . . The recent acquisition by ye prexy of a renewal of *First Telegraph-First Telephone* FCC licenses assures membership in the Quarter Century Club.

•

News Notes Requested

. . . We urgently request VWOA members to mail us items for this page. It is up to you. What appears in this page depends entirely upon the material received from our members. . . . An interesting note has come in from A. W. Watt, editor of the *Australian Exporter,* published at Sydney, Australia, requesting information on the constitution and by-laws of VWOA and details for setting up an organization of wireless pioneers in the *Down-Under* continent. We shall be happy to supply Mr. Watte with the necessary details and wish him success in his pioneering endeavors. . . .

Veteran VWOA member Sam Schneider with one of the radiofoto units he operated during his tenure at O.W.I. during World War II.

Oldtimers

Old timer Ben Beckerman, who retired in 1942, after 35 years at sea, told his friends at the recent N. Y. City dinner-meeting in June that he was really enjoying his present job of "just taking it easy." . . . George Maki is now stationed out in Cedar Rapids, Iowa . . . Glad to have George Street, long chairman of the Honolulu chapter of the VWOA, back with us in New York. Enjoyed a long chat with him recently at the Waldorf. . . . Dr. F. A. Kolster is quite active these days with his antenna developments. Several of his wartime achievements have been converted into commercial applications, which should soon make their appearance on the market. . . . A real pioneer, J. M. Christianson, has recently returned to Port Jefferson, Long Island, after serving with the Navy for the duration plus. J. C. is with A. T. & T.

Trammell at WNBW Opening

HONORARY MEMBER NILES TRAMMELL, president of NBC, presided at the inaugural program of the new NBC television station, WNBW, in Washington. He said:

"This is a day that we at NBC have been looking forward to for a long time. For more than eight years, ever since our New York television station went on the air in 1939, we have been planning for this opening of an NBC station in Washington. We shall furnish programs that originate here in Washington, and also network programs from other cities. The coaxial cable between here and New York is already in operation. In the not-too-distant future we hope to be able to bring television programs direct from many other places—from Chicago and New Orleans, from Florida and California.

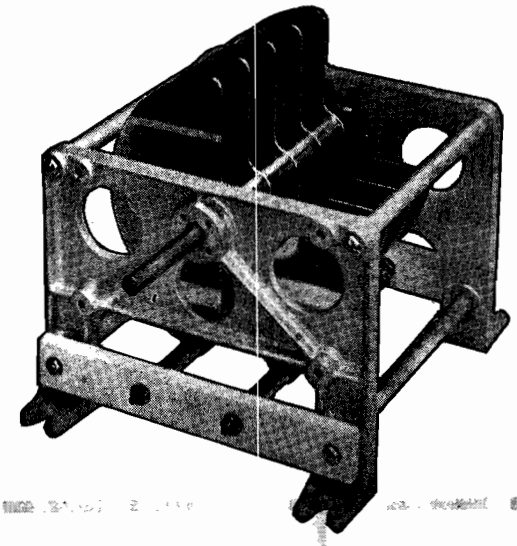
"From Washington we expect to send across the country the sight and sound of Congress in session, the reports of Government leaders to the people, not to mention the numerous objects of historical and artistic interest in which this city abounds. Most of the people in the United States will be seeing Washington for the first time when it comes to them by television.

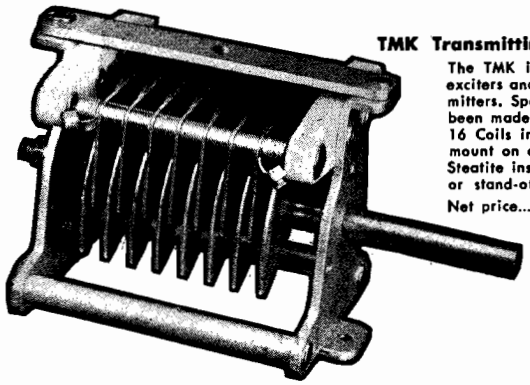
"In my opinion, television is destined to perform a very definite service in our American system of government."

TML Transmitting Condenser

The TML condenser is a 1 KW job throughout. Special Steatite insulators prevent flashovers. Thick capacitor plates provide high voltage ratings. Sturdy cast aluminum end frames and dural tie bars permit an unusually rigid structure. Precision end bearings insure smooth turning and permanent alignment of the rotor. End frames are arranged for panel, chassis or stand-off mountings.

Net price.....From $11.50 to $24.60





TMK Transmitting Condenser

The TMK is a condenser for exciters and low power transmitters. Special provision has been made for mounting AR-16 Coils in a swivel plug-in mount on either top or rear. Steatite insulation. For panel or stand-off mountings.

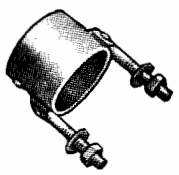
Net price.....From $2.30 To $5.11

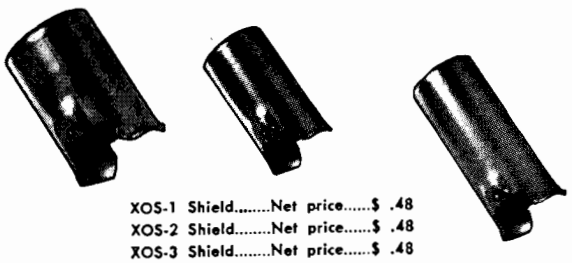
The XOA Socket for Miniature Button 7-pin base tubes is made of low-loss mica-filled bakelite. It mounts with two 4-40 screws. Terminals for the Type XOA extend axially from the socket. Type XOR is identical to Type XOA, but has terminals extending radially. Axial or radial contacts can be used in the same socket base.

XOR Type Socket....Net price....$ .50

XOA Type Socket....Net price....$ .50

The XOS tube shield is a two piece shield for Miniature Button 7-pin base tubes. It mounts with the XOA or XOR socket and is available in three sizes, XOS-1 (for 1-3/16" tube body), XOS-2 (for 1½" tube body), and XOS-3 (for 2" tube body).





