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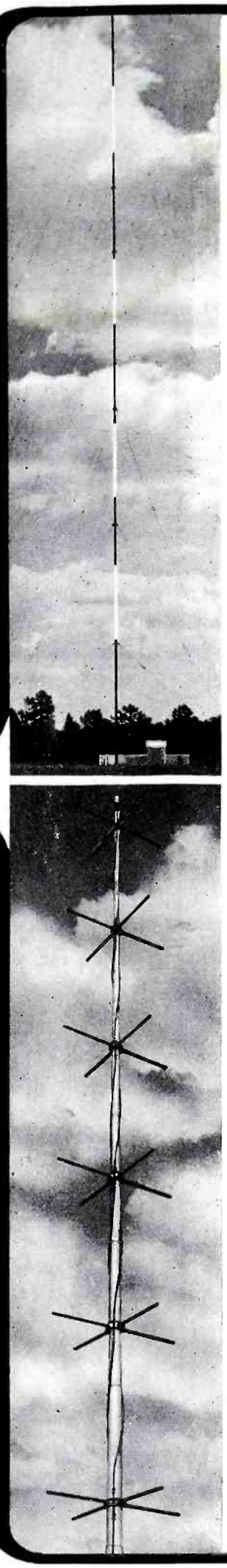

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COMMUNICATIONS

JUNE
1941

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VOLUME 21
NUMBER 6

RAY D. RETTENMEYER
Editor

• Contents •

COVER ILLUSTRATION

National Broadcasting Company making a direct television pickup of a recent baseball game between the Brooklyn Dodgers and the Cincinnati Reds at Ebbets Field, Brooklyn.

• Comments •

• • • • The seventeenth annual convention of the Radio Manufacturers Association is being held from June 10 through 13 at the Stevens Hotel in Chicago. The program of this gathering will be found on page 22 of this issue.

• • • • As a result of the aluminum shortage, manufacturers of recording blanks are finding suitable substitutes. Several manufacturers have already announced the availability of glass-base discs, while others are using paper as a base. Quality is said to compare favorably with aluminum-base discs.

• • • • Restrictions on aluminum are focusing attention on inductive tuning methods. Some receiver manufacturers are already using inductive tuning in both home and auto sets.

• • • • The summer convention of the Institute of Radio Engineers will be held at the Hotel Statler in Detroit, Michigan, June 23-25. This promises to be a very interesting gathering and will feature papers on the following subjects: television, frequency modulation, ultra-high-frequency antennas, ultra-high-frequency tubes, broadcast transmitters, transmission lines, etc.

• • • • At the opening sessions of the Senate Interstate Commerce Committee, Senator Wallace A. White urged a study by congress of all phases of American radio . . . including the Federal Communications Commission. The statement was made on the resolution introduced by Senator White on May 13 asking for such a study.

• • • • According to figures released by the FMBI the sale of f-m receivers is climbing. During April approximately 2,500 f-m sets went into American homes, an increase of 15% over the figures for March. It is believed that some 30,000 f-m receivers are now in use.

BRYAN S. DAVIS
President

JAMES A. WALKER
Secretary

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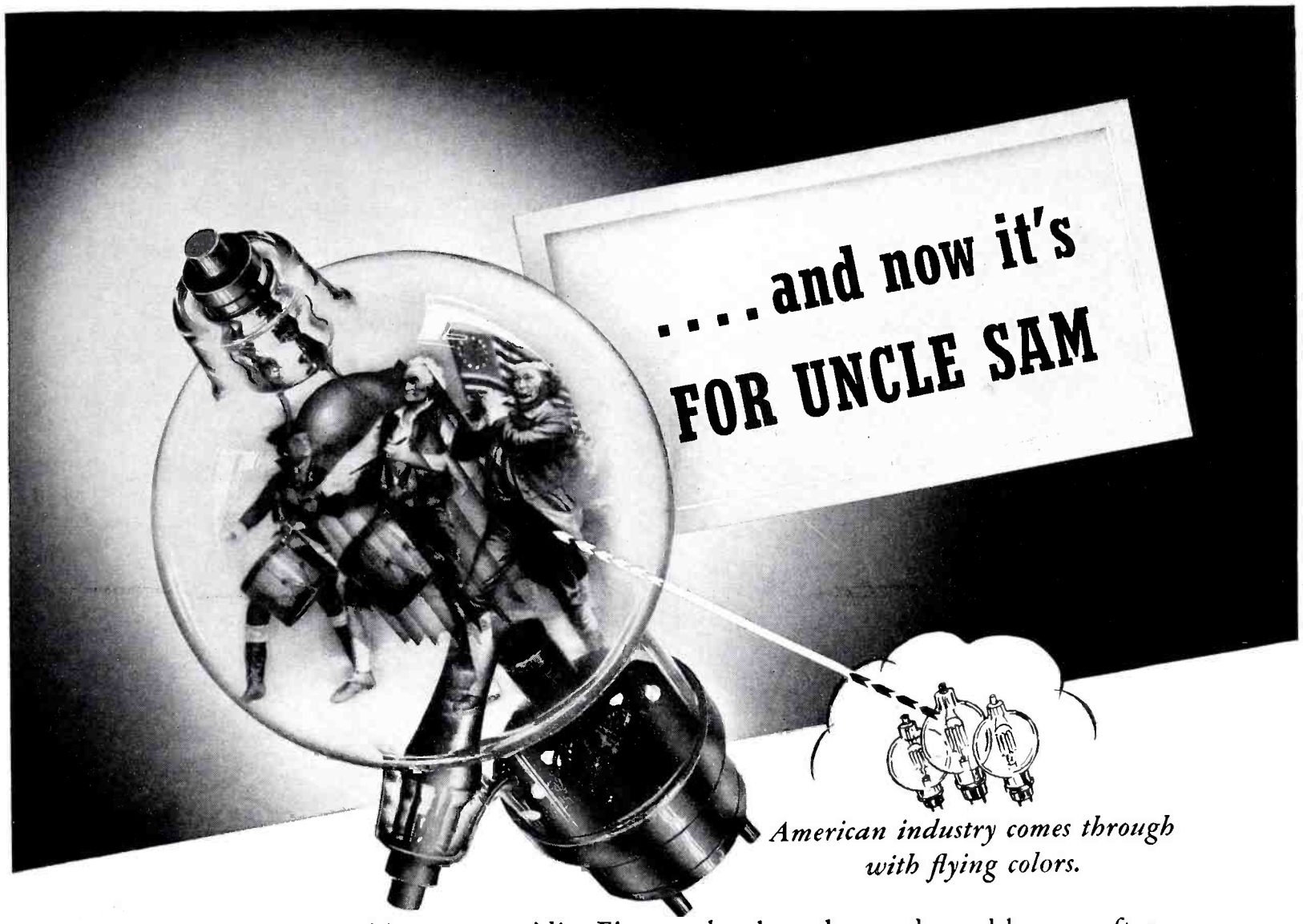

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A Direct-Reading
FIELD-INTENSITY METER

By JOHN P. TAYLOR

THE type 308-A field intensity meter is a new precision-type instrument designed with an eye to various applications in the broadcast, medium-wave and long-wave fields—but especially with a view to fulfilling the need for a more convenient instrument for use in broadcast allocation and coverage studies. Field intensities from 20 microvolts per meter to 10 volts per meter at frequencies from 120 kc to 18,000 kc are read directly from the dial. The procedure required in using this new meter is similar, but somewhat simpler, than with previous designs. And, of course, there are no calculations at all to be made. Because of certain refinements which have been made, the accuracy obtainable should be better than heretofore obtained.

Direct-Reading—How It Is Done

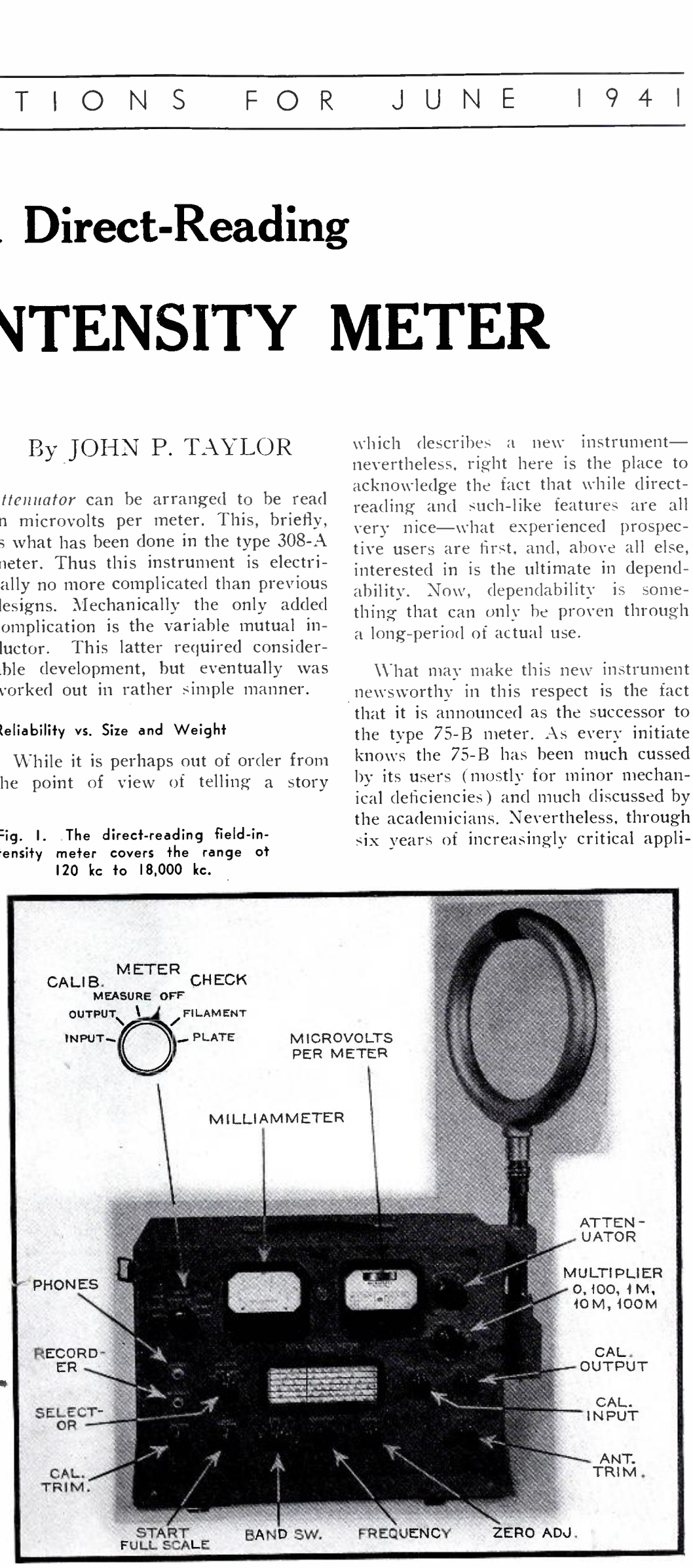
Direct-reading-on-the-dial is something the designers of measuring equipment are wont to lie awake nights thinking about. That it should ever have been attempted in a field intensity meter intended to work over a wide intensity and frequency range seems—at least, on first thought—like a tribute to someone's insomnia. It is, therefore, rather surprising to find on closer examination that the idea which makes direct-reading possible, is, in itself, very simple. Reduced to essentials, it is this: Instead of using a *fixed step attenuator* and reading on the output meter *various values* proportional to the actual field intensities (as was done in previous field intensity meters), this new instrument incorporates a *continuously variable attenuator* and readings are made by adjusting this attenuator to give a predetermined *fixed reading* of the output meter. Now, if in addition, during the calibration process (which precedes the actual making of readings—and which consists essentially of setting the receiver gain at a predetermined value) the attenuator is set, not at a fixed value as previously, but rather at various values determined from a calibration curve—then the *scale of the variable attenuator* can be arranged to be read in microvolts per meter. This, briefly, is what has been done in the type 308-A meter. Thus this instrument is electrically no more complicated than previous designs. Mechanically the only added complication is the variable mutual inductor. This latter required considerable development, but eventually was worked out in rather simple manner.

Reliability vs. Size and Weight

While it is perhaps out of order from the point of view of telling a story which describes a new instrument—nevertheless, right here is the place to acknowledge the fact that while direct-reading and such-like features are all very nice—what experienced prospective users are first, and, above all else, interested in is the ultimate in dependability. Now, dependability is something that can only be proven through a long-period of actual use.

What may make this new instrument newsworthy in this respect is the fact that it is announced as the successor to the type 75-B meter. As every initiate knows the 75-B has been much cussed by its users (mostly for minor mechanical deficiencies) and much discussed by the academicians. Nevertheless, through six years of increasingly critical appli-

Fig. 1. The direct-reading field-intensity meter covers the range ot 120 kc to 18,000 kc.



cation it has remained the one standard of comparison. The overshadowing reason for this popularity has been the demonstorated ability of the 75-B to duplicate readings consistently under all conditions.

The type 308-A meter incorporates the same idea of dependability first—and in that fact will be found the answer to some questions. For instance, every effort was made to reduce the size and weight of the equipment—but the net difference is disappointing. Any further improvement would have entailed using lighter materials (of doubtful strength to stand up under portable use), of eliminating some of the most valuable features, or of jam-packing the assembly together. Incidentally the last, viz., accessibility, is another feature not always given due importance. Any equipment destined to ride 200,000 miles or more in a truck or station wagon is bound to come apart somewhere, some time. When it does, the assembly must be such that the average operator can make the necessary repairs on the spot—otherwise the loss of time may be far out of proportion. Thus all that can be said for the 308-A is that it is small enough to go handily into a car—and light enough to be carried short distances by one man. Anything smaller would have been regarded by the writer—and by the most experienced field men—with a dubious eye.

Some New Features

The front view of the 308-A meter is shown in Fig. 1. Missing, as will be seen at once, are the old plug-on coils. Instead there is a band-change switch of the type used on later receivers. Along with this comes ganged tuning. Thus, instead of the three previous tuning controls, there is now one—and instead of referring to tuning charts there is a large scale plainly marked in frequency. This eliminates completely the old difficulty of locating weak signals and helps to avoid mistakes. Nor is the error due to a possible discrepancy in tuning increased. The heterodyne oscillator can be set on the nose with the main frequency control—after which small adjustments of the antenna and calibrating oscillator trimmers brings these into accurate peak adjustment.