XOS-1 Shield.....Net price.....$ .48
XOS-2 Shield.....Net price.....$ .48
XOS-3 Shield.....Net price.....$ .48

QUALITY

IS THE ONLY BARGAIN IN RADIO PARTS

If you're building fine apparatus, National parts will help to deliver the kind of performance your equipment must have to sell successfully in today's competitive market.

That's why National parts are a fine investment. They may cost a little more — but in return you get quality materials, careful workmanship and long-life.

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Malden, Mass.

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Please write to Department 11 National Company, for further information.

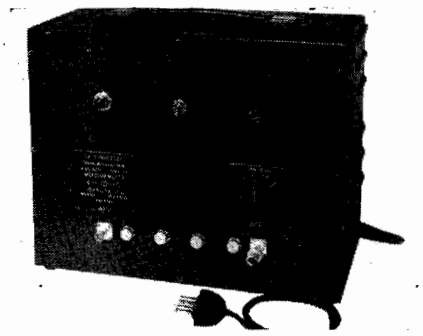
MAKERS OF LIFETIME RADIO EQUIPMENT

The Industry Offers

MEASUREMENTS CORP. CONVERTER

A converter, M-275, to be used in conjunction with the model 78 FM standard signal generator for alignment and testing of i-f amplifiers and discriminators has been developed by Measurements Corp., Boonton, N. J. Converter uses the beat frequency method of signal generation and provides output voltages of 10 microvolts to 1 volt, variable with the 78-FM attenuator, in the 4.5-, 10.7-, and 21.7-mc ranges. Provision has been made for the addition of one extra frequency.

The modification of the model 78-FM, which covers a frequency range of 86 to 108 mc, for use with the M-275, is simple as all necessary connections are made externally. When companion units are ordered, the 78-FM is modified at the factory, otherwise complete instructions and materials are provided for this operation.



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G. E. BEACON ANTENNA

A beacon antenna, type EY3A, for two-way communications in the 152-162-mc band has been made available by the transmitter division of G. E.

A multi-element antenna, the power gain is said to be about two and a half times that of the ordinary coaxial dipole. Antenna offers a circular azimuth pattern.

Terminal impedance is 50 ohms.

* * *

DUMONT VOLTAGE CALIBRATOR

A voltage calibrator, type 264-A, for measuring the peak-to-peak voltage of signals being viewed on the oscillograph screen, has been announced by Allen B. Du Mont Laboratories, Inc., Passaic, N. J.

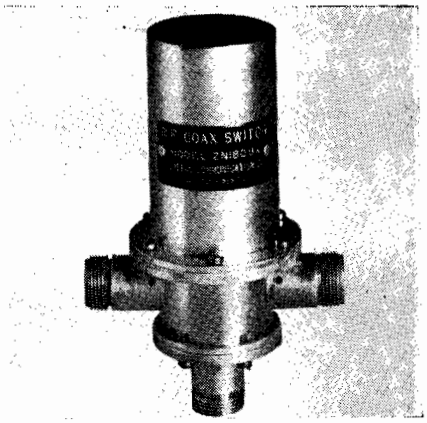
The output of the calibrator is essentially a square wave the amplitude of which is continuously variable from 0 to 100 volts. This continuously variable output is obtained from a linear potentiometer with a direct-reading calibrated dial divided into 100 divisions. Connected in parallel with the output potentiometer is a conventional, four-step decade output attenuator, providing four ranges of voltage readings: 0-0.1, 0-1, 0-10 and 0-100 volts.

GENERAL COMMUNICATION REMOTE CONTROL R-F COAXIAL SWITCH

A remote-control microwave switch has been announced by General Communication Company, 530 Commonwealth Ave., Boston 15, Mass., for antenna switching and remote control instrumentation. Switch is said to be designed to have a minimum reflection loss in the r-f range up to 5,000 mc.

The voltage standing-wave-ratio curve is said to be almost flat from 500 to 4,000 mc; at 3,000 mc it is less than 1.2.

Characteristic impedance is 50 ohms; insertion loss. 3 db at 3,000 mc; power rating 100 watts at 3,000 mc; voltage rating 500 volts peak, crosstalk 60 db.



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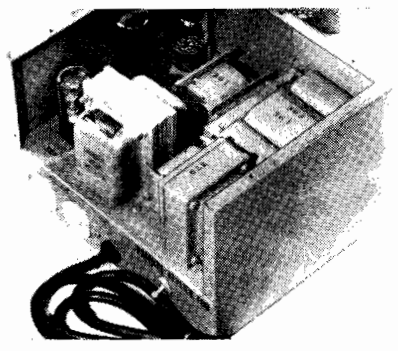
SORENSEN A-C VOLTAGE REGULATOR

A portable a-c voltage regulator, model 150, has been announced by Sorensen & Company, Inc., 375 Fairfield Avenue, Stamford, Connecticut.

Regulator has an input voltage range of 95 to 125 volts a-c with an output of 115 volts. Regulation accuracy is said to be ½ of 1% and maximum harmonic distortion is 5%. Measures 9"x7½"x6".



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RADIO-RECEPTOR MINIATURE SELENIUM RECTIFIERS

A line of miniature selenium rectifiers has been announced by the Seletron Division, Radio Receptor Company, 251 West 19th Street, New York 11, New York.

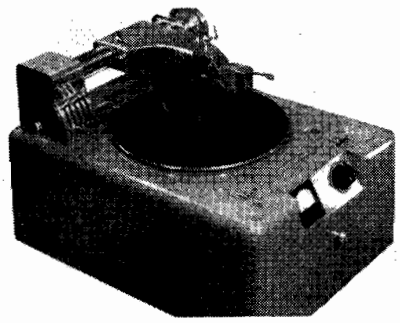
Types available include: 5M1, a 100 mil 5-plate stack 1"x1"x⅞"; 5P1, a 150 mil 5-plate stack 1 3/16"x1 3/16"x⅞"; and the 5Q1, a 250 mil 5-plate stack 1½"x1½"x⅞".

ROBINSON RECORDER

A professional recorder has been announced by the Robinson Recording Labs., 2022 Sansom St., Philadelphia 3, Pa.