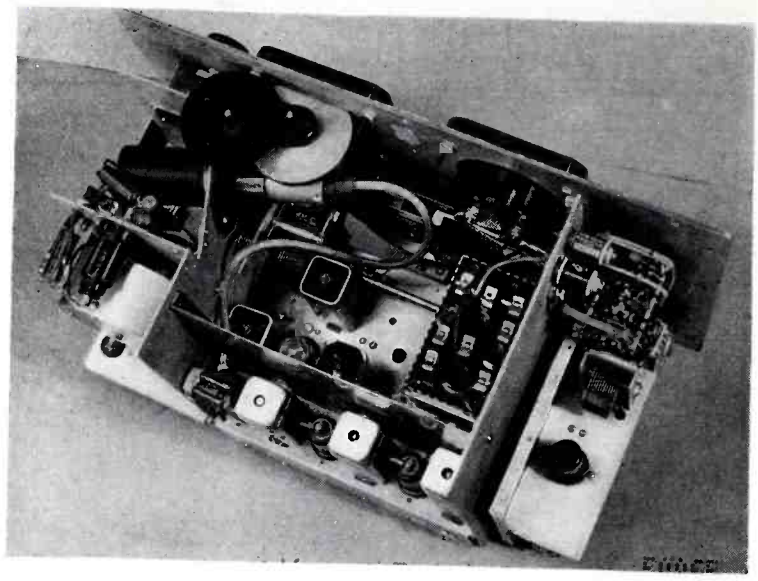
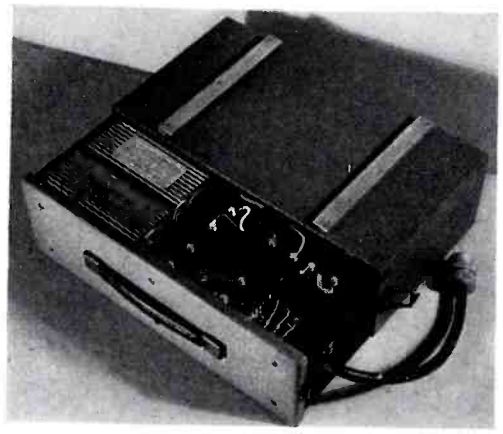
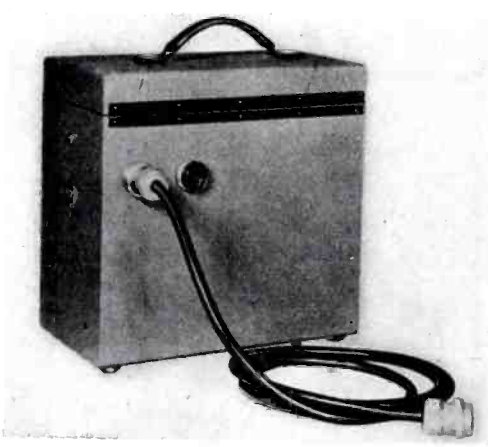


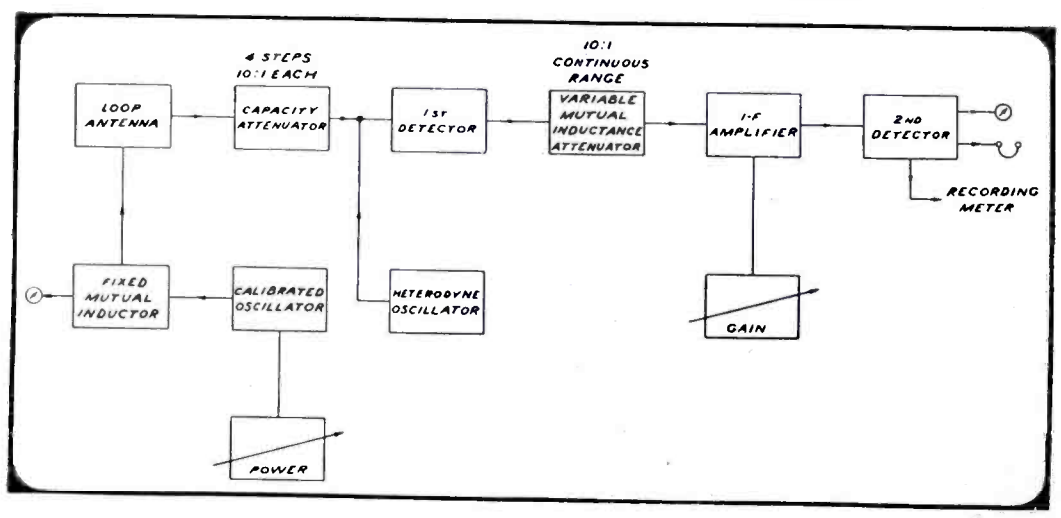
Fig. 5.—Interior of the 30-A field intensity meter. Note gear-driven mutual inductor which provides direct reading of field intensities from 20 microvolts per meter to 10 volts per meter.



Above: Fig. 2. Battery box for use with the direct-reading field-intensity meter. This may be attached to the bottom of meter for convenience in carrying.



Above: Fig. 3. Vibrator-type power supply can be used with motor-cycle type battery or from car battery. Below: Fig. 4. Block diagram of the meter.



Next most obvious improvement is in the loops. Those used with the new 308-A meter are mounted in aluminum shields and are provided with an entirely new and much sturdier mounting arrangement. Each loop covers two bands, so that only two loops are needed to cover the band from 540 kc to 18,000 kc (which formerly required four loops). The low-wave (120-540 kc) band is covered by a third loop which is optional equipment.

Since the loop holder and one loop can be carried in the instrument lid, and as there are no plug-in-coils to mess with, the big equipment and battery box used with the 75-B is not required with this new meter. Where it is desired to use dry batteries a shallow case (see Fig. 2) is available. This fastens directly to the bottom of the instrument case, and connections are made with a short length of cable. For longer periods of use a vibrator power supply (see Fig. 3) is available. This may operate from a self-contained motor cycle-type storage battery or directly from the car battery.

Outline of Operation

The actual operation of the 308-A field intensity meter can be best understood by considering the measuring procedure in step-by-step fashion. Referring to the block diagram shown in Fig. 4 it will be seen that this instrument consists essentially of a superhet receiver plus a separate "calibrated" oscillator. Actually the oscillator is calibrated only in that for a specified reading on the meter it gives a fixed voltage in the single turn secondary of the fixed mutual inductor. This single turn being in series with the loop, a convenient predetermined calibrating voltage is thereby provided. It might be noted here that only one meter is used in the

(FI METER—continued on page 24)

Operating problems in

FREQUENCY-MODULATION TRANSMITTERS

Part II

By I. R. WEIR

Transmitter Eng. Dept.
General Electric Co.

Measuring Equipment

New Measurement Problems

THE Federal Communications Commission, believing that wide-band frequency modulation would be capable of providing higher fidelity transmission of speech and music than standard broadcasting, set up standards of good engineering practice much more rigorous than for standard broadcasting. These new requirements aid f-m broadcasters in maintaining a truly high standard of fidelity.

The general design of the high-frequency broadcast transmitting system (main studio amplifiers, lines or radio circuits between studio and transmitter, and transmitter) must be in accordance with the requirements shown in column 2 of Fig. 13.

It is quite evident from these requirements that a high standard of performance is required for the proper operation of every f-m station. A few people have expressed the belief that such high standards of quality are unnecessary. However, a few observers in our laboratory have observed distortion as low as two per cent and many have objected to noise as low as 60 db.

The Federal Communications Commission requires all f-m stations to have measuring equipment to assure that the station is being operated in accordance with their Rules and Regulations. The high performance standards require measuring equipment with a very high order of precision.

Since f-m and a-m broadcast systems are designed to reproduce audible sound, most measurements are similar or the same for the two systems. For f-m, the new method of modulation requires a slightly different technique and reference basis in some cases.

It may be of interest to describe the measuring equipment used at the G-E proving ground for correct operation.

Percent Modulation or Frequency Swing

One of the first measurements which should be made on an f-m transmitter is that of frequency swing, since it is first necessary to determine the audio input corresponding to ±75-kc swing or 100% modulation to be used as a reference for other measurements.

The audio output from a test f-m receiver, which will be described later, may be utilized to measure the frequency swing of an f-m transmitter. This audio output is measured on a cathode-ray oscilloscope or on a peak-reading vacuum-tube voltmeter. The peak-reading vacuum-tube voltmeter is the most convenient to use because the swing, or percentage of modulation, can be read directly from the instrument calibration in much the same manner as in reading peak modulation for standard broadcast transmitters.

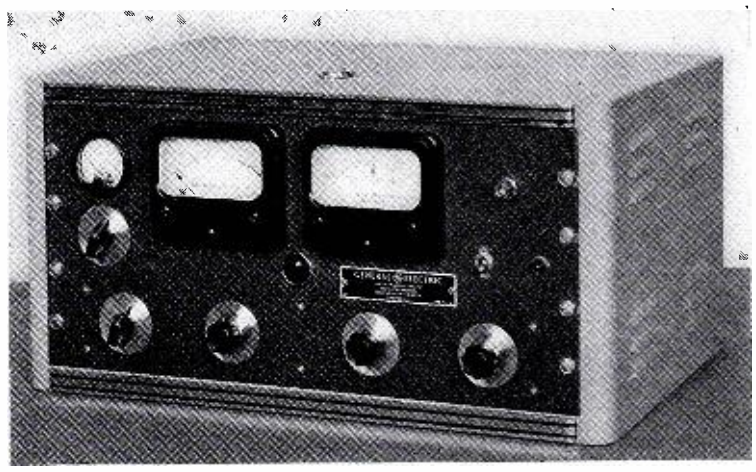
The test receiver and peak-reading voltmeter must be calibrated in kc swing of the tranmitter. There are two or three methods by which this may be done. A method suggested for calibration has been described by Murray G. Crosby in the *R. C. A. Review*.[4] His method is based upon the amplitude characteristic of the carrier in a frequency-modulated wave when a single sinusoidal modulating wave is applied.

This method enables us to quite accurately calibrate our f-m receiver and tube voltmeter for frequency swing; but, however, it is not entirely satisfactory for low modulation frequencies.

Measurement of frequency swing at low audio frequencies can be made by using a highly selective receiver and tuning across the frequency band occupied by the transmitter while it is modulated by a low-frequency oscillator. There will be a fairly constant tone in the limits of the transmitter deviation and practically no signal outside the region when a low modulation frequency is used. This results from the fact that,

Right: Fig. 14. G-E f-m monitor. Measures center-frequency deviation, % modulation; includes modulation-limit flasher, high-fidelity a-f output and temperature-controlled crystal. Left: Fig. 15. Square-wave generator.

[4]Murray G. Crosby, "A Method of Measuring Frequency Deviation", *RCA Review*, April, 1940.



as the ratio of swing frequency to modulated frequency becomes greater, we are approaching a nearly uniform distribution of energy out to the extremity of the frequency swing.

These two methods can not be used as a modulation indicator for a transmitter since they require the application of steady tone modulation in order to take readings. They can, however, be used for a calibration of an indicating device which may be used as a modulation indicator. This indicating device may consist of the f-m test receiver, in which case the amplitude of its output should correspond directly to the frequency swing. It is essential that the input signal be of sufficient strength to saturate the limiter. The audio output voltage from the receiver may be applied directly to a cathode-ray oscillograph or to a vacuum-tube peak voltmeter as is customarily done in reading peak modulation of standard broadcast transmitter.

Measurements with Test Receiver

One of the most important units developed to measure many of the f-m transmitter characteristics is a special test receiver, designed to operate over the range 42 to 50 mc. The voltage versus frequency characteristic of the discriminator and detector was made sufficiently linear over the required frequency range to accurately measure all audio characteristics of the transmitter. Care was taken to be sure that very little noise is introduced by this test receiver. A good method of checking the noise introduced by this unit is to supply it with the output of a stable crystal oscillator. Any residual noise then present at the output of the discriminator detector is due to internal noise in the test receiver. A very good limiter circuit was used in this receiver to make the audio output correspond directly to the frequency swing of the input signal, regardless of the possible presence of amplitude modulation of this signal.

The measurements next considered all require this special test receiver.

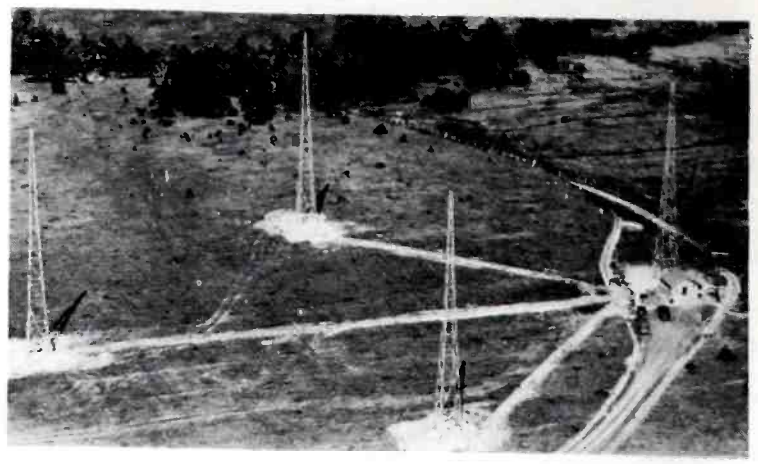


Fig. 18. The re-broadcast receiving station. Note the four 128-foot towers supporting the rhombic antenna. This antenna is used for both television and f-m re-broadcast receiving purposes.

(a) *Audio-frequency Response*

The audio-frequency response characteristic of an f-m transmitter is measured by reading the audio output voltage from the test receiver vs. the audio input voltage to the transmitter over the frequency range of 50 to 15,000 cycles. The audio-input voltage is held constant at that value which will give ±75-kc swing with 100-cycle modulation. A tube voltmeter is used to measure the audio voltages. Care should be taken to make sure that no r-f voltage is introduced in any of the measurement circuits. Shielded leads may be used if care is taken to be sure that the capacity added does not affect the audio-frequency measurements. If chokes or bypass capacitors are added to eliminate radio frequency from the measurement circuits, caution should be exercised to see that they have appropriate values so as to not affect the audio-frequency measurements.

(b) *Modulation Linearity*

The modulation linearity characteristic is measured by reading the output voltage from the test receiver vs. the audio input voltage to the transmitter at constant audio frequency. The transmitter frequency swing should be directly proportional to the audio input to the transmitter. In other words, there should be no compression or expansion of volume range of the studio program.

(c) *F-m Noise*

Frequency-modulation noise may readily be measured by again using the test receiver. The transmitter modulation level is adjusted for 100 per cent modulation (±75-kc swing). The resulting audio voltage is measured at the output of the test receiver; this voltage is used as the zero-db reference level. Then the transmitter audio input line is replaced by its line impedance and the output audio voltage of the test receiver again measured; this voltage is introduced by the transmitter. The usual method of expressing noise level is by calculating the ratio of the measured f-m noise voltage to the voltage at 100% modulation, and expressing this ratio in db. All audio voltages should be measured with a suitable tube voltmeter.

(d) *Distortion*

Audio-frequency harmonic distortion was measured by means of a distortion meter or a wave analyzer, which was used to analyze the audio output of our test receiver. The wave analyzer separates the various harmonics and thus gives us more information than the distortion meter, although a longer time is required to obtain data. The input audio voltage wave should have a very low harmonic content if distortion measurements as low as one per cent are desired in the output.

(e) *Mean Carrier Frequency*

When the transmitter is unmodulated, the carrier frequency may be measured by the same methods as are employed for amplitude-modulated transmitters. There are two methods of measuring the carrier center-frequency during modulation. One method is to divide the modulated carrier frequency a large number of times so that the frequency swing becomes very small and the carrier frequency is measured by standard methods as employed for amplitude modulation. The other method employs the f-m test receiver. The linearity of the discriminator and detector characteristic in the test re-

F M SYSTEM PERFORMANCE REQUIREMENTS

CHARACTERISTICS	F.C.C. OVERALL REQUIREMENTS	TRANSMITTER MEASUREMENTS	STUDIO AUDIO MEASUREMENTS	RELAY CIRCUIT REQUIREMENTS
AUDIO FREQUENCY	±2 DB OF 1000 CYCLES 50 TO 15,000 CYCLES	BETTER THAN ±1DB OF 1000 CYCLES 30 TO 16,000 CYCLES	BETTER THAN ±1DB OF 1,000 CYCLES 30 TO 15,000 CYCLES	±1DB OF 1,000 CYCLES 30 TO 15,000 CYCLES. SYSTEM MUST BE COMPENSATED OVERALL
FM NOISE LEVEL	60DB BELOW 100% MOD. 50 TO 15,000 CYCLES	BETTER THAN 70 DB BELOW 100% MOD. 30 TO 16,000 CYCLES	BETTER THAN 65 DB BELOW LEVEL OF 1 MV INPUT TO PRE-AMPLIFIER	SHOULD BE BETTER THAN 65 DB
DISTORTION	LESS THAN 2% (R.M.S.) 50 TO 15,000 CYCLES	LESS THAN 1.5% 30 TO 15,000 CYCLES	LESS THAN 0.5% 30 TO 15,000 CYCLES	LESS THAN 1.5% 30 TO 15,000 CYCLES

PHASE DISTORTION OR TIME DELAY SHOULD BE CONSIDERED.

Fig. 13. Performance requirements of an f-m system. The general design of high-frequency broadcasting systems should be in accordance with these data.

ceiver are such that the average d-c voltage developed by the circuit is proportional to the mean carrier frequency, even with modulation present. The center-frequency alignment of the discriminator may be checked by means of a crystal oscillator. A d-c meter is connected in the discriminator output and calibrated directly in cycles from the assigned frequency.

Amplitude-modulation Noise Measurement

Amplitude noise produced by a transmitter can be measured in the same manner as is followed for standard transmitters.

It is quite important that amplitude noise be kept at least 50 or 60 db below 100 percent modulation. This is particularly true for receivers operating in weak carrier fields where the receiver limiters are not fully operating.

New Measuring Apparatus

(a) *FM Station Monitor*

A new frequency-modulation station monitor has been developed specially for f-m station operation. A photograph of this unit is shown in Fig. 14. The meter on the right side of the monitor indicates the deviation of the center frequency with or without modulation up to ±2000 cycles. The meter on the left side indicates the percent modulation either positively or negatively. A limit flasher can be adjusted from 50 to 120 percent to warn the operator of over-modulation. Terminals are provided from which the audio quality can be monitored by means of an amplifier and speaker.

The power supply has been built into the monitor. It has been designed with an electronic voltage regulator so the unit will be capable of operating satisfactorily over a large line voltage regulation.

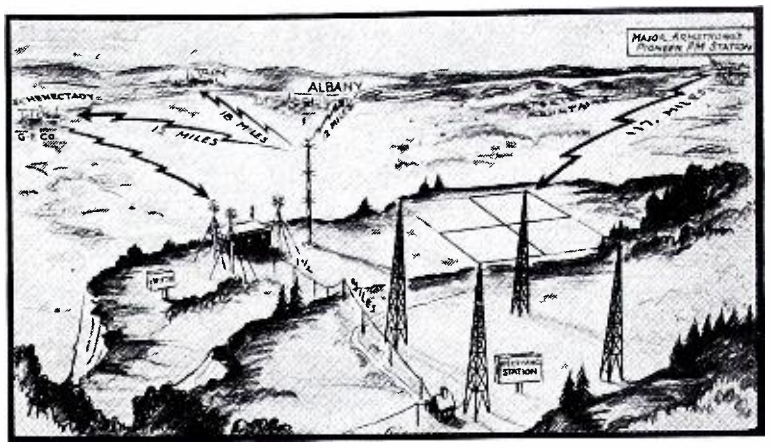


Fig. 17. Perspective sketch of f-m and television relay receiving station in the Helderberg mountains near Schenectady.

(b) *Square-Wave Generator*

In the past, time delay distortion or phase characteristic of a system has not been considered important, but, since true high fidelity is required for f-m, the time delay distortion of a system should be given consideration. Many circuits tend to have a lower velocity of transmission near the ends of the audio-frequency band, than in the middle portions. This difference of transmission is called time delay distortion. The A. T. & T. Co. has made careful listening tests,[5] and has found that, if the highest transmitted frequency (15,000 cycles) has a delay more than 8 milliseconds greater than 1000 cycles and if, at 100 cycles, the delay is more than 15 milliseconds greater than at 1000 cycles, the distortion becomes noticeable

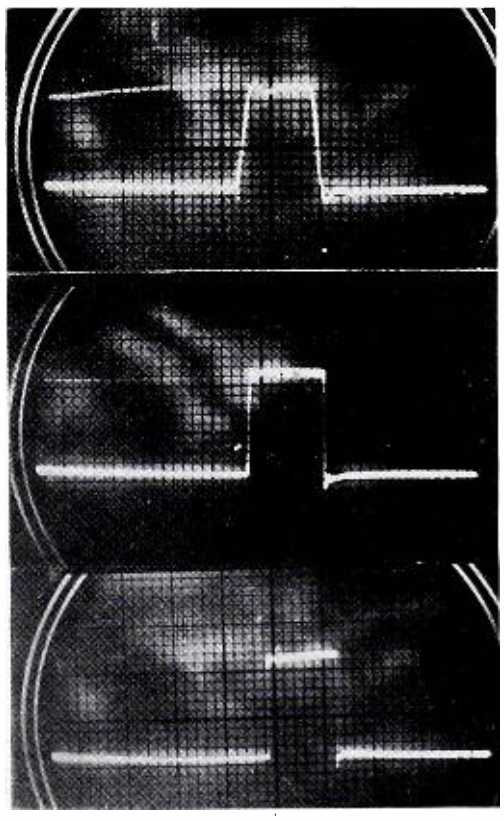
The delay distortion of a system may be checked quite readily by applying a square-wave to the input of the system and noting the wave shape in a cathode ray oscillograph connected to the output of the system. If any of the square-wave harmonic components are changed in amplitude or phase by the system, the output wave will be distorted.

Fig. 15 shows a square-wave generator which can generate waves of 1.5 to 250,000 c-p-s with the pulse width adjustable from 10 to 50 percent. Continuous frequency variability is provided by means of coarse and fine frequency control.

Fig. 16 shows cathode-ray oscillograph traces of 16% square-wave pulses after they have passed through an f-m transmitter and an f-m test receiver. The fundamental frequencies are 38, 190, and 1000 cycles. The 1000-cycle square wave has a definite slope to the sides of the wave, which indicates a limitation of frequency band being transmitted above 20 kc. This is well out of the audio-frequency band.

Employment of a square-wave oscillator is a very convenient means of taking a quick check on the entire frequency and phase characteristic of a system. It is suggested that a square-wave oscillator test be made on the entire system each day before starting programs.

Fig. 16. Cathode-ray oscillograph traces of 16% square-wave pulses that have passed through an f-m transmitter and f-m test receiver.



Studio Problems

Reference Level

Studio facilities have been covered very well, so my discussion of studio performance problems will be limited to one point, namely, a suitable reference level for noise measurements.

All high-fidelity microphones, regardless of type, have one common and regrettable characteristic. This is very low terminal voltage per unit of sound pressure. The output of the average commercial studio microphone is about —60 db for a sound pressure of 10 bars (1 bar = 1 dyne/sq. cm.). A 10-bar sound pressure at the microphone may be considered the maximum level which will ordinarily be encountered in average studio musical programs. Normal speech at about 30 inches from the microphone develops a maximum sound pressure of about 1 bar. A full symphony orchestra may, upon occasion, set up microphone pressures as much as 100 bars. It is seen that the sound pressure at a microphone varies over a tremendous range depending upon the type of program.

The fundamental question arises: What sound pressure are we to assume as the reference level for noise measurement? If we use a 100-bar refer-

[5] F. A. Cowan, R. G. McCurdy, I. E. Lattemer, "Engineering Requirements for Program Transmission", January 27-31, 1941, A.I.E.E. Winter.

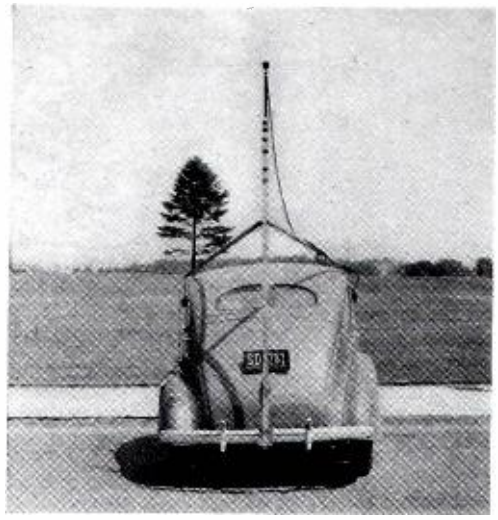


Fig. 20. Automobile equipped with horizontal dipole antenna for field-intensity survey of W2XOY.

ence level, we most certainly can obtain a very favorable signal-to-noise ratio. On the other hand, if we used a 1-bar reference level, it would seem almost impossible to obtain the desired signal-to-noise ratio.

The reference level for noise measurements for a speech input system should be a standard voltage applied to the input terminals of the microphone pre-amplifier. This method of rating would eliminate the differences in signal voltages for different microphones used. Some users of broadcast equipment have standardized on an applied voltage of 1 millivolt at the input terminals of the microphone preamplifier. This voltage not only represents a convenient figure for numerical calculations, but it also corresponds closely with maximum voltage developed under the average studio conditions.

It is considered highly important that standardization immediately be effected among the entire broadcast industry for rating the signal-to-noise ratio of speech-input systems, just as standardization was recently effected on the method of indicating level on program circuits by the new vu meter. As the situation now stands, the current FCC requirements for a 60-db ratio between signal and noise in f-m transmitting systems has no definite meaning as applied to speech input equipment.

General Electric is now developing a line of studio equipment to meet the over-all system requirements of FCC (1 millivolt at input terminals). Fig. 13, Column 4, indicates the characteristics of the equipment.

Studio-to-Transmitter Circuit

General Requirements

The transmitter requirement for a studio-to-transmitter circuit is that the program material must be transmitted with a very high degree of naturalness. Of course we all realize there are some limitations in the human ear, in the listening conditions, and in the program material which make such ideal transmission unnecessary. Nevertheless we can express our studio to transmitter circuit requirements for satisfactory transmission as to audio-frequency range, noise, and distortion as indexes of quality.

The Federal Communications Commission has given us certain requirements which aid us in determining the performance specifications for a relay circuit. The over-all requirements for an f-m broadcast transmitting system (which include main-studio amplifiers, lines or radio circuits between studio and transmitter, and transmitter) must be in accordance with those shown in the second column of Fig. 13.

It is quite evident that we can determine our requirements for a studio-to-transmitter circuit, since we already know the overall requirements and also the measured performance of our transmitter and studio equipment. The required performance characteristics of the studio-to-transmitter circuit are shown in the last column of Fig. 13.

Wire-Line Circuits

The wire-line facilities generally available at the present time for connecting f-m programs into networks and conducting them from studio to main transmitter are usually limited to the transmission of audio frequencies up to 6000 or 8000 cycles. The noise level of available lines usually does not meet our requirements, although the distortion requirements can generally be met. It is understood that telephone lines can be constructed to meet all the relay requirements if the broadcaster is willing to pay for such service.

Radio-Relay Circuits

The telephone line limitations are not imposed on an ultra-high-frequency f-m radio relay circuit. The noise level, the audio frequency characteristic and distortion can be made to meet our requirements.

It is generally necessary to install the main transmitter at some distance from the broadcasting studios, in order to take advantage of the best location for radiation. Usually the best site for a transmitter station is a hill or mountain top where no telephone lines are available. This usually results in the necessity of installing a new telephone line designed specially for f-m service or a radio relay circuit.

The FCC, in response to several applications and a number of inquiries regarding radio-relay facilities to transmit programs from the studio to the main transmitter, paved the way for such short-distance relay service January 15 of this year. Both f-m and a-m will be used on frequencies above 330,000 kilocycles. It is understood that appropriate rules specifying frequency allocation will be drafted to establish this service on an experimental basis. No application will be considered until such rules are adopted. Relay circuits will be required to utilize highly directive antennas for unidirectional transmission so that many stations throughout the nation may use the same frequency.

Precedents have been established for both wire line[6] and radio relay[7] studio-to-transmitter circuits. Assuming that the quality of transmission can be made the same over wire lines and radio and that both methods meet our requirements, then the choice of a relay circuit is an economic one. A choice must be made between an investment in special telephone connections and subsequent rental charges vs. the installation ot a radio receiver and transmitter and their operating cost.

Studio-to-transmitter Circuit at G-E F-M Station

Preliminary cost estimates on constructing and renting a wire line to meet our requirements clearly indicated that the initial cost of an ultra-high-frequency f-m relay transmitter and receiver with their operating cost would be small in comparison with that of a wire line. Operating experience with a radio circuit at the G-E proving

[6] WIXPW and W2XMN use wire lines.
[7] WIXOJ uses a radio relay circuit.

Fig 21. The equipment used in the field-intensity survey of radio station W2XOY.

ground has shown many ways in which the operating cost can be reduced from our original estimate.

Fig. 17 is an artist's drawing of the arrangement under which General Electric operates the relay circuits at the proving ground. A 50-watt 161.775-mc experimental transmitter carries the local program from the Schenectady studio to the main transmitter building 12 miles distant. The relay transmitting and receiving antennas are both of the simple rhombic-type, each leg being about 2½ wavelengths long. The transmitting antenna is mounted on the Schenectady studio building about 100 feet above the surrounding ground level. The receiving antenna is mounted on 60-ft. wooden mast.

Re-broadcast Relay Circuit at G-E F-M Station

The re-broadcast relay circuit is used to intercept programs from other f-m stations. Since it is desired to relay programs from stations as close as two channels (400 kc) from our carrier frequency, the re-broadcast receiving station was located one and one half miles from our transmitting station. When the program is received at the re-broadcasting receiving station, it is sent over an open-wire line to the transmitter station. This connecting line was specially designed to have very good transmission characteristics. Fig. 18 shows the re-broadcast receiving station with four 128-ft. towers supporting a large rhombic antenna. This large rhombic antenna is our television re-broadcast receiving antenna, but is also used for receiving f-m stations. Such a large antenna is not necessary for f-m re-broadcast reception, but in our case was convenient to use. It is possible to successfully use this antenna for simultaneous reception of television and f-m signals. A small dipole antenna was found to be adequate for receiving signals of suitable broadcast quality from W2XMN (Alpine, New Jersey) and WIXOJ (Paxton, Mass.). General Electric is developing receivers and transmitters to meet the requirements of f-m radio relay circuits.

Field-Strength Measurements

The field strength contour expected from a 50-kw transmitter at our Helderberg Station is shown on the map of the area. (Fig. 19.) This contour was calculated from actual field measurements taken with 2.5-kw transmitter output, and adjusted for a 200-ft., three-bay turnstile antenna and a transmitter output of 50 kw. This station is now licensed to operate on 2.5 kw and no decision has been reached as to future power. It will be noticed that the greatest field strength is toward the northwest, north and northeast directions, while the intensity is low in a southerly direction. This is due to the location of the transmitter on the edge of a high escarpment running roughly northwest to southeast. The effective height toward the north is approximately 1200 feet, while it is much less toward the south. It will be noted the greatest field strength is in the direction of the New York State Capital District Cities of Albany, Schenectady, and Troy.

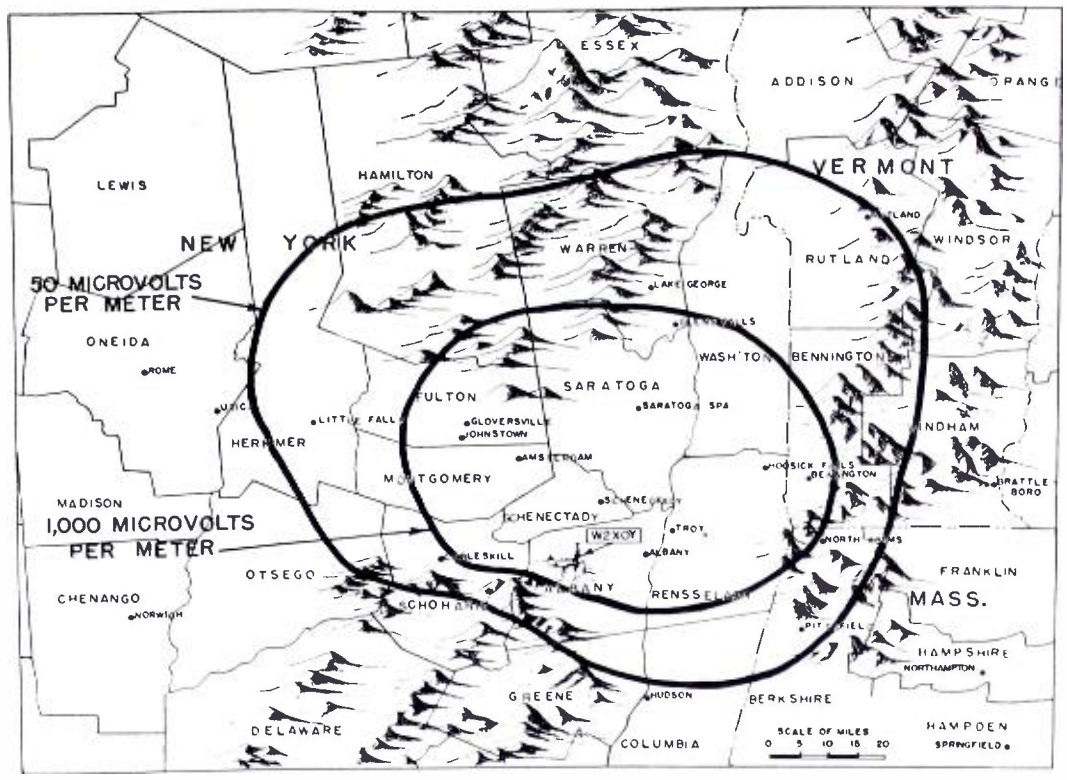


Fig. 19. The field-strength contour expected from a 50-kw transmitter located at Helderberg. Contours calculated from actual field measurements taken with 2.5 kw transmitter.