Chassis, built on a cast aluminum bedplate, features a cast-in control panel for VI meter, fader and switches. Cutter carriage is made in two styles which will accommodate any existing type of recording mechanism. The standard type, illustrated, accommodates RCA, Presto and other popular small cutting heads. A second type of carriage is made for WE wax cutters. Vertical vee-slide block permits adjustment of cutting needle angle, accommodating all cutting needle lengths. A four-to-one internal gear wheel for spiraling is provided on the right-hand end of the mechanism.

There are five pitches available by means of five levers projecting from the pitch change box; pitches are 85, 100, 120, 130 and 140 lines per inch. Pitch can be changed instantaneously, and while recording.



* * *

BROWNING F-M/A-M TUNER

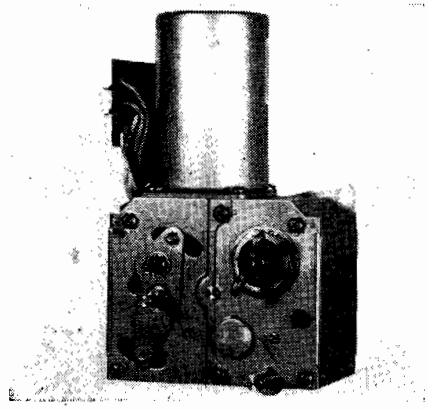
An f-m/a-m tuner, model RJ-14, in rack panel style, has been announced by Browning Laboratories, Inc., Winchester, Mass.

The a-m section is of the superhet type employing an r-f stage. The f-m section uses the Armstrong circuit with dual limiters and covers the 88 to 108-mc band. The r-f stage, mixer, and oscillator are of the miniature type.

* * *

COLLINS AUTOMATIC-POSITIONING MECHANISM

An automatic control device, type 496A autotune, which can be operated from a remote position using either push buttons or a tap switch, has been announced by the Collins Radio Company, Cedar Rapids, Iowa. Provides 10 positions with each position independently adjustable over a 360° rotation of a positioned shaft. Reset accuracy is said to be within .05°. Standard unit provides unidirectional rotation



of the control shaft; reversible models are available.

Can be built for operation from any a-c or d-c voltage. Operating time is a maximum of six seconds; output torque is a maximum of 6 inch pounds.

* * *

ERCO FREQUENCY-SHIFT EQUIPMENT

Frequency-shift telegraph equipment comprising keyer-converter, receiver and exciter has been announced by Erco Radio Laboratories, Inc., Garden City, N. Y.

Keyer-converter, 216-S, is for converting output of receiver to polar voltage, Has calibrated self contained **mark-space** frequency measuring circuit. Internal polar relay or adjustable polar voltage outputs. Capable of keying speeds of better than 500 wpm.

Receiver, 87-R, is crystal controlled, with channel change over by means of pretuned plug-in coil-crystal tray. Image rejection said to be 70 db at 4 mc and 55 db at 20 mc.

Exciter, 177-T, is for keying transmitters by frequency-shift method. Crystal controlled; provisions for 3 frequencies. Mark and space frequencies both adjustable.

* * *

CLOUGH BRENGLE AUDIOMATIC GENERATOR

An *audiomatic generator*, type CB182A, has been announced by the Clough Brengle Company of 6014 Broadway, Chicago 40, Illinois.

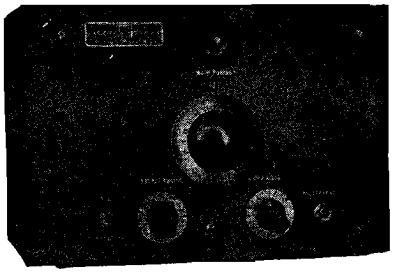
Designed on the automatic beat-frequency principle, unit, coupled with a standard oscillograph, is said to visually portray the entire frequency-amplitude characteristic of the circuit being tested. Sweep rate of from 5 to 8 seconds.

* * *

COLUMBUS ELECTRONICS F-M MODULATOR EXCITER

A f-m modulator exciter, model FMO-428, has been developed by Columbus Electronics, Inc., 229 S. Waverly Street, Yonkers, N. Y.

Reactance modulator for narrow band f-m. Output on 80, 40, 20 and 10 meters. Visual indication of frequency deviation. Bulletin S-1 contains full details.



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TELEX MONOSET VOLUME-CONTROL UNIT

A volume-control unit has been added to the monoset, manufactured by the electro-acoustic division of Telex, Inc., Minneapolis, Minn.

Unit is on the main cord.

* * *

HYTRON V-H-F TRIODE

A medium-power v-h-f triode for operation as an oscillator and amplifier at 50 to 430 mc has been developed by Hytron Radio and Electronics Corp., Salem, Mass.

Has a thoriated-tungsten instant-heating filament. Filament and plate potentials can be

(Continued on page 34)

The Industry Offers

(*Continued from page 33*)

applied simultaneously. The plate and grid connections are made to caps at the top of the bulb for maximum efficiency in line-tank oscillators.

Can be used as an r-f power amplifier and oscillator in class C telegraphy and frequency modulation and amplitude-modulated r-f power amplifier and oscillator in class C telephony.

Filament potential, a-c or d-c, 6.3 ±5%; current, 2.6 amperes; amplification factor, 9.6.

* * *

U. S. RUBBER CO. ALUMINUM WIRE

Insulated aluminum electrical wire has been announced by the wire and cable department of United States Rubber Company, Rockfeller Center, N. Y.

Complete data on the electrical and mechanical characteristics appear in a 32-page booklet, *Aluminum Building-Wire Handbook*.

* * *

AEROVOX MOTOR-CAPACITOR SERVICING KIT

A motor-capacitor servicing kit that determines the right capacitance in the absence of such information or indentification, and provides that capacitance until standard replacements are available, has been announced by Aerovox Corporation, New Bedford, Mass.

Kit features a capacitor selector which clips in place of the defective motor-starting capacitor. Five toggle switches are flipped until the quick-

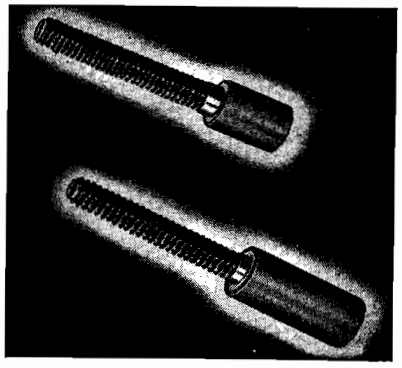
est start is obtained within safe voltage limits as indicated by the voltmeter. The correct capacitance value is read from the *on* switches.

* * *

STACKPOLE POLYTITE TRIMMER ELECTRODE CORES

Molded Polytite trimmer electrode core forms have been announced by the electronic components division of the Stackpole Carbon Company, St. Marys, Pa. The molded Polytite is said to have a high dielectric constant. Cores are moisture repellent and carry a heavy dielectric coating. Electrode surfaces have short, symmetrical current paths, and inductance may be kept low enough for use in the 200-megacycle range.

Trimmers suited for minimum capacity adjustments in tuned circuits where they may be installed, either across the tuning capacitor or across the tuning inductance. Where desired, trimmers may be mounted directly to tuning capacitors.



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C-D PLUG-IN ELECTROLYTICS

A line of plug-in electrolytic capacitors, type QC, has been announced by Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

Units are hermetically sealed in round aluminum containers and are provided with a four-pin octal-base mounting.

Bulletin No. 100-425 contains complete capacitor data.

* * *

ELECTRONIC LAB. CONVERTER

A converter for operation of coin-operated phonographs and other motor-driven or radio-amplified equipment has been developed by Electronic Laboratories, Inc., Indianapolis.

Unit has been designed for 110 d-c line operation to operate devices up to 400 watts, 60 cycle, 110 volts a-c.

* * *

G. E. ALUMINUM-BACKED TV PICTURE TUBE

A ten-inch aluminum-backed tv-picture tube, type 10FP4, has been developed by the tube division of G. E.

Maximum ratings of the 10FP4 include an anode voltage of 10,000; grid No. 2, accelerating electrode, voltage of 410; grid No. 1, control electrode, —125 volts.

Constructed with a small-shell 7-pin duodecal base. Under typical operating conditions, the focusing coil current, d-c, requires about 100 ma.

* * *

PICKERING CARTRIDGE

A ½-ounce cartridge with a high-impedance magnetic head has been announced by Pickering & Co., Inc., 29 W. 57th St., N. Y. 19, N. Y. Keystone clip mounting is said to permit adjustment for minimum tracking error.

Cartridge is said to have output which is flat from 40 to 10,000 cps from constant-velocity recordings. Output voltage for a stylus velocity of 10 cm per second is 70 millivolts, designed to be fed directly into the grid of an amplifier tube.

Has a .003" permanent sapphire stylus.

Cartridge has a d-c resistance of 500 ohms, with an inductance of 20 millihenries. Frequency at which the lateral stiffness of the moving system resonates with the mass of the cartridge alone is approximately 40 cps.

* * *

BUGGIE MOBILE ANTENNA

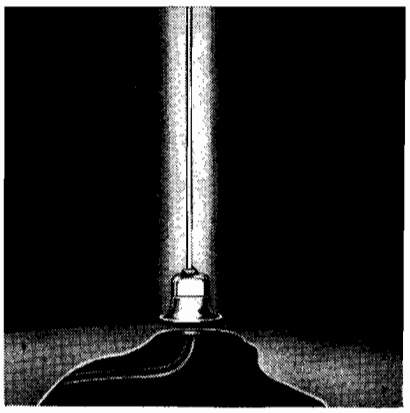
A single-hole mount antenna for mobile radiophone service featuring a self-threading plug

(*Continued on page 36*)

The Industry Offers

(*Continued from page 35*)

and a watertight sealing assembly has been announced by H. H. Buggie & Company, Toledo 1, Ohio.



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WHEELOCK COAXIAL CABLE RELAY

A coaxial cable relay for the switching of antenna from receiver to transmitter, has been developed by the Signal Engineering & Mfg. Co., Dept. CR20, 154 West 14th St., New York 11, N. Y.

Relay embodies a single-pole, double-throw switch with the current carrying elements contained within a cavity; characteristic impedance of 75 ohms.

All current-carrying parts are silver plated. Contacts are silver, and are welded or silver-soldered to the current-carrying elements. Threaded nipples for cable connectors are ⅛"x24 thread.

Actuating magnet may be wound for operation on d-c or a-c; 6, 12, 24, 32 and 110 d-c, and 115 or 230 a-c.

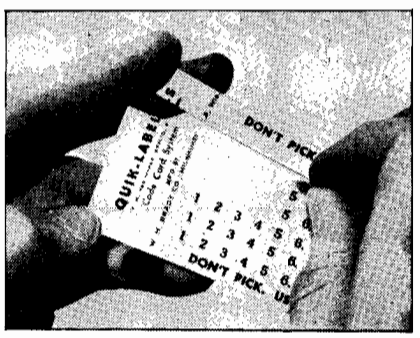
* * *

BRADY COMPANY WIRE MARKERS

Self-adhesive *quik-label* wire marker cards with two *self-starter strips* have been announced by W. H. Brady Co., Dept. 97, 815 North Third Street, Milwaukee 3, Wisconsin.

With self-starter feature 1½" labels can be cut in half to make each label ¾" long.

The first *self-starter strip* aids in the removal of one row of ¾" long *quik-labels* by automatically exposing the end of each label. The second *self-starter strip* is removed to expose the ends of the ¾" long labels in another row.



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ECKSTEIN COMMUNICATIONS AUTO MODEL

A communications auto radio, Karadio 80, has been developed by the Eckstein Radio and Television Co., 914-16-18 LaSalle Ave., Minneapolis 2, Minn. Sets are furnished in three models:

Model 80A, designed for the amateur, with two short-wave bands in the amateur frequency as well as the standard broadcast band.

Model 80B for the aircraft frequencies; radio range and tower frequencies, or 190 to 450 kc; broadcast band, and band three for 2.4 to 6.8

(*Continued on page 42*)

News Briefs

(*Continued from page 26*)

LITERATURE

The RCA tube department has prepared a *Quick Selection Guide* offering technical data on more than 200 RCA transmitting and industrial tubes.

In abridged folder form, the guide presents dimensions, ratings, etc. Tube types covered include power tubes, thyratrons, voltage regulators, rectifiers, ignitrons, phototubes, cathode-ray tubes and special tubes.