The equipment required for field measurements consisted of a receiver, antenna, and a recording ammeter calibrated in units of field strength. The power supply for this measuring equipment was a 6-volt battery with a voltage regulator, so that readings were independent of variations in battery voltage. The grid current of the limiter tube in the receiver was indicated on a recording microammeter calibrated in field strength units. The antenna and receiver were also calibrated, the receiver by means of a signal generator and the antenna from a known field.

The antenna was mounted on an automobile at a height of about 10 feet above the ground. The directional effect of the car on the antenna calibration was then determined, and found to be small. Continuous readings of field strength along at least eight radials from the transmitter were taken. The readings were then multiplied by three since the field strength values desired are based on a 30-ft. antenna height. These radial readings were then analyzed by dividing them into sections of not more than 10% of the service radius and not more than 5 miles. The field intensities in each section of the chart were analyzed to determine the intensities over 50 percent of the distance (median) throughout the section.

Fig. 20 is a photograph of the antenna mounted on the car used for making the field-strength survey of our station W2XOY. Fig. 21 is a photograph of the field-intensity measuring equipment installed in the car. General Electric is developing recording equipment better suited for such field measurements.

Conclusion

What has the proving ground proved?

It has proved that transmitting equipment, antennas, studio equipment, relay transmitters, and measuring equipment can be designed to meet your operating problems and FCC requirements. It has further proved that your operating problems can be solved very simply and that all the operating features to which a broadcaster is accustomed in his standard broadcast equipment can also be provided in the f-m line.

While studying these f-m problems, we must all remember that no matter how painstakingly apparatus is designed, how thoroughly individual parts are tested before assembly, how accurately the units are wired and assembled, there is only one sure way to discover whether or not a system is as good as it should be and that is to test it in actual service, proving all things and holding fast to that which is good.

"Radio Prepares for National Defense"

Says LEWIS WINNER
Market Research Engineer

•After a tour of some thirty radio manufacturing plants, research laboratories, operating and maintenance organizations

WHEN the priority regulations struck with its staggering might at industry the consensus was that chaotic fear would result, factories would soon unloose thousands to the ranks of unemployed and machines would begin to idle again. However, typical American solidarity not only routed such a remote condition, but sped that indomitable American will to proceed and succeed, regardless of the burden. And the radio industry pitched in, too, with all its might.

Civilian Needs

The needs of the civilian population will not be neglected in this vast defense program. It is acknowledged that this phase is a most important one, and while the priorities system is designed primarily to implement the production and acquisition of material for the Army and Navy and defense needs of Great Britain, priority help can be and will be given to important civilian projects. The authorities realize and have stated many times that it is just as important to encourage priority in many civilian projects, as for instance, in the case of a large factory, employing thousands of men engaged in the production of purely civilian commodities. While this plant may have little or no direct connection with defense, it is not very wise to close such a factory, for the men thrown out of work will actually curtail the necessary continuance of the program.

Critical List

There is no denying that there are hardships to overcome, as is evident by the Priorities Critical List, which is a list of items, largely military in character, on which the appropriate Army and Navy representatives, in placing their orders or contracts, may issue preference rating certificates. This list is subject to revision once each month, and is available from any field representative of the Army or Navy. Copies are also available through trade associations, or from the Information Division, Office for Emergency Management, new Social Security Building, Washington, D. C.

In the latest critical list, we find acetone, ammonia, radio batteries, cadmium, chromium, cobalt, radio and electrical condensers, pig and fabricated copper, all types of ferrous alloys, formaldehyde, radio-frequency meter sets, dynamotors, halowax solution for insulating wire, steatite insulation, iron and steel products (rolled, drawn, forgings, castings, and pig iron including alloy steels), lead, manganese, molybdenum, electric motors (except fractional horsepower), nickel, synthetic resin, molding powders, tungsten, zinc, in addition to the more familiar ones, such as aluminum, brass, bronze, etc., previously listed.

Equipment Design

The list with these critical necessities, should be always kept in mind in designing future equipment. Of course, the authorities do not say that all these products shall hereafter be made for defense orders. However, when, defense orders are issued, these products or materials shall of course, receive preferential rating.

Aluminum

The mandatory control of aluminum precipitated the first problem to solve. This order provides that all producers of aluminum, both primary and secondary, will rate a customer's requirements according to a schedule of preference ratings. This schedule contemplates that all defense requirements, either direct or indirect, shall be classified as A-10, unless higher ratings are provided by the Priorities Division. The remaining civilian requirements are given B ratings, ranging from B-1 to B-8. B-1 rating provides that one percent of each supplier's product be set aside each month and deliveries be made out of this reserve, only in accordance with specific orders issued by the Priorities Division. In other words, there is a reserve for taking care of unforeseen demands. The remaining ratings divide civilian industries into seven categories, in accordance with their relative importance to the total defense

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Showing several coil shields made from powdered iron. The one at the left is still unfinished.

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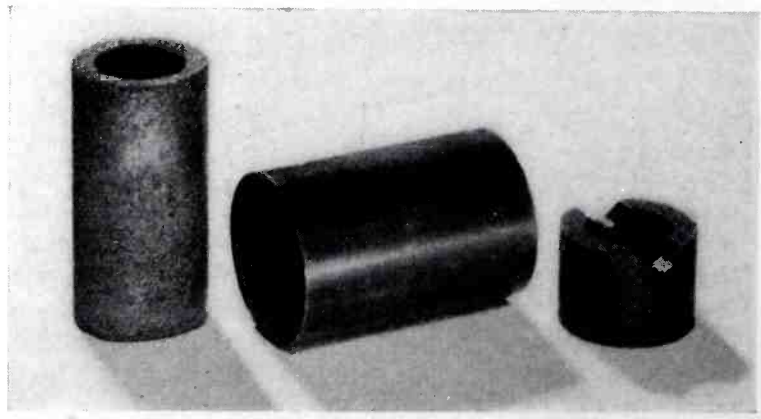

effort. For example, B-2, is for the repair or replacement of existing apparatus, while B-3 is for public health and safety. After the producers of aluminum have rated their customers in accordance with this standard, they submit their judgment to the Priorities Division, each month for approval.

If there is not enough aluminum to satisfy all orders during a particular month, as there obviously has not been (or there would be no need for control), the orders are scaled down on the basis of a fixed percentage of the average 1940 shipments. This percentage for April was 80% for the B-2's, ranging down to 10% for the B-8's in the case of virgin aluminum. In the case of secondary aluminum, the ratio was 100% for the B-2's down to 50% for the B-8's.

Available Aluminum

In 1940, approximately 2000 tons of aluminum were used in the radio industry. Variable condensers consumed about 1000 tons, while 500 tons went into electrolytic units. Another 500 tons went into the making of foil, cans, rods, discs, etc. In view of the low rating given, B-7, about 30% of the 1940 consumption of the better grade material will be allowed, when, civilian supplies are available. About 60% of the lower grade material will be available.

Substitution

It is thus evident that it has become quite imperative to resort to methods of substitution to overcome this handicap. The substitutions are taking two forms; material substitution and product substitution. Material substitutions are gaining in prominence. In view of previous experience and full knowledge of this procedure (it having been practiced long before the priority regulations were put into effect) excellent results are already being attained in this direction.

Plastics

In the electrolytic capacitor division, one manufacturer is replacing the cans of dry electrolytic condensers with plastic tubes. These tubes will be supplied in a variety of colors, to conform with the color code, and thus simplify ordering and use. Although it has been the impression that substitutions would increase the price tremendously, in this instance, the price increase is small.

Plastics are also playing a major role as a substitute in many other instances. Actually, plastics are playing a return engagement. For, in the old days, laminated plastics were quite popular as subpanels. Aluminum and steel came along and sort of shelved the popular fellow. Today, however, subpanels are again being made of laminated plastics, particularly for aircraft radio receivers. Chassis are also being made of similarly constituted plastics, with hollows in the strengthening ridges to accept the leads.

Some manufacturers are also preparing plastic containers with sprayed metallic surfaces, the metal consisting of finely ground scrap material. Thus, shielding surfaces will also be available, with only a minimum of metal used.

Recording Blanks

Another division of the industry that has taken the bull by the horns is the disc division. Several manufacturers have produced glass base recording blanks. The claims are that sound is reproduced as well as with the standard aluminum base. Shipping methods have also been developed to facilitate the safe transportation, and according to reports, test and regular shipments have proved successful.

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The accompanying illustration shows several powdered iron pots and tuning assemblies. The pen point was included in the photo to show comparative sizes.

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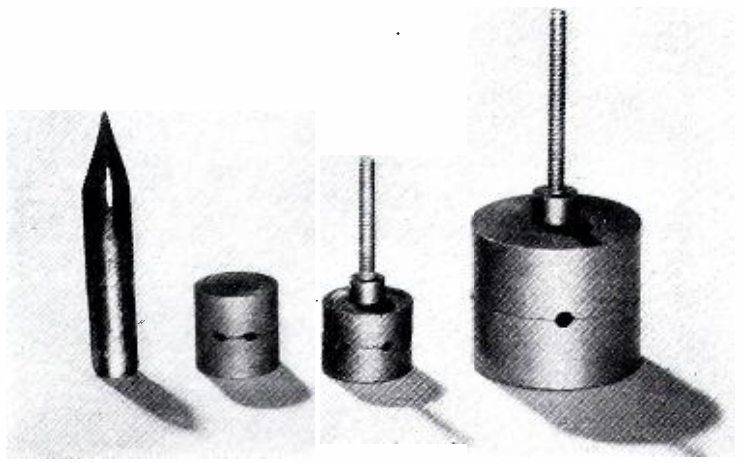


Variable Condensers

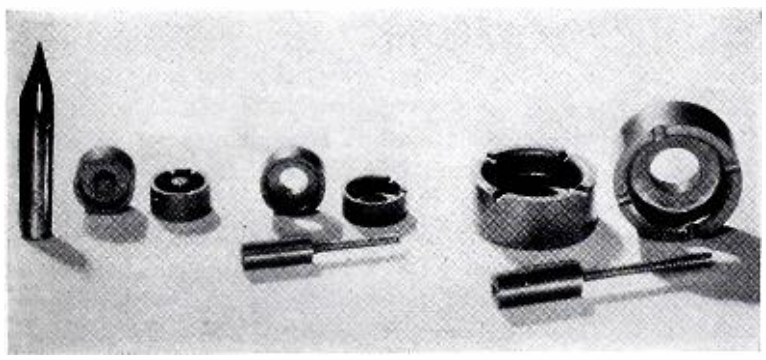
Variable condensers, using the preponderance of aluminum, have received the most jostling by the priority regulations. And here manufacturers will find themselves in quite a bit of a problem. Of course, it is possible to construct condensers of other metals, such as iron, brass or steel, but there are complications in each instance. These fall in the category of weight, corrosion, microphonism, electrical deficiencies (such as magnetic fields), mechanical deficiencies (such as warping). Condensers for the larger receivers using the above materials, can be produced effectively, with necessary caution, but the smaller type condensers with microscopic spacing present a more difficult problem. Accordingly, some manufacturers have studied other means of tuning and have particularly directed their attention to inductive tuning. Here again we meet an old friend.

Inductive Tuning

Inductive tuning had its inception in 1896, when Fleming described its virtues in his grand book. Since then, it has had many wild rides, but during the past few years, it has become an important factor. Automobile manufacturers recognized its possibilities, in view of the high gain possible and small space necessary. Constant improvements have brought them to a point, where many of the automobile receiver makers will be using them for their new crop of sets. And quite a few household receiver manufacturers may also adopt this method of tuning.

Powdered Iron

Here again American ingenuity showed its force, for with the coming of the war, the source of supply of powdered iron became scarce. It became essential to develop a powdered iron



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In this photo the coil shields and tuning assemblies are the same as in the photo at the top of the page, except that they have not been assembled.

• • •

that would equal or exceed the imported material. And most essentially, it was necessary to develop a material that would not be on the scarce list. Such is available today.

This powdered iron, in a variety of styles, is used in i-f transformer housings and shields too, in addition to inductive tuning units.

Under test, the use of a powdered iron shield is said to increase the Q of a coil from say 150, with an aluminum shield, to 165. With an iron or "tin" can cover, the Q is reduced to 85. With zinc the Q would be 140.

The inductive tuning methods, usually take the form of a plunger, or a threaded shaft, with suitable dial control. The i-f transformers use cup cores in a three piece construction, and eliminate the use of the trimmers.

Speakers

Some brow furrowing resulted when the popular Alnico, used in p-m speakers, was placed on the restricted list. In 1940, almost 1000 tons of this material went into the manufacture of 5,500,000 receivers. However, specialists say that there are other permanent magnetic steels that may be used to afford comparatively satisfactory results. These include . . . manganese, 1% chrome, 3% chrome, 5% tungsten, honda (new), mishima, cerstit 500, remalloy, and 77 platinum-cobalt oxide compressed.

There is no doubt that these substitutions will increase the price. And, in addition, a study of the critical list will reveal that some of these metals are restricted. Accordingly it appears as if the dynamic speakers are in for a bit of spotlighting again.

Nickel

Nickel, another important item in the radio industry, and now on the critical listing, appears to be one of the tougher problems to solve, since much of it is imported from Canada, where the need is great too. Approximately 15,500,000 pounds of nickel were available in the month of May, the largest ever made available for industrial use in this country, in any one month. The total demand for nickel, however, for civilian as well as defense, purposes, is considerably higher than the supply.

According to present estimates, if the demands for nickel in May from all sources could be filled, approximately 21,000,000 pounds would be necessary, thus indicating an overall shortage of about 5,500,000 pounds. In view of the rapid change in the supply and demand situation, it is impossible to estimate the future shortages exactly, but recent estimates indicate that the overall shortage for all needs, will probably be over 45,000,000 pounds for 1941.

Shown above is a new type recording blank using a glass base instead of the conventional aluminum. Several manufacturers have announced glass-base discs, while others are using special paper for the base. Illustration courtesy Presto Recording Corp.

In the tube industry, where nickel plays a leading part, many of the problems have already been solved. For instance, copper flashed steel rods are being used for grid supports. Oxidized steel is being used for plates in certain tubes. Iron grid wires with nickel sleeves are also being included. And even in the cathode, where the nickel sleeves are quite imperative, steps are being made to develop a suitable substitute. It is believed however, that the priority authorities, cognizant of the importance of tubes in civilian life, may relax this restriction and allow greater use of nickel for tubes.

Inventory Control

Recently, an inventory control plan was instituted to prevent overbuying for unnecessary inventories. This was applied to sixteen metals, including cadmium, chromium, cobalt, copper, ferrous alloys, iron and steel products, molybdenum, tin, etc. This order will cure to an extent the bottlenecks that have been occurring in sources of supply. Despite the broad scope of this order, it, in fact, amounts to an honor system for the industry. It is hoped that thus inventories will be controlled most efficiently.

Nickel Steels

Nickel bearing steel, also on the priority listing, is defined as any steel containing 0.4 percent or more of nickel or any steel containing less than 0.4 percent of nickel, if nickel is specified by the customer, or is known to have been added to obtain a desired physical quality in the steel.

Jobbers

An interesting sidelight in this priority situation, is the position of the radio parts jobbers. Many alert jobbers aware of the pressure under which factories producing the essential radio parts, are filling an important niche, particularly for the manufacturer of complete receivers or transmitters who requires but short supplies of parts from time to time. Too much time is consumed by going directly to the factory, and thus he directs his orders to the jobber. In the New England sector, where there are many such receiver and set manufacturers, jobbers are doing a grand business. The parts factories are delighted, for it facilitates operation and delivery, and the receiver or transmitter manufacturer is satisfied for he receives his parts quickly. The jobber of course receives his just reward for this service.