Premier Metal Etching Company, 21-23 44th Ave., Long Island City 1, New York, have prepared a 2-page bulletin on etched and lithographed metal name and trademark plates.

The G. E. plastics division has prepared a 64-page booklet on Textolite laminated plastics.

The booklet lists 44 grades of the sheet material along with their electrical, physical and mechanical properties.

The G. E. metallurgy division, Pittsfield, Mass., has prepared a 36-page booklet on permanent magnets. Data presented includes p-m characteristics, applications and designs.

Federal Telephone and Radio Corporation, 100 Kingsland Road, Clifton, N. J., have released a 16-page booklet describing multi-channel l-f/h-f/v-h-f communication transmitters for ground-to-air and point-to-point service.

Hytron Radio and Electronics Corp., Salem, Mass., have prepared a 4-page transmitting and special-purpose tube catalog.

Presented are data on low and medium-mu triodes, zero-bias triodes, v-h-f triodes, v-h-f miniature and acorn r-f pentodes, rectifiers, gaseous voltage regulators, etc.

Irvington Varnish & Insulator Company, Irvington 11, N. J., has prepared a wall chart presentation of essential physical, chemical and electrical data on insulating varnishes.

The Concord Radio Corporation, 901 West Jackson Blvd., Chicago 7, Illinois, have issued a 72-page catalog supplement, featuring sets, parts, record players, changers, sound equipment, ham gear, test equipment, etc.

Shure Brothers, Chicago, have released two catalogs, describing microphones and pickups.

Catalog 157, covering microphones, features data on the multi-impedance "Unidyne" and "Sonodyne" dynamics, and two new crystal microphones, the "Monoplex" and the "Versatex."

Catalog 158, on pickups, features data on the "Muted Stylus" pickup, cartridge, and needles, the cartridge replacement "Pack" and lever-type cartridges.

The General Radio Experimenter, for May, contains an article on "Connection Errors in Capacitance Measurements," by Robert F. Field.

The Radio Engineering Laboratories, Inc., 35-54 36th Street, Long Island City 1, N. Y., have prepared a 4-page leaflet describing f-m broadcast receivers.

•

RCA TV ENGINEERING CLINIC

Frank M. Folsom, executive vice president in charge of the RCA Victor division discussing features of the 16-mm television motion picture projector with a group of broadcasters who attended a television engineering clinic recently held in Camden, N. J. Left to Right, are: George S. Johnson, KOB, Albuquerque; J. Duncan, WLW, Cincinnati; G. O. Milne, American Broadcasting Co., New York; Mr. Folsom; Merrill A. Trainer, manager of the RCA television equipment sales section; Dan Hunter, WMAL, Washington, D. C.; E. J. Meehan, Jr., of the RCA television equipment sales section; Paul Wittlig, CBS, New York; John M. Sherman, WTCN, Minneapolis; and Cliff Denton, of the New York Daily News.

TV Remote Pickups

(*Continued from page* 14)

work program is received from a station on a different power supply system than that supplying the receiver or local broadcast station.

Pulse Timing and Amplitude During Switching

It is expected that many television programs broadcast from any one transmitter will originate from a number of different locations. For instance, during one 15-minute program it may be necessary to switch frequently between the signals originating at a local studio, signals received from a telemobile unit or signals received from a television network relay system. Strictly speaking, since these signals are all broadcast from the same transmitter the standard specifying the maximum allowable rate of change of frequency of the horizontal synchronizing pulses may be considered to apply. However, no equipment for producing this result in a satisfactory manner has been developed nor is it certain that satisfactory performance requires that it should be. If the horizontal hold circuits at a television receiver can follow frequency variations of 0.15% per second, then if a phase difference between the horizontal pulses from the two signals involved in the switching operation is one-half the period of a horizontal line, the time required to synchronize with the new signal will be approximately 1/5 of a second. It is expected that the horizontal scanning circuits in most receivers will respond even faster than this so that very little disturbance will be noticed due to this difference in phase between the horizontal pulses of the two incoming signals.

A difference in phase between the vertical blanking signals involved in a switching operation can be very much more objectionable, because of the sudden appearance of the vertical blanking signal as a horizontal black bar in the received picture after the switching operation is completed, unless precautions have been taken to keep the two vertical blanking signals approximately in phase. The fading out of one signal and fading in of the second will partly overcome this difficulty but an objectionable transient in the vertical hold circuit may still cause annoyance. A proposed standard would require that this phase difference between the two vertical blanking signals should not exceed ±5% of one vertical frame. If the two synchronizing generators originating the ver-

tical blanking signal are connected to the same power supply system this adjustment can be made manually and satisfactory operation obtained unless the lock-in circuits in the sync generators permit a wide variation in phase between the vertical blanking signal and the power supply frequency. When the two synchronizing generators are on separate power supply systems means should be provided to adjust the phase of the local synchronizing generator each time that a switching operation is performed involving a remote signal.

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F-M Installation

(*Continued from page* 13)

WOPI-FM went on the air using a 26″ temporary antenna and a reduced power of 3 kw. With this setup r-f power was evident everywhere in the building. Lights in the building continued to burn after they had been turned off. Metal strips around the operating console became warm. It was possible to develop a considerable fever, just by standing near the antenna. This situation, of course, was corrected when we started using full radiated power of 10.4 kw and the turnstile antenna on January 4, 1947.

All broadcasts from the mountaintop transmitter are, at present, for test purposes only. However 25-watt 214-mc s-t link equipment is on hand, and this will make it possible to broadcast commercial programs from the Bristol studios of WOPI-FM.

Our commercial schedule will provide for broadcasting from 9:30 A.M. to 2 P.M. and 5:30 to 10:30 P.M.

Listener reports have indicated excellent coverage. With the temporary antenna, reports were received 70 miles from White Top. With full power, blanket coverage has been reported within a radius of 100 miles, with other reports coming from as far as 295 miles away, in Charleston, South Carolina. Over 700 sets have been reported by radio dealers and listeners in the WOPI-FM coverage area.

Set reports with information on types of receivers in use, antennas in use, and name of set owners, are being sent in by dealers to permit the compilation of audience data and estimate commercial possibilities of our transmissions.