Prices

In view of the priority regulations and general conditions, prices of parts are changing constantly. Accordingly, the catalogs that will reach the fans, hams, experimenter, engineer and manufacturer will in some instances have blank spaces where the prices usually appear. Price sheets with prices as of the date delivered, or as close to it as possible, will be included.

New Products

Although the laboratories of manufacturers are engaged in extensive work in developing materials and products for defense, sufficient time has been set aside to permit development for civilian use. This has meant that many extra hours of hard work have been added to the already pressing schedules of engineers. However, the enthusiasm to serve their nation, has been made more than evident by these engineers, and as a result, civilian necessities will not be thrown to the wayside. Best evidence of this are the many announcements of new products already available.

These new products are not restricted to any one division of the radio industry and neither are they all substitute products. For instance, there will be found new tube testers, receiver analyzers, popular priced ultra-high-frequency midget tubes, low-priced rectifier tubes, twin beam power tubes, high power triodes of the 812 type, microphones, loudspeakers, inter - communicating equipment, motion picture sound projectors, etc.

Many of the new products that will be available, will serve the dual purpose of acting as a substitute and as a superior replacement in receivers and transmitters. In other words, there should be no fear that the substitutes being offered are simply slap-dash products and thus lack efficiency. A study of them will reveal that many have features that have always been wanted. Thus to defense work, we shall be indebted for a host of important developments that will provide us with efficient and quality products.

It all started in a tent...

AGAINST the horizon of "the spires of Princeton," the world's largest radio research laboratories are to be built by the Radio Corporation of America at Princeton, New Jersey.

The new RCA Laboratories, to be completed before the year-end, are planned to promote the growth of radio as an art and industry, and to meet the expanding demands of national defense. Several hundred research experts and engineers will coordinate their efforts to create new products and services, and improve existing ones, in all fields of radio and electronics.

The march of progress which has led to Princeton started back in 1919 when the first RCA laboratory was located in a tent, later to be augmented by a shack 15 feet square at Riverhead, L. I. From that humble beginning, with public service as the watchword, RCA has pioneered in radio manufacturing, international communications, marine radio, broadcasting, sound reproduction and television. Through continuous research it has discovered keys that have unlocked new doors of radio science, and has extended the usefulness of radio into many realms of public service.

Now, RCA research experts on a united front at Princeton are to take another historic step to enhance America's preeminence in radio, and to increase the services of radio to the Government, to the people of the United States and to industry.

RCA LABORATORIES

A SERVICE OF RADIO CORPORATION OF AMERICA
Radio City, New York

RCA Manufacturing Co., Inc. • Radiomarine Corporation of America
RCA Laboratories • National Broadcasting Company, Inc.
R.C.A. Communications, Inc. • RCA Institutes, Inc.

Measuring C and L at R-F

By J. E. WILLSON
P. R. Mallory & Co., Inc.

• The measurement of distributed capacity and pure inductance at radio frequencies

In designing inductances for r-f filters and other networks it is desirable to know accurately their values of pure inductance and distributed capacity. Measurements of these kinds can be made at radio frequencies by using only a standard radio receiver having automatic volume control and an accurately calibrated variable condenser. Any commercial radio station may be used as the signal generator. The principal advantages of this are that the frequency will be known very accurately, usually within a few cycles, and that the frequency will not vary due to a load being placed on the generator.

A superheterodyne receiver having automatic volume control may be used as an aperiodic detector when making the measurements. From the theory of automatic volume control it is known that the smaller the incoming signal the greater the plate current of the controlled tubes will be due to the change in grid bias caused by the a-v-c action. Therefore, with a minimum input signal the plate current will be maximum.

In a parallel tuned circuit containing inductance and variable capacity the impedance at resonance will be maximum. Therefore, at resonance only a very small part of the signal of the resonant frequency will pass through the circuit. If a parallel tuned circuit is placed in series with the antenna of a receiver and made to resonate at the frequency to which the receiver is tuned, there will be a minimum input signal to the receiver at that frequency. At any other point other than resonance of the tuned circuit there is a much greater received signal. As the circuit is tuned through resonance, an indicating milliammeter placed in the plate circuit of any tube controlled by the a-v-c circuit will indicate maximum current at the resonant point of the tuned circuit.

If a multiband receiver is used, measurements can be made at nearly any frequency if one has a suitable calibrated condenser which will resonate the tuned circuit at the frequency of the incoming signal. The only requirements of the standard condenser are that its calibration must be accurate and that it must be the correct value to cause resonance in the tuned circuit at the frequency of the generator. If the broadcast band alone is used, inductances of 20 mh and above yield better results when a standard variable condenser of 1000 mmfd or larger is used.

The circuit connections are made as shown in Figs. 1 and 2. The parallel tuned circuit is inserted in the antenna lead of the receiver, an external ground being used as an aerial. By using the ground as an antenna the rotor of a standard condenser could be grounded, thus preserving the original calibration.

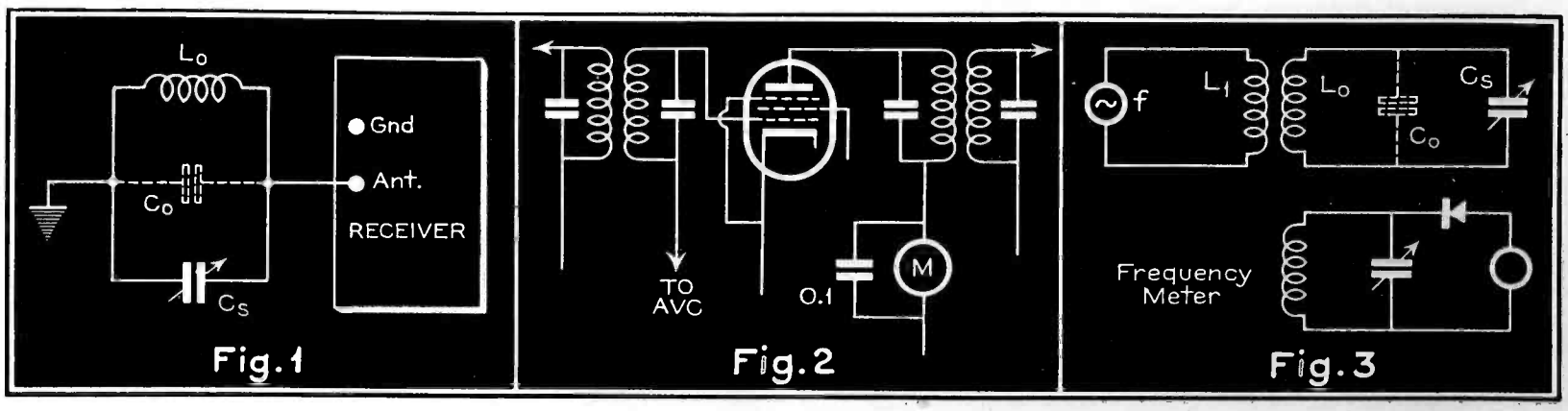
The equations used for calculating the distributed capacity and pure inductance of a coil will contain two of frequency and two values for the settings of the standard condenser. It was found desirable to make measurements at two slightly separated frequencies and combine the results into one equation. This gave much better accuracy than measurements made at a single frequency.

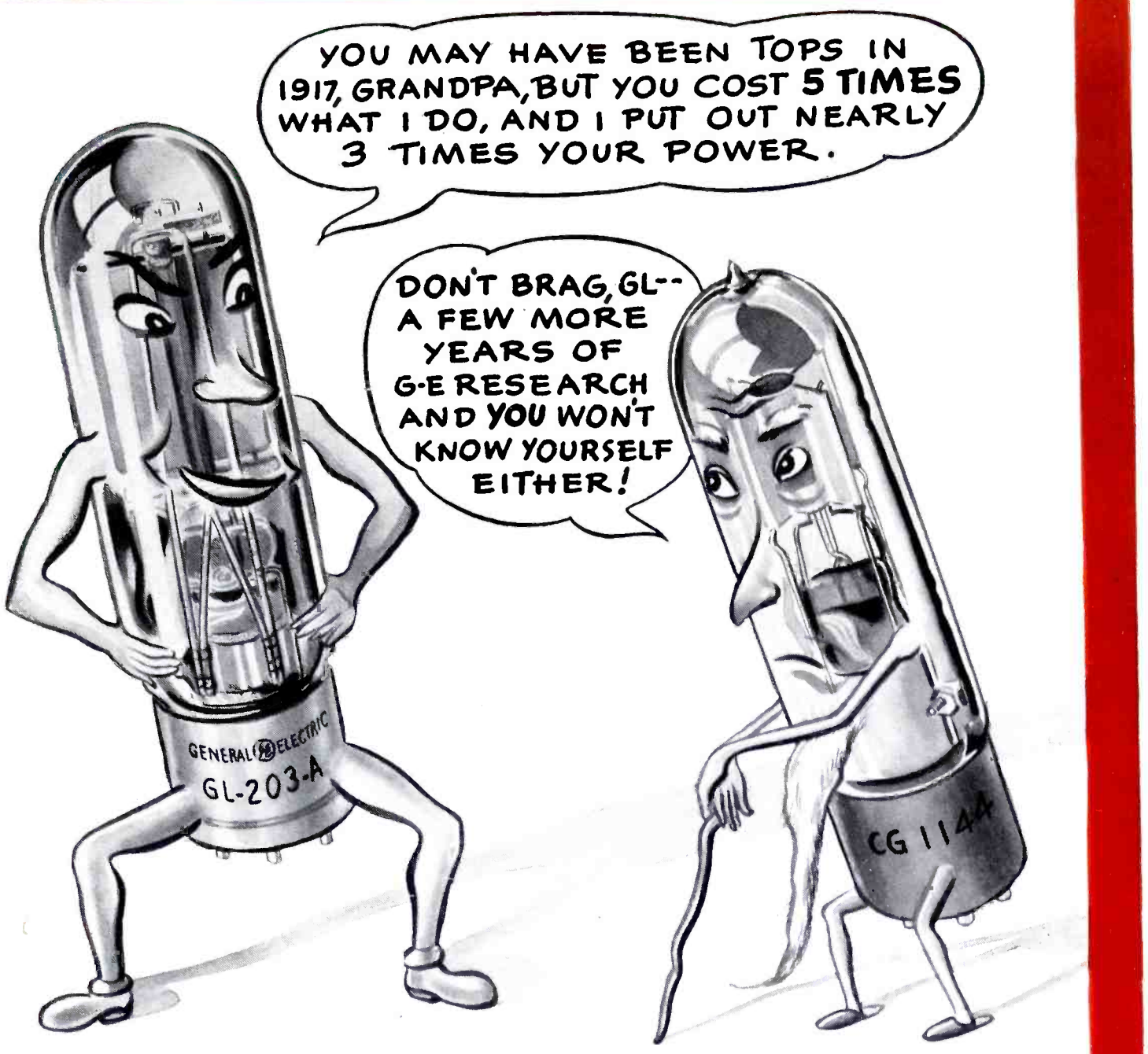
The procedure used in making the measurements is as follows: The receiver is tuned to some commercial transmitting station and the standard condenser is varied until there is a maximum current indicated on the milliammeter. The frequency of measurement and the setting of the variable condenser should be noted. This same procedure is followed at another frequency close to the first. The values of frequency and capacity obtained are then substituted in the equations, which when solved will show the values of inductance and capacity.

In Fig. 3 it must be assumed that there is a mutual coupling between the inductances I_x and I_o, yet that the close proximity of the two coils does not change their absolute values of inductance. This can be assumed because the method outlined above utilizes a radiation rather than an induction field of

(L & C—continued on page 24)

Circuit connections for measuring L and C at radio frequencies





Both "50-watters"..But today's GL-203-A gives you 15 times as many "watts per dollar"

Were you a tube buyer in 1917? Probably not—but those who were know that General Electric was a leader in the tube business then, as it is today. The progress that's been made in "50-watters" is typical of the results achieved through G-E research.

You can get G-E tubes promptly through any of our offices—located in 80 principal cities. Get in touch with your G-E representative today. General Electric, Schenectady, N. Y.

"How To Plan an FM STATION"
by W. R. David
. . . is a valuable aid to any FM-minded organization. Ask the G-E representative who serves you for a free copy, or write direct to General Electric, Radio and Television Department, Schenectady, N. Y.

GENERAL ELECTRIC

VETERAN WIRELESS OPERATORS ASSOCIATION NEWS

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

Plaque

WE acknowledge with thanks the recent letter from the Hon. James Lawrence Fly, Chairman of the Defense Communications Board and the Federal Communications Commission, in which he says in part:

"The Marconi Memorial Plaque which your Association kindly awarded to the Defense Communications Board through me as Chairman, is now resting securely in my office where the Board meets at least once a week. It is, indeed, a very attractive Plaque and is being constantly admired by many visitors to my office. Sincerely yours, James Lawrence Fly, Chairman."

In Service

Among our members who have entered active service in the armed forces of our country recently are the following: Fred Muller, Past President and present Director, now on active duty in New York as a Lieutenant Commander in the Navy in charge of Radio installations and inspections in the Third Naval District; Carl O. Peterson, a member of the two first Byrd Expeditions to Antarctica—now serving as Communications Officer on the *U. S. S. Ranger,* an aircraft carrier of our Navy—Carl is a Lieutenant, Senior Grade; Fred McDermott, formerly of the Program Service of the American Telephone and Telegraph Company, who was called back to active service—Fred had retired as a Chief Radioman after twenty years' service; V. H. C. Eberlin, a former Treasurer of our Association and recently Technician at the Hialeah plant of Tropical Radio—now a Lieutenant (JG) in the Navy at Jacksonville, Fla.; Karl Baarslag, who has authored four books so far, will soon enter the Navy as a Lieutenant (JG).

We shall be glad to include the names of others in the services and news of their activities. Just drop us a note to Radio City.

Smoker

The VWOA Smoker held at Fusco's Restaurant in New York City on April 15th was deemed by all attending a grand success. The Association was host to five members of the Wireless Telegraph department of one of his Majesty's ships in the harbor.

The five guests were S. Belsham, Thomas Scott, J. Thompson, L. Simpson, and A. Phipps.

Among those present were: G. N. Mathers, of Tropical Radio; T. H. Ellis, also of Tropical; O. W. Penney, of the staff of WMCA; Pierre Boucheron, General Sales Manager of the Farnsworth Television and Radio Corporation; E. J. Quinby, of RCA; "Bill" Marshall, of the New York Telephone Company Ship Telephone Service; Victor Ladaveze, with RCAC at Rocky Point, L. I., who came all the way in to New York for the party; A. J. Costigan, Traffic Manager of Radiomarine; "Bill" Simon, our Chancellor of the Exchequer and Marine Radio Superintendent of Tropical Radio; George Clark, our energetic secretary; Ed. G. Raser, who came up from Trenton for the affair—he started in radio in 1912; J. O. Allison, Supervisor in the Radio department of A. T. & T.; John F. McCloskey, though not eligible for membership, yet a constant attendant at our Smokers; E. Garcia, who started in radio in 1924; Henry T. Hayden, Sales Engineer of the Ward Leonard Company and Chairman of our Membership Committee; V. P. Villandre, of Radiomarine, Chairman of our Ticket Committee; R. H. Frey, Radio Supervisor of the Bull Steamship Company; D. Currie, in radio for fifteen years; A. O. Thomas, a veteran in radio since 1912; Robert E. Pearson, of Postal Telegraph—started in 1915 in the wireless field; Geo. Duvall, a thirty-one-year veteran—first assignment in 1910—now National President of the Radio Servicemen's Association and some others whose names fail us at present.

The feature of the evening was the telling of stories by all present and we were forced to render our best in order to stay in the running with our English guests.

Next Smoker

Because of the enthusiastic response to our recent Smoker and since it was unanimously agreed that another similar event should be scheduled in the near future plans have been completed for our next Smoker to be held at Fusco's Restaurant, 18 Beaver Street, New York City, on Tuesday evening, June 17, 1941. A good dinner will be served accompanied by all the beer one can drink for the very moderate sum of two dollars. All those attending these affairs in the past have enjoyed them. Why don't you plan to be present on this occasion? Your friends—not members of our Association—will be accorded a cordial welcome. Will we see you there?

Message

Message from the Chief Signal Officer of the Army, Major General J. O. Maubergne, Signal Corps., to the Veteran Wireless Operators' Association:

"Mr. President and Members of the Veteran Wireless Operators' Association:

"I have been highly honored by the tender of honorary membership to your Association which binds together in fraternal organization those outstanding heroes of communication, without whom national defense would be a complete failure.

"Without communications in national defense, whether furnished by commercial companies or by communication agencies of the national defense forces—and both are absolutely essential as a team—military and naval movements and combat would undoubtedly fail.

"Wireless operators are the backbone of wireless communication so essential to 'blitzkrieg" warfare with tanks, combat cars, mechanized artillery and infantry, observation and dive-bombing aircraft, and in fact all operations of the Army and those associated with the G. H. Q. Air Force. The inspiration and stimulus given by your organization to young and old operators in the defense service to fight to the last gasp to get their messages through before they are obliterated is your contribution to national defense.

"By bringing to the attention of all operators the aims and purposes of your organization, namely, to foster and extend an esprit de corps among wireless operators; to afford opportunity for social intercourse, and to promote a fraternal and comradely sentiment between and among its members; to recognize meritorious service rendered by wireless operators on land, at sea, or in the air, by the erection of memorials and by the bestowal of testimonials, medals, scholarships, or other suitable awards; to acquaint the public with the work, traditions and ideals of wireless operators and to perform and encourage any other purely fraternal activity or activities adjudged helpful to the wireless profession; you will fill them with the esprit de corps of existing and departed wireless operators and will so imbue them with your ideals that they, too, under the most severe conditions that can try man's soul, will be true to their creed and their resolution to equal the performance of the heroes who have gone down in history—in your history—as being worthy of the appellation of the Veteran Wireless Operators' Association.

"Gentlemen, your duty to national defense is clear and your contribution will heap greater and greater glory on your organization."

• • •

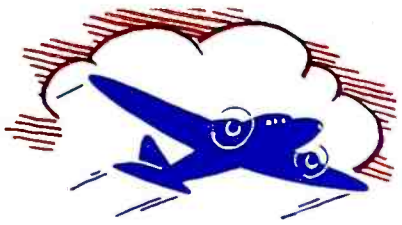
TELEVISION STATION

The Federal Communications Commission gave the "go-ahead" signal to Thomas S. Lee's Hollywood television station W6XAO for full commercialization on July 1. This commercial license represents the fruits of eleven years' work and an investment of half a million dollars.

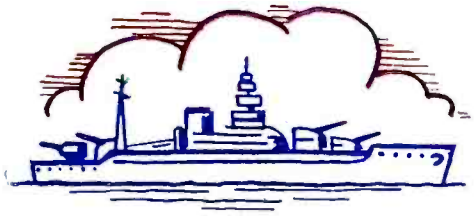
SOLAR SERVES THE SERVICES...

Just as nerves control our bodies, communications equipment controls modern warfare. Nerves must not fail; communications must be maintained.

Solar is proud of...and is zealously guarding...the reliability which its Capacitors add to radio and electrical control equipment for the Armed Service Branches of our Government.

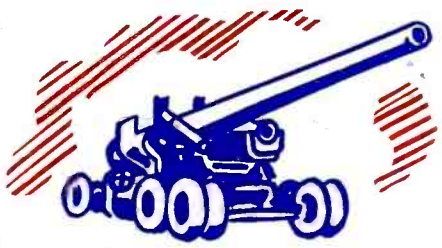


IN THE AIR special Solar capacitors function down to −40°C. or at 50,000 feet altitude, and under severe vibration.



ON THE SEA are Solar capacitors which have passed salt-water immersion tests, are corrosion-proof and stabilized.

MOBILE FORCES—Solar capacitors of compact special design can take punishment from extremes of heat and cold and have passed exacting vibration tests,



ARTILLERY — directed from aircraft — or controlled electrically from the ground — gains certainty of action from reliable electrical equipment — including Solar capacitors.

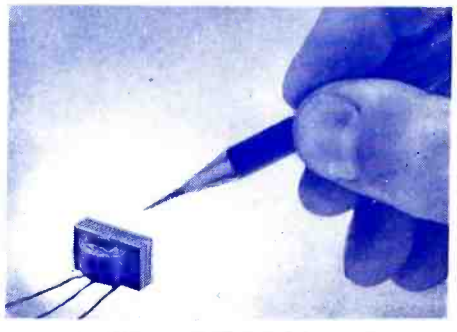
Solar reliability is built into all types of electrical condensers for industrial, radio and service applications.

SOLAR MFG. CORP. BAYONNE, N. J.

It is surprising to most people to find out that by far the bulk of U.T.C. production is on special units not normally catalogued. It is impossible to describe all these thousands of special designs as they become available. The solutions to three typical customers' problems are shown below.

FULL WAVE VARITRAN

● In one full wave rectifier application, our customer was employing a standard varitran with a step-down transformer having a center tapped secondary. The U.T.C. design division simplified this construction by developing a special varitran unit with an insulated secondary and a double contact structure, permitting a continuous variable voltage to be obtained each side of center. The step-down transformer is now entirely eliminated.



THE SMALLEST

● In one special application the requirements call for the smallest output transformer possible, size and weight being of paramount importance. The design developed by U.T.C. has dimensions only 7/16" square by ¾" high. Almost ten thousand turns are employed in the coil of this unit. Ten of these transformers weigh only three ounces.

600 AMP. VARITRAN

● In bending some types of tubing, it is desirable to heat the tubing to a highly ductile point, thus preventing kinking. A special U.T.C. varitran was developed for this application. This unit combines a standard varitran with a step-down transformer. The output current, for any type of load normally encountered, can be varied continuously from zero to 600 Amps. with direct meter calibration.

MAY WE ASSIST YOU IN YOUR PROBLEMS?

The design ingenuity used in these applications has helped many users in other problems. The cumulative experience acquired in such development makes U.T.C. an ideal source for transformers to specifications.

UNITED TRANSFORMER CORP.

150 VARICK STREET ★ NEW YORK, N. Y.

EXPORT DIVISION: 100 VARICK STREET NEW YORK, N. Y. CABLES: "ARLAB"

OVER THE TAPE

TELEVISION APPLICATIONS

New application forms to expedite the transition of television stations from experimental to commercial basis have been made available by the Federal Communications Commission in preparation for the advent of television commercial service on July 1. Form 330 covers construction permit for a new commercial television station under the rules and regulations and standards adopted by the Commission's order of April 30.

MEASUREMENTS CORP. EXPANDS

Measurements Corp. are now located in a new factory on Intervale Ave., Boonton, N. J. The new air-conditioned building provides facilities for greatly increased production.

AUDIO DEVELOPMENT BULLETIN

Audio Development Co., 123 Bryant Ave. No., Minneapolis, Minn., have recently issued a bulletin covering patch cords, plugs, jacks, jack panels, vu meter panel, pads, chassis, etc. Copies available from the above organization.

G-E BOOKLET

"The Change to Plastics" is the title of an attractive new folder issued by the Plastics Department of the General Electric Co., Pittsfield, Mass., giving twelve case histories in which plastics have been used in making items formerly made of other materials. Copies available on request.

PINKERTON JOINS INCO

W. C. Pinkerton, for the past six years assistant technical editor of Chemical Engineering Catalog, has resigned to join the Monel and Rolled Nickel Advertising Department of the International Nickel Company. A specialist in the handling of technical material for the process industries, he will edit house publications devoted to those industries.

LAFAYETTE P-A CATALOG

A new 48-page catalog devoted exclusively to sound equipment and including the brand-new Lafayette line for 1941-2 has been issued by the Lafayette Radio Corp., 100 Sixth Ave., New York City. Illustrated listings of some 25 amplifier models and approximately 75 coordinated sound systems, plus expanded lines of accessories, recorders, intercommunication equipment and custom-built systems for school, industrial and other specialized applications, are included.

DRAKE CATALOG

The new Drake catalog, just off press, lists dial and jewel pilot light assemblies and parts. They are illustrated and described together with information as to voltage, lamps required, jewel colors, type of mounting, and complete measurements. Price list for each type of assembly is included, covering not only complete assemblies, but the various individual parts. A copy of the new catalog will be mailed without obligation to anyone interested. Address Drake Mfg. Co., 1713 West Hubbard St., Chicago.

The odd looking horns with their abrupt steps are actually steel forms into which Dr. Vincent Salmon, of Jensen Radio Mfg. Co., cast plaster paris internal contours to test his new mathematically developed "Hypex" horn formula.

R. C. P. CATALOG

The 1941-1942 line of test equipment offered by Radio City Products Co., 88 Park Place, New York City, is making its bow at the Chicago trade show. Immediately after the show, complete details of some fifty models which comprise this line will be presented to the public in a brand new R. C. P. catalog (No. 125), which is now in preparation.

WESTERN ELECTRIC APPOINTMENT

Walter L. Brown of Huntington, W. Va., took office Thursday, May 1, as vice-president and general counsel of the Western Electric Company, according to an announcement by C. G. Stoll, company president. He succeeds T. Brooke Price, who becomes general attorney of the American Telephone and Telegraph Company. Mr. Brown was elected to Western Electric's board of directors at a stockholders' meeting two weeks ago.

IRVINGTON VARNISH MANUAL

The Irvington Varnish & Insulator Co., Irvington, N. J., are distributing a 34-page manual. The purpose of the book is to assist the user in the proper selection and application of insulating varnishes. The booklet is illustrated and contains many charts and tables.

BROWN ON TRIP

Francis H. Brown, manager of National Recording Supply Co., Hollywood, the middle of May started, via auto, on a southern trip accompanied by "Barb" Barbley, of the sales staff. They will contact dealers and swing around to Chicago in time for the trade show there in June.

SOLAR APPOINTMENT

Mr. William F. Seeman, 523 Ellicott Square, Buffalo, New York, district sales manager of the Solar Manufacturing Corp., has recently been elected to the corporation's Board of Directors.

WESTINGHOUSE LEAFLET

Insulators for supporting outdoor disconnect switches, bus structures, and other high-voltage equipment are described in a new 8-page leaflet announced by Westinghouse. They are designed for use on lines with system voltages between 7.5 and 69 kv. Application and construction details are given. All styles and physical dimensions are shown by line drawings. Complete electrical data are listed for each style. A copy of Descriptive Data 39-400 may be secured from Department 7-N-20, Westinghouse Elect. & Mfg. Co., East Pittsburgh.

NBC STUDIOS

Work on the job of constructing two more audience-type studios in Radio City, already the largest radio studio plant in the world, was begun recently, according to an announcement by O. B. Hanson, NBC vice-president and chief engineer. The two new Radio City units, said Hanson, will incorporate advanced radio studio design with the atmosphere of the intimate theatre. Each will provide seats for an audience of 450 persons.

RADIO'S MASTER ENCYCLOPEDIA

United Catalog Publishers, Inc., 108 Lafayette St., New York City, have announced their 1940-41 edition of "Radio's Master Encyclopedia." This book contains 750 pages of listings of manufacturers and manufacturers' items. The price is $2.50.

CHANGE OF NAME

The name of the Astatic Microphone Laboratory, Inc., Youngstown, Ohio, has been changed to The Astatic Corporation. This is said to be a change in name only, not altering in any way Astatic holdings, contracts, personnel or policies.

OHMITE APPOINTMENT

Roy S. Laird has been appointed sales manager for the Ohmite Manufacturing Co., Chicago. Mr. Laird has been with the company 5 years as sales engineer and is well known in both the jobber and industrial fields.

DU MONT EQUIPMENT SALES

The appointment of Leonard F. Cramer as sales manager of the Instrument and the Video Equipment Divisions is announced by Allen B. Du Mont Labs., Inc., of Passaic, N. J. The Instrument Division continues in the sale of standard and special cathode-ray oscillographs, tubes and associated equipment. The new Video Equipment Division is surveying, planning and building equipment for television broadcasting.

WABC TRANSMITTER

Fifty tons of steel-armored marine cable, three miles in total length, were sunk to the bottom of Long Island Sound to complete the link between Columbia's new transmitter for its key station, WABC, and the mainland. The new transmitter is nearing completion on Columbia Island, a mile off New Rochelle, N. Y., in Long Island Sound.

AUDIO DEVELOPMENT CATALOG

Audio Development Co., 123 Bryant Ave., Minneapolis, Minn., have just released a catalog covering the ADC line of transformers. Rather complete data are given. Copies may be secured by writing to the above organization.

(TAPE—Continued on page 26)

Seventeenth Annual Convention

RADIO MANUFACTURERS ASSOCIATION

- *Hotel Stevens, Chicago*
- *June 10-13*

THE advance program has been prepared for the seventeenth annual RMA Convention and the Radio Parts National Trade Show, both at the Stevens Hotel in Chicago. "Radio Week" will be observed in Chicago from June 11 to 13, with the RMA convention and many committee and group meetings being held on June 10 and 11, with the annual Radio Parts Trade Show continuing through Friday, June 13. The latter is sponsored jointly by RMA and the Sales Managers Club, and virtually all exhibit space in the Exhibition Hall of the Stevens Hotel were reserved, much in advance of schedule.

RMA Convention

President J. S. Knowlson of RMA will preside at the annual RMA membership luncheon meeting on Tuesday, June 10. The annual radio industry banquet, for RMA members and guests, will be held Wednesday evening, June 11, in the Grand Ball Room of the Stevens Hotel. Chairman Paul V. Galvin and the RMA Convention Committee are arranging another excellent program of entertainment, preceded by the usual cocktail party. Another social event of the annual industry gathering in Chicago will be the radio golf tournament under the auspices of the Radio Industries Golf Club of Chicago and probably at the Calumet Country Club, the scene of many past annual events of radio golfers. This year, however, the tournament probably will be held on Friday, June 13, the closing day of the Parts Trade Show, instead of as usual in previous years on Thursday.

Trade Show

The Radio Parts National Trade Show, again under the management of Ken Hathaway, will open at 2 P. M. on Tuesday, June 10, and close at 8 P. M. on Friday, June 13, with an open house reception. Exhibition for radio jobbers will close officially at 6 P. M. on Thursday, June 12, with an evening show period for the Radio Service Men of America and guests. The annual dinner of the National Radio Parts Distributors' Association is scheduled for Wednesday evening, June 11.

Group Meetings

Many industry and group meetings are being arranged for the Chicago radio gathering. There will be meetings of the Sales Managers Clubs, the Radio Service Men of America, "The Representatives," and other organizations of the industry. All four RMA general divisions—the set, tube, parts and amplifier and speaker manufacturers, together with many committees of RMA, will also hold meetings.

Program

The tentative Convention and Parts Trade Show program follows:

Tuesday, June 10

10:00 A. M.—RMA Board of Directors' Meeting. Presiding, President J. S. Knowlson, West Ball Room, Third Floor.

12:30 P. M.—RMA Membership Luncheon Meeting. Presiding, President J. S. Knowlson, North Ball Room, Third Floor. Annual Business Meeting of RMA Membership, including annual reports of President Knowlson, Treasurer Muter and others, will follow luncheon.

2:00 P. M.—10:00 P. M. Radio Parts National Trade Show, Opening, Exhibition Hall, Stevens Hotel.

2:30 P. M.—RMA Set Division, Annual Meeting. Chairman, Paul V. Galvin. Private Dining Room No. 1, Third Floor.

2:30 P. M.—RMA Tube Division, Annual Meeting. Chairman, Roy Burlew. Private Dining Room No. 5, Third Floor.

2:30 P. M.—RMA Parts and Accessory Division, Annual Meeting. Chairman, H. E. Osmun. Private Dining Room No. 2, Third Floor.

2:30 P. M.—RMA Amplifier and Sound Division, Annual Meeting. Chairman, Donald MacGregor. Private Dining Room No. 3, Third Floor.

Wednesday, June 11

10:00 A. M.—6:00 P. M. Radio Parts National Trade Show. Exhibition Hall, Stevens Hotel.

10:00 A. M.—RMA Committee on Advertising. Chairman, John S. Garecau. Private Dining Room No. 4, Third Floor.