•

HOFFMAN-MARKOW PAPER TO APPEAR IN AUGUST

The concluding installment of the Hoffman-Markow article on *Mobile F-M Communications Equipment For* 30 to 44 *Mc* will appear in the August issue of COMMUNICATIONS.

WABD TV Antenna

(*Continued from page* 18)

other, their mutual impedance considerations are cancelled.

Performance and Compliance Specifications

A set of performance specifications was drawn up to assure compliance to good engineering practice, as related to television requirements, before an order for the complete system was released. The following summary itemizes the major requirements and the manner in which the system complied:

A—Batwing Antenna System

(Considered from *diplexer* output points through antenna.)

1—Original specifications on the antenna system imposed the following conditions:

(*a*)—Line impedance feeding *EW* and *NS* radiators, 51.5.

(*b*)—Standing-wave ratio of 1.4 or better for ±45 kc deviation from 81.75 mc *for the sound line.*

(*c*)—Standing-wave ratio of 1.1 or better for +4.0 mc −0.75 mc deviation from 77.25 mc *for the video line.*

2—Two methods of measurement were used for determining the standing-wave ratio:

(*a*)—A wobbulator-scope method which consisted of a constant amplitude r-f wobbulator tee-feeding an RG8/U solid transmission line and a high impedance detector, the output of which was connected across the input terminals of a 5″ scope. RG8/U transmission line (300′) was connected through a constant impedance *taper* fitting into the respective radiator transmission line being measured.

This method adapts itself to making rapid visual checks on the overall system performance, but is useless in determining the character of any unknown complex impedance.

(*b*)—To check the foregoing measurements we used a slotted line whose impedance and geometry were identical to the line being investigated (1⅝″). A

high-impedance, high-frequency vacuum-tube voltmeter was used to determine the standing-wave ratio and reactive displacement.[4] It is of interest to note that it was necessary to make the above measurements after 12, midnight. The f-m stations in the metropolitan area of New York City were of such intensity that they could be read on both the scope and slotted line measuring equipment resulting in a high degree of inaccuracy. When measurements gave indication of error the slotted line was used to make a standing-wave analysis, resulting in the finding of voltage minimum and voltage maximum points corresponding to the operating f-m stations.

3—The results of the foregoing measurement methods are shown in Figure 6. Examination shows that both the *NS* and *EW* radiators fall within the specifications, except at one discrete point, this discrepancy may well be attributed to measurement error.

B—Television Diplexer Unit

1—Specifications on the *Diplexer* system imposed the following conditions.

(*a*)—Attenuation of sound component *in video line* at least 20 db down.

(*b*)—Attenuation of video component *in sound line* at least 20 db down.

2—To measure this characteristic the signal was fed into the video input circuit of the diplexer and the magnitude of signal in the sound input determined. Voltage measurement was made on both input circuits and the ratio of the two determined.

3—The results of these measurements in db are shown in Figure 8.

Inspection shows that feed-through from one input into the other is within the required performance specifications.

Measurements indicating power gain over the previous single bay system are not yet available. However, the signal strength on both video and sound have been increased by a con-

(*Continued on page* 43)

mc which includes the 3105 and 6210 kc channels as used by private aircraft.

Model 80C, for the export market and covers the more commonly used frequencies in foreign countries.

No flexible shafts are used. Tuned r-f stage on all bands. Sensitivity on all bands is said to be less than 5 microvolts for .5 watt output.

* * *

SPRAGUE TELOHMIKE CHECKER

A capacitor-resistor checker, TO-3 Telohmike, has been announced by the Sprague Products Company, North Adams, Mass.

Checker is a bridge-type capacitance and resistance analyzer with built-in d-c volt-milliammeter. Direct reading calibrated dial is color coded to correspond with selector switch. Capacity ranges are from .00001 to 2,000 mfd in four steps. Resistance ranges are 2.5 ohms to 25 megohms in three steps. Insulation resistance range indicated by direct meter reading is 0-2,500 megohms. Electrolytic leakage is measured in ma at rated d-c voltage. Capacity and power factor of electrolytic capacitors are measured with rating polarizing voltage applied. Power factor measurement range is from 0-50% at 60 cycles.

* * *

ELECTRO-VOICE BUTTON-CONTROL FLOOR STAND

A button-control floor stand, model 430, has been announced by Electro-Voice, Inc., Buchanan, Michigan. Button gives finger-tip control of shaft height.

Height adjustment 36" to 65"; 3-leg spread, 17".

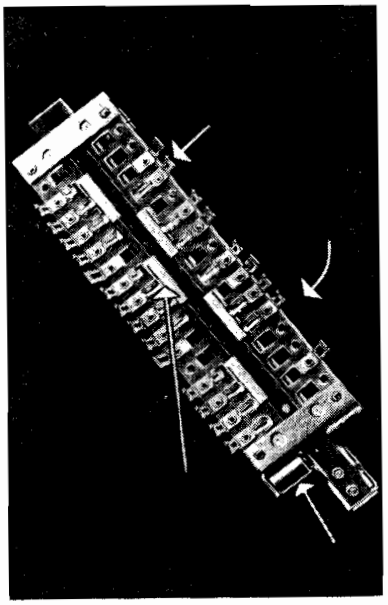
The Industry Offers

(*Continued from page 36*)

CENTRALAB SLIDE SWITCH

A slide switch featuring flat horizontal design has been developed by Centralab, Milwaukee 1, Wis.

Twisted ear mounting accommodates panels from .038" min. to .052" max. thickness. Length of unit variable from min. of 5 clips (1.909") to max. of 20 clips per side (5.659") in ¼" gradations. Width, 1 11/32". Height, .321 from mounting panel. Available with or without, indexing 2 or 3 positions, ¼" movement per position. All metal parts cadmium plated steel. Insulation, .062 laminated phenolic. Contacts, shorting type only. Clips, spring brass silver plated.



* * *

JONES FANNING STRIP

A fanning strip permitting the anchoring and soldering of from one to 20 wires from the cable leadin to proper terminals has been announced by Howard B. Jones Division, Cinch Mfg. Corporation, 2460 W. George St., Chicago 18, Ill.

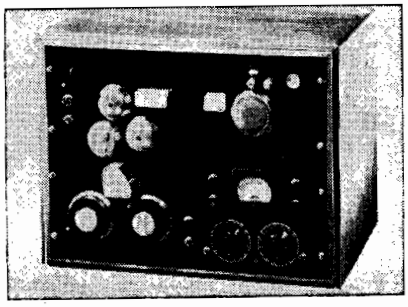
Fanning strip is designed for use with Jones barrier terminal strips Nos. 141 and 142; No. 141 provides for one to 20 contacts and No. 142 one to 17 contacts.

* * *

MAGNECORD WIRE RECORDER

A wire recorder, model SD-1, that is said to have a frequency response flat within 2 db from 50 to 12,000 eps with a signal-to-noise ratio of over 45 db, has been announced by Magnecord, Inc., Chicago 21, Ill.

Unit uses stainless steel wire .004" in diameter, and a capstan drive system to drive wire across the heads at four feet per second.



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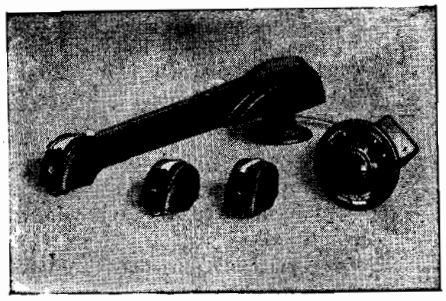
R-MC TRANSCRIPTION PLAYER

A transcription player, TP-16C, for transcription records up to 16", 78 or 33 1/3 rpm, is available from the Radio-Music Corporation, East Port Chester, Connecticut.

Motor is constant-speed type. Drive wheel and idler have neoprene tires, precision ground for concentricity.

Switch output impedance, 30,250, and 500/600 ohms.



Low-Voltage Supplies

(*Continued from page 25*)

the two tubes, providing a system which has extremely low drift. The gain of such a circuit, when the load presented to the output terminals of the bridge is greater than a megohm, will be approximately $-\mu/2$, where μ is the amplification factor of the individual triode.[10] The gain of this type of bridge can be increased considerably by the substitution of pentodes for the triodes, the only disadvantage in the substitution being that voltage regulator tubes must be added to the circuit to provide stable sources of screen potential, as shown in 3*d*.

The regulation characteristics of a six-volt, 14-ampere voltage regulated power supply employing some of the circuits discussed are summarized in Fig. 4. Incidentally this supply, illustrated in Figure 5, which is similar to the commercial Nobatron supply, has an internal resistance of approximately .0043 ohms.

References

[1]G. E. Hamilton and T. Maiman, *Voltage Regulated Power Supplies*, COMMUNICATIONS; Nov., Dec., 1945, and Jan., 1946.

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[3]H. Holubow, *D. C. Saturable Reactors for Control Purposes*, Electronic Industries; March, 1945.

[4]R. R. Batcher and W. Moulic, *The Electronic Control Handbook*, Sec. 4, Chap. 3; Caldwell-Clements, New York, N. Y.

[6]*Technical Data on Type X-6030, Emission Limited Diode*, Sylvania Electric Products.

[6]J. M. Cage, *Negative Feedback Amplifier Theory Applied to Regulators*, Proceedings of the National Electronics Conference; 1944.

[7]*Type 2B23, Magnetically Controlled Diode*, Electronic Tube Engineering Bulletin No. 8, General Electric.

[8]C. R. Knight, *Magnetic Control of Anode Current*, Electronic Industries; December, 1946.

[9]M. Artzt, *Series Balanced Amplifier*, Pat. 2,310,342.

[10]M. Artzt, *Survey of D.C. Amplifiers*, Electronics; August, 1945.

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WABD TV Antenna

(*Continued from page 41*)

siderable degree, since a much greater service area has been established.

Credits

Appreciation and credit are extended to R. K. Olsen who co-shared the problems encountered in the entire system measurement.

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[2]G. H. Brown, *The Turnstile Antenna*, Electronics; April, 1936.

[3]RCA Engineering Products Department Manual, TF-3A Super-Turnstile Antennas MI-19012-A and MI-19012-B, IB-36024 Preliminary.

[4]G. E. Hamilton and R. K. Olsen, *Transmission Line Measurements as Applied to Television Antennas*, COMMUNICATIONS; Jan., Feb., March, 1947.