10:00 A. M.—RMA Export Committee. Chairman, Walter A. Coogan. Third Floor, West Ball Room.

12:15 P.M.—RMA Credit Committee, Luncheon Meeting, Eastern and Western Divisions. Chairman, J. J. Kahn; Vice Chairman, Victor Mucher, and S. J. Storm. Private Dining Room No. 1, Third Floor. Business Session with NCO following luncheon.

12:30 P. M.—Luncheon Meeting, New RMA Board of Directors, Private Dining Room No. 2, Third Floor. Election of President and other RMA officers for ensuing year.

7:00 P. M.—RMA Annual Industry Banquet. Convention Committee Chairman, Paul V. Galvin. Grand Ball Room, Stevens Hotel. RMA Members and Guests. Informal. Ladies invited. Dancing.

7:00 P. M.—Annual Dinner Meeting, National Radio Parts Distributors' Association.

Thursday, June 12

10:00 A. M.—10:00 P. M.—Radio Parts National Trade Show. 6:00 P. M.—10:00 P. M. for RSA Members.

12:30 P. M.—Radio Industries Golf Tournament, Calumet Country Club. Luncheon at Club House at 12:30 P. M. and Dinner at 7:30 P. M.

Friday, June 13

11:00 A. M.—8:00 P. M.—Radio Parts National Trade Show.
6:00 P. M.—8:00 P. M.—Open House.

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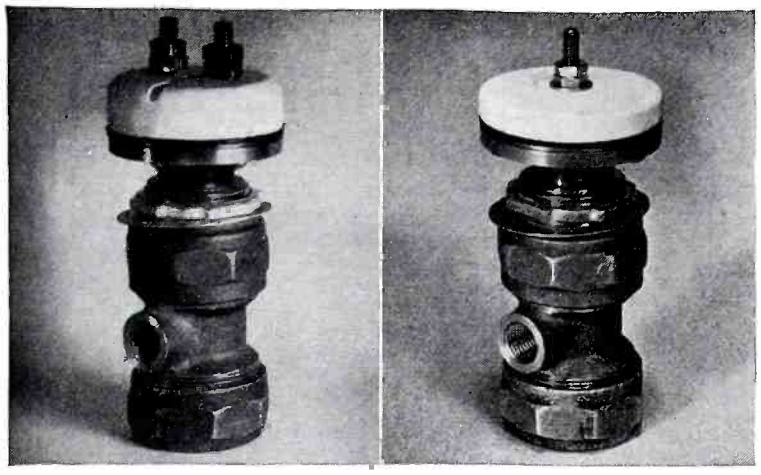
FRANKLIN MEDAL TO ARMSTRONG

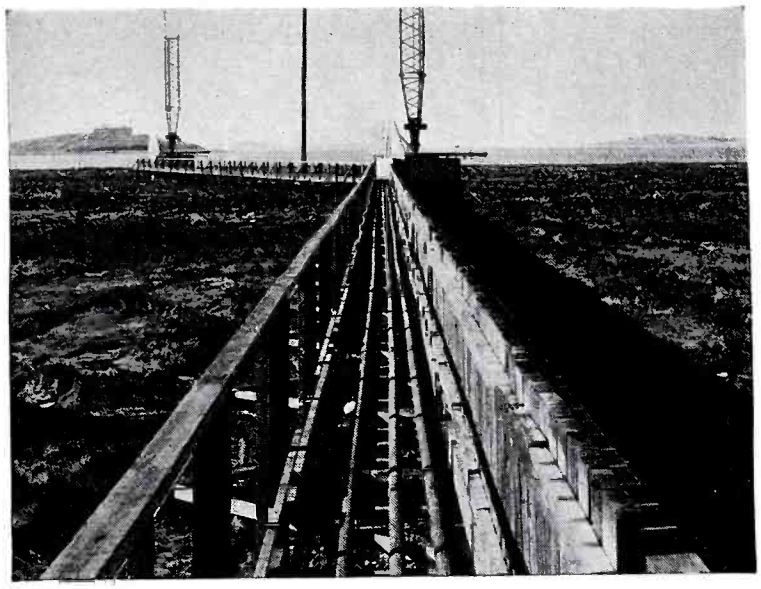
Radio communication as an industry, and radio listening as a pastime, are being changed to a revolutionary degree by the invention of "Frequency Modulation," which is expected to make far-reaching changes in coming months. The Franklin Institute awarded its famous Franklin Medal on Wednesday, May 21, to Major Edwin Howard Armstrong of New York City, the inventor of "frequency modulation." This medal is awarded every year from a fund established by the late Samuel Insull, Esq., "to those workers in physical science or technology, without regard to country, whose efforts have done most to advance the knowledge of physical science or its application."



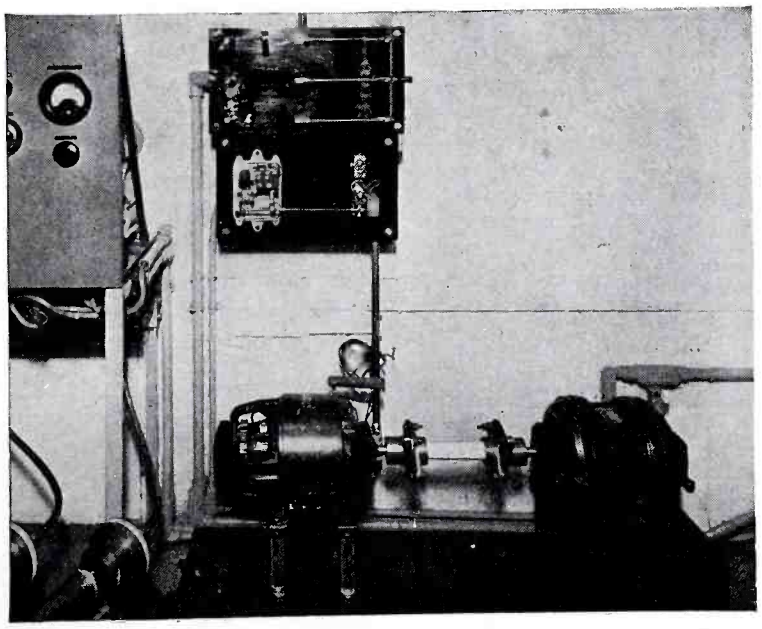
INSULATION HIGHLIGHTS

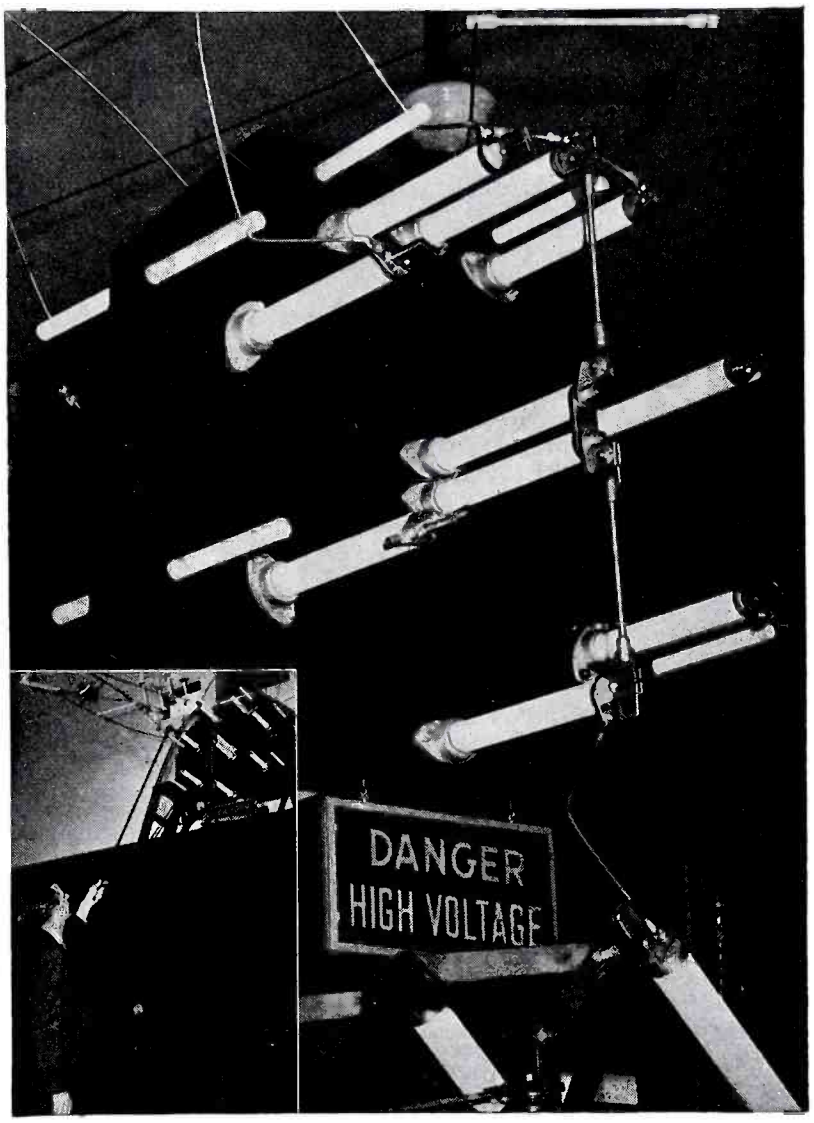
(*Above*) NEW FLARE TYPE END SEALS have been added to Isolantite's comprehensive list of fittings for transmission lines. End seal at left is for new balanced two-wire lines while fitting at right is for the coaxial lines. These new flare type end seals are for use in ultra high frequency service, such as frequency modulation, television, airport beacons, and special applications.

(*Below*) CONCENTRIC TRANSMISSION lines built by Isolantite serve Westinghouse 50KW Station WBZ and WIXK, the new FM transmitter at Hull, Mass. Isolantite* 2⅝" diameter transmission line provides maximum safety factor for high power broadcast and minimum attenuation for ultra high frequency FM service.



(*Below*) HIGH STRENGTH AND RIGIDITY of Isolantite make it particularly adaptable to applications where insulators are subjected to continual fatigue or repeated mechanical stresses. These mechanical features, in addition to its availability in custom built shapes, are exemplified by its use as a shaft coupling in this tower light M-G set at Station WDAF, Kansas City.





(*Above*) STAND-OFF INSULATORS of Isolantite are used extensively at the Lawrenceville, N. J., station of the American Telephone and Telegraph Company's Long Lines Department. Photos show front and rear views of antenna selector switch panel on South American lines. This use of Isolantite in overseas radio-telephone equipment is typical of the ways in which it serves every major branch of the communications industry.

**Registered trade-name for the products of Isolantite, Inc.*

ISOLANTITE

CERAMIC INSULATORS

ISOLANTITE, INC. FACTORY: BELLEVILLE, NEW JERSEY

SALES OFFICES: 233 BROADWAY, NEW YORK, N. Y.

L & C

(Continued from page 16)

the generator. The frequency square equations for determining the pure inductance and capacity are derived as follows:

$$f_1^2 = \frac{1}{4\pi^2 [L_o ({}_1C_s + C_o)]}$$

$$f_2^2 = \frac{1}{4\pi^2 [L_o ({}_2C_s + C_o)]}$$

$$\frac{f_1^2}{f_2^2} = \frac{{}_2C_s + C_o}{{}_1C_s + C_o}$$

$$C_o = \frac{f_1^2\,{}_1C_s - f_2^2\,{}_2C_s}{f_2^2 - f_1^2}$$

$$C_o = \frac{(f_1\sqrt{{}_1C_s} - f_2\sqrt{{}_2C_s})}{(f_1\sqrt{{}_1C_s} + f_2\sqrt{{}_2C_s})(f_2 + f_1)(f_2 - f_1)}$$

${}_1C_s$ = capacity of C_s at f_1
${}_2C_s$ = capacity of C_s at f_2
C_s = standard variable condenser
C_o = distributed capacity of coil
L_o = pure inductance of coil

$${}_1C_s + C_o = \frac{1}{4\pi^2 f_1^2 L_o}$$

$${}_2C_s + C_o = \frac{1}{4\pi^2 f_1^2 L_o}$$

$${}_1C_s - {}_2C_s = \frac{1}{4\pi^2 f_1^2 L_o} - \frac{1}{4\pi^2 f_2^2 L_o}$$

$${}_1C_s - {}_2C_s = \frac{1}{4\pi^2 L_o}\left(\frac{1}{f_1^2} - \frac{1}{f_2^2}\right)$$

$$L_o = \frac{\frac{1}{f_1^2} - \frac{1}{f_2^2}}{4\pi^2 ({}_1C_s - {}_2C_s)}$$

$$L_o = \frac{\left(\frac{1}{f_1} + \frac{1}{f_2}\right)\left(\frac{1}{f_1} - \frac{1}{f_2}\right)}{4\pi^2 ({}_1C_s - {}_2C_s)}$$

This method of measurement, even though it requires very simple equipment, will yield accurate results. Results may be attained to an accuracy as good as the standard condenser.

• • •

FI METER

(Continued from page 6)

308-A. By means of a selector switch (upper left hand in front) it is connected as an r-f voltmeter to indicate the calibrating voltage, as a plate milliammeter in the output stage, or as a d-c voltmeter to read battery voltages.

To go on with the procedure, the first step as in any such equipment is, of course, to tune in the signal. The meter may be used as an indicator and the loop is turned to obtain maximum reading. Second, the loop is rotated for minimum signal pickup and the calibrating voltage adjusted. This is simply effected by placing the meter in the "CAL. INPUT" position and setting the needle to the red line by means of the "CAL. INPUT" control (which latter is simply a rheostat in the plate of the oscillator). Third, the curve in the lid of the case is consulted and the attenuator is adjusted to the setting for the frequency in question. Fourth, the meter is placed in CAL. OUTPUT position and the pointer brought again to the red line by means of the CAL. OUTPUT control. The latter controls the gain of the first i-f stage and provides the means of setting the gain of the receiver to that predetermined (in the calibration of the instrument) as necessary to make the scale read correctly at the frequency of measurement. This done the loop is returned to maximum, the meter is changed to the "MEASURE" position, and the pointer once more brought to the red line—this time by varying the attenuator. The reading of the attenuator is the signal intensity in microvolts per meter. The

whole procedure is a matter of seconds. Where successive measurements on the same frequency are being made it is hardly necessary to calibrate each time —although experienced field men usually do so just as a precaution.

In addition to the controls mentioned above there are antenna and cal. oscillator trimmers, zero and full-scale meter adjustments and, of course, the band switch—one of which is involved in the average measurement procedure (usually being adjusted just once for each set of measurements).

Improvements in Accuracy

It is interesting to note that a number of the design changes in the 308-A meter are such as to make for greater overall accuracy. Perhaps most noteworthy of these is the solution of the problem of non-linearity effects in the first and second detectors. In the discussion above the attenuator has been referred to as if it were a single unit. Actually, it consists of two parts. The first is a capacity attenuator having fixed 10-to-1 steps, and the second a variable mutual inductor with a ten to one overall range. The fixed-step unit is placed between the loop and the first detector. Thus the latter need be linear over a range of only ten to one—instead of a million to one as was formerly required. In regard to the 2d detector, this need not be linear at all, since it is always read at the same level. This latter was one of the biggest sources of error in previous designs—in fact it could only be kept down by using an output meter with hand-calibrated scale—an expensive and not-too-satisfactory solution. The 308-A meter appears to have solved this.

Another minor design change is the i-f response curve. Formerly this was sharply peaked. Not only did this make tuning difficult but it also resulted in a possible source of error since a very slight mis-tuning would give a too-low reading of the output meter. The response curve in the 308-A is sharp-sided (necessary to eliminate adjacent channel interference) but has a flat top—thereby easing tuning difficulties and probably improving accuracy.

Another improvement results from the loop construction. Since these are now shielded the error due to "antenna effect" (and which could be quite large in proximity to an antenna) has presumably been eliminated. It is also interesting to note that the so-called "loop error" (which was supposed to be inherent to any calibrating method relying on the introduction into the loop of a local cailbrating voltage) if in fact it ever existed, will at least have been reduced in the 308-A since the tuning bands have been reduced (viz, 550-1250,

1250-3000, etc., as compared to 500-1500, 1500-4500, etc.).