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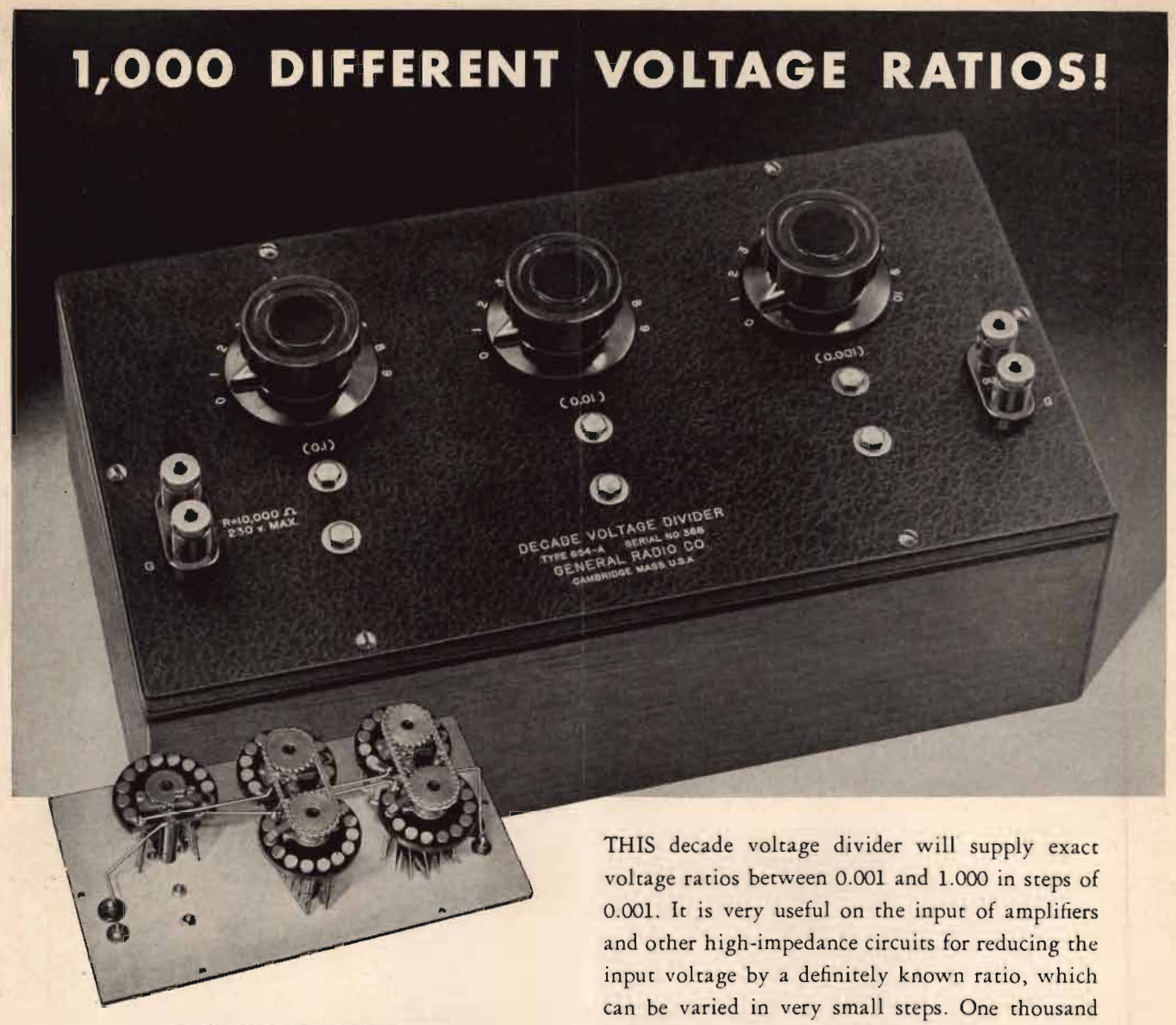

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ACCURACY: each resistor is adjusted within ±0.1%, error in voltage never exceeds ±0.2%

INPUT IMPEDANCE: constant resistance of 10,000 ohms regardless of ratio setting

OUTPUT IMPEDANCE: varies from 10 to 10,000 ohms, depending upon settings

FREQUENCY CHARACTERISTIC: if external capacitance across output terminals is less than 20 micromicrofarads, frequency error is less than 0.1% below 10,000 cycles

TEMPERATURE COEFFICIENT of resistors is less than ±0.002% per deg. C at normal room temperature

AT THE MOMENT WE HAVE A FEW IN STOCK

WRITE FOR COMPLETE DATA

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The input resistance remains constant regardless of dial settings, consequently reaction on the input voltage is eliminated.

The instrument is equivalent to a pair of our type 602 Decade-Resistance Boxes connected in series and so arranged mechanically that as resistance is taken out of one box it is added to the other to maintain the total resistance constant at 10,000 ohms.

All resistors are wound with an alloy wire of such characteristics that no difficulty from thermal emf will be encountered in direct-current measurements.

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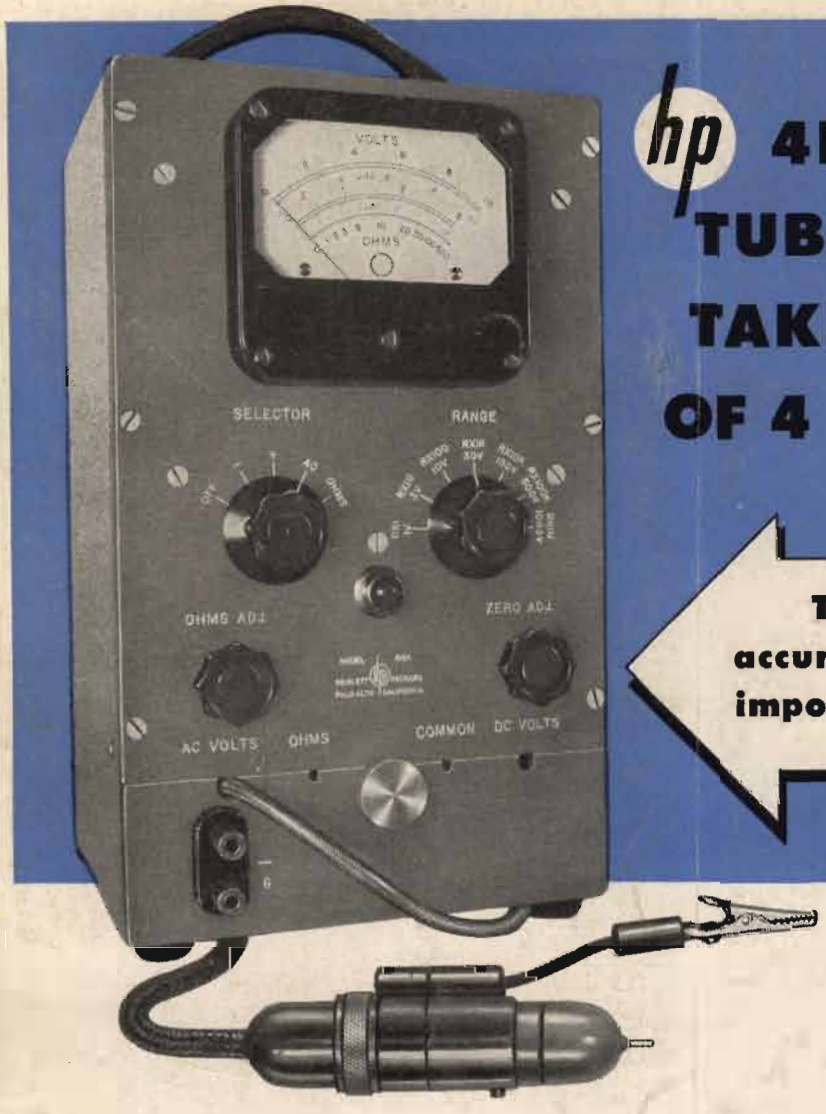

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