Finally there is the more nebulous but probably equally important point that the attenuator scale can be read more accurately (certainly more easily) than could the meter scale of the older style instruments. This is particularly true where there is some carrier shift on the signal being read. In such cases the pointer can be gradually edged onto the line between bursts of modulation. This is easier than trying to read between bursts.

Application

The 308-A meter has any number of possible applications—covering, as it does, practically all fields of communication except the ultra-high. In fact, used in combination with a type 301-A u-h-f field intensity meter, the total range of the two is from 120 kilocycles to 125 megacycles—a lot of territory!

Since the broadcast field makes up the most important field of use, the general design of 308-A has followed most closely the requirements of broadcast station engineers and consultants. For most such use an equipment which can be used conveniently in a truck is indicated. With some contriving the 308-A probably can be used satisfactorily with a loop permanently mounted in the roof of the truck. However, a simpler solution is the use of a wood-body station wagon—in which case the regular loops can be used without modification. Moreover, if extended "proof-of-performance" jobs are to be undertaken it will soon be found that for measurements near to the transmitter it will at times be necessary to take the equipment where the truck cannot be driven. Experience indicates that only an equipment of flexible design will meet both requirements. The 308-A should do this. When set up in the truck it can be operated from a power supply. For "walking" measurements a battery case can be kept handy. With the station-wagon setup the same loops can be used for both types of measurements.

A jack for phones and another for a recorder are provided on the 308-A. For extended recordings the writer believes a standard receiver with a d-c amplifier—all operated from a voltage-regulating transformer—is the best set-up. However, for short periods of recording the direct connection will find some application.

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BOOK REVIEW

MATHEMATICS APPLIED TO ELECTRICAL ENGINEERING, by A. G. Warren, published by D. Van Nostrand Co., Inc., 250 Fourth Ave., New York City, 384 pages, price $4.50.

This book deals with the application of mathematical methods to engineering and physics. Its contents are directed particularly to the problems of electrical engineering. This work is intended as advanced study for those students and engineers familiar with calculus and elementary differential equations.

The author presents many short cuts to the solution of electrical problems. The data on converging series is especially helpful to engineers engaged in research. The utilization of a combination of graphical and numerical methods of computation to a single problem is particularly laudable.

Such subjects as real and complex numbers, linear differential equations, Bessel's functions, operational calculus, conjugate functions and Fourier series are covered in considerable detail. Three appendices and an excellent bibliography are included.

The material in this book is not only well arranged and presented in logical sequence, but also the treatment of problems is both practical and clear. This book is especially recommended for engineers interested in higher mathematics, particularly those in the research fraternity.

R. D. R.

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TAPE

(Continued from page 21)

WESTINGHOUSE BULLETIN

Primary fuse cutouts for outdoor use on distribution transformer installations are described in a new 4-page leaflet announced

by Westinghouse. Distinctive characteristics of these expulsion type fuses with ratings up to 100 amperes at 7500 volts are discussed. Operation and construction details are described and illustrated. A table of standard ratings and style numbers facilitates ordering. Bracket styles giving physical dimensions and arrangement are also tabulated. A copy of Descriptive Data 38-620 may be secured from Department 7-N-20, Westinghouse Elect. & Mfg. Co., East Pittsburgh.

ALEXANDERSON RECEIVES AWARD

Dr. Ernst F. W. Alexanderson, consulting engineer of the General Electric Company, was presented in May with the Schenectady Advertising Club's annual award, given each year to an outstanding local man or woman through whose accomplishments Schenectady has received unusually favorable publicity. The award was made at a luncheon at Schenectady's Hotel Van Curler, attended by more than 200 persons representing 10 civic organizations.

SELECTING SOUND SYSTEMS

Allied Radio include in their new 1941 spring and summer catalog an easy-to-understand chart covering all p-a applications, including churches, schools, auditoriums, carnivals, night clubs, taverns, skating rinks, athletic fields, outdoor meetings, armories, stadiums, etc. Information is specified for computing the area to be covered in square feet, wattage required in amplifier, size and make of speakers needed, and type of baffle to use. The catalog, including the complete chart and instructions, is available from Allied Radio Corp., 833 W. Jackson Blvd., Chicago.

FOUCH ON TOUR

James R. Fouch, president of Universal Microphone Co., Inglewood, Cal., late in May started for the Mid-west in conjunction with Government microphone orders. He will give his annual factory representatives' banquet during the trade show in Chicago.

G-E BULLETIN

The General Electric Co., Schenectady, N. Y., are making available a booklet entitled "How to Plan an FM Station." Prepared by W. R. David, the booklet outlines the requirements and cost of installing and operating an F-M broadcast studio and 1000-watt transmitter. It is a booklet which all engineers interested in f-m should have on hand. Copies may be secured from the above organization. Write for Bulletin GED-915.

CENCO NEWS CHATS

The April 1941 issue of Cenco News Chats is now available. It contains data on scientific and laboratory apparatus. Available from Central Scientific Co., 1700 Irving Park Rd., Chicago.

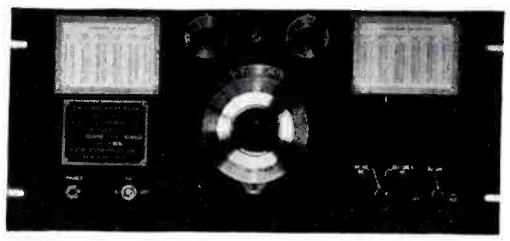
DU MONT TELEVISION STATION

With most of its equipment already installed and tested, the DuMont television station W2XWV is rapidly completing its technical and program facilities in anticipation of commercial television. This station, whose antenna is mounted on top of a 42-story New York building is equipped for complete sight and sound broadcasting. Studio facilities cover both direct and film pickup as well as remote pickup equipment. It is understood that fluorescent lighting will be used.

NEW PRODUCTS

U-H-F RECEIVER

In the accompanying illustration is shown the Series 224 ultra-high-frequency receiver announced by Radio Receptor Co., 251 W. 19th St., New York City. This unit



is designed for airport traffic control and communications. Three models are available covering 60 to 66 and 123 to 128.5 mc, 123 to 128.5 mc and 140 to 144 mc. Literature available on request.

TUBES

RCA Manufacturing Co., Inc., Harrison, N. J., are making available the following new tubes: RCA-6SS7, RCA-12SN7-GT, RCA-931, RCA-8001.

The 6SS7 is a remote cut-off, r-f amplifier pentode of the single-ended metal type having a 6.3-volt, 0.15-ampere heater. This new tube provides for a further degree of flexibility in the design of a-c/d-c receivers utilizing a single-ended metal types, where the total heater voltage of a complement of 0.15-ampere types heretofore available would exceed 117 volts.

The 12SN7-GT is a single-ended, twin-triode amplifier having separate cathode terminals for each triode unit. It is recommended for use in resistance-coupled circuits as a voltage amplifier or phase inverter. Since this tube has separate cathodes which are brought out to terminals in the base, this tube offers greater flexibility from the circuit designer's standpoint than do other twin triodes having only a single cathode connection.

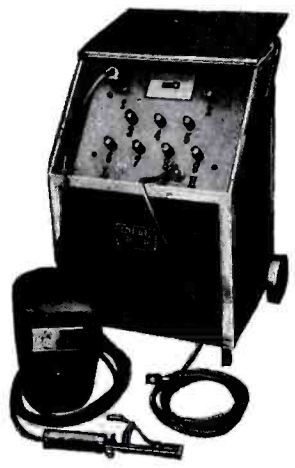
The RCA-931 is a new type of phototube in which the photocurrent produced at a

light-sensitive cathode is multiplied many times by secondary emission occurring between nine successive dynodes within the tube. It is capable of multiplying feeble currents produced by weak illumination as much as 230,000 times. Focusing of the electron stream is accomplished electrostatically within the tube. The 931 employs the S4 photosurface which has higher sensitivity to blue-rich light than to blue-deficient light.

The 8001 is a transmitting beam pentode suitable for power amplifier, modulator, and oscillator service. Because its driving power requirements are low, and because neutralization is generally not required, the 8001 is particularly useful in all band transmitter designs. In class C telegraph service, the 8001 will provide a power output of approximately 230 watts at frequencies as high as 75 megacycles. Its plate dissipation is 75 watts.

WELD-MASTER

Simplified welding is claimed as the outstanding feature of a new a-c electric arc welder just announced by the Ideal Commutator Dresser Co., 4025 Park Ave., Sycamore, Ill. The design includes a reactance winding on a separate core in addition to the transformer. This reactance winding acts as a stabilizer, making it easy to strike an arc and hold it. As the distance between the end of the welding rod varies, this reactance winding causes the



voltage to vary proportionately so that the arc is always smooth. Fifteen different welding heats between 20 and 175 amperes give the operator heat and penetration control for each individual job and different parts of the same job. Penetration may be up to ¼" or more if desired. These heats are at two voltages—45 and 70 volts. The standard welder is for 230-volt, 60-cycle operation. Size welding rod recommended is 1/16" to 5/32". Primary current 1.75 amps no load, 52 amps full load, overall dimensions, 17" x 15" x 26" high, weight 190 lbs. Accessories available with the Weld-Master include ground lead, electrode lead, electrode holder, welding rod, primary cord and plug.

GLASS BASE DISC

Due to the expanding defense program and resulting priorities, manufacturers of instantaneous recording discs found their aluminum supplies completely cut off. As in many other industries, an intensive search for an adequate substitute resulted. The solution to this problem was not so simple. An adequate base for these recording discs must be thin, completely flat, flawlessly smooth, free from any tendency to spring or warp and have a surface to which the acetate coating will properly adhere. Audio Devices by new technique in cutting and drilling the glass, are said to have produced a disc on which recorded sound is reproduced as well as on the standard aluminum base discs. Audio Devices, Inc., 1600 Broadway, New York, N. Y.

RESISTANCE STANDARDS

The Shallcross 800 series resistance standards are calibrated resistances from 1 ohm to 10 megohms in single units and in various combinations. They are designed

for d-c electrical measurements and a-c measurements at frequencies up to 20 kilocycles. Further information obtainable from Shallcross Mfg. Co., Collingdale, Pa.

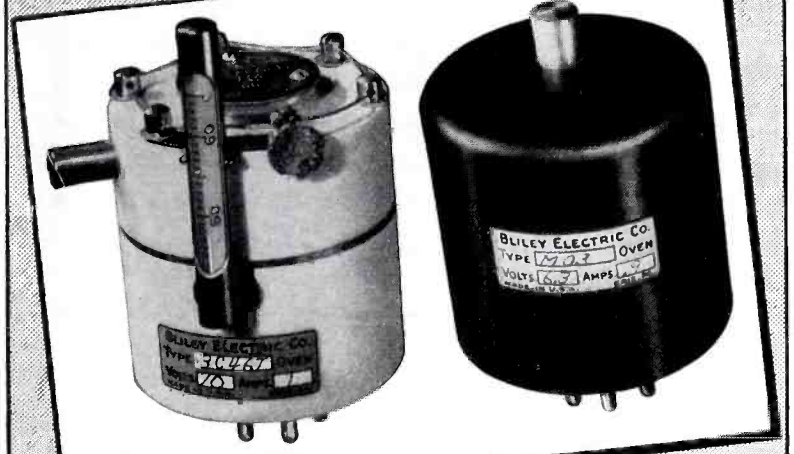
NEW PLASTIC PRODUCT

In view of the aluminum situation, the R. D. Werner Co., Inc., 380 2nd Ave., New York, finishers of extruded metal moulding, recently announced a new line of plastic products under the trade names "Plastikmould" and "Plastiktrim." These new plastic products are manufactured in a wide range of colors in similar shapes and sizes as now supplied in aluminum; also rods, tubes, and other commercial items, both flexible and rigid. Mr. P. C. Goodspeed, who has had many years' experience with plastics, is in charge.

EICOR CONVERTER

Eicor announces a new converter design. This new unit is said to be more compact, and convenient for portable or permanent use. It converts direct current to alternating current for amplifiers, projectors, phonographs, radio receivers, transmitters, medical equipment, musical instruments, and other applications. Available for 6, 12, 32, 115, 230 volts, or other standard d-c input—and has standard a-c output. All-equipped with ball-bearings. Available with or without filter. For full details, write to Eicor, 1060 W. Adams St., Chicago.

Bliley
CRYSTAL UNITS



Engineered Reliability
—Guaranteed Accuracy . . .

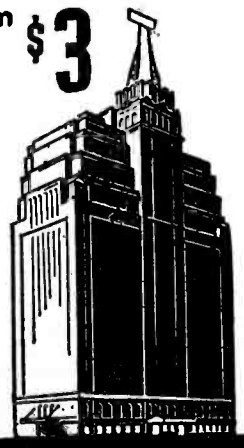
BLILEY precision-made Crystal Units are supplied for all frequencies from 20Kc. to 30Mc. Catalog G-12 contains complete information.

BLILEY ELECTRIC COMPANY
UNION STATION BUILDING ERIE, PA.

Direct Subway Entrance to all Points of Interest

New York's Popular
HOTEL
LINCOLN
44TH TO 45TH STS. AT 8TH AVE.

OUR CHOICEST ROOMS From $3
1400 ROOMS each with Bath, Servidor, and Radio.
★ Four fine restaurants awarded Grand Prix 1940 Culinary Art Exhibition.



MARIA KRAMER
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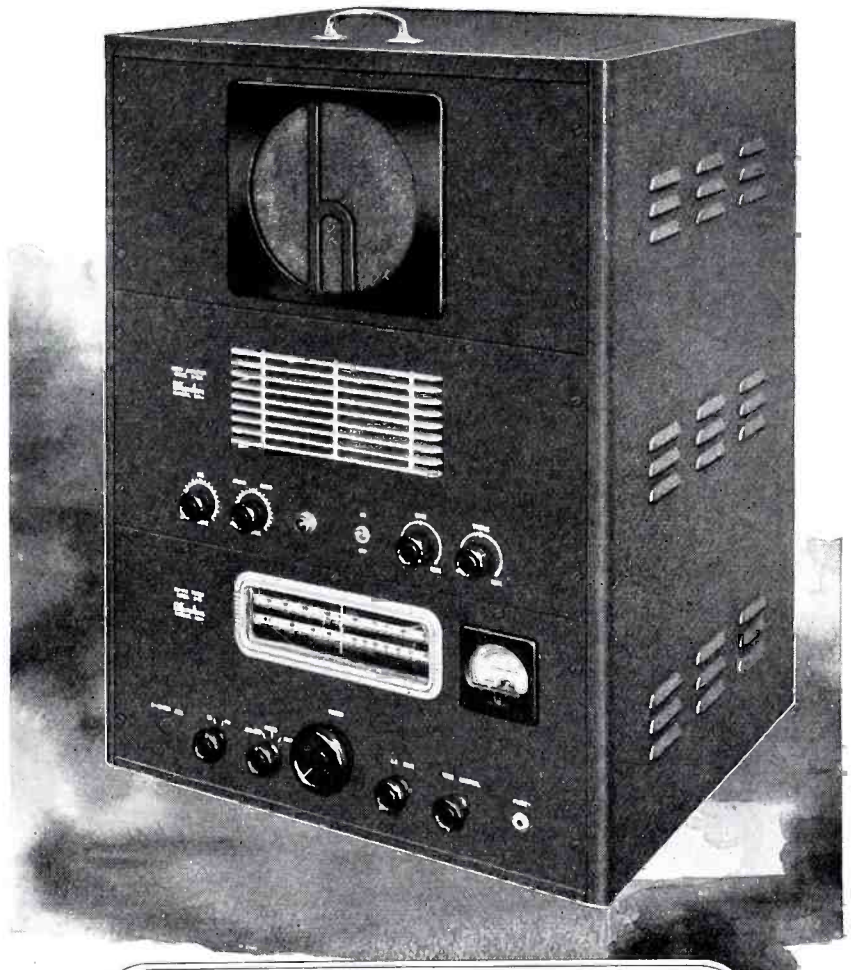


New **FM/AM**
RADIO RECEIVING STATION

. . . With 25 Watt High Fidelity Amplifier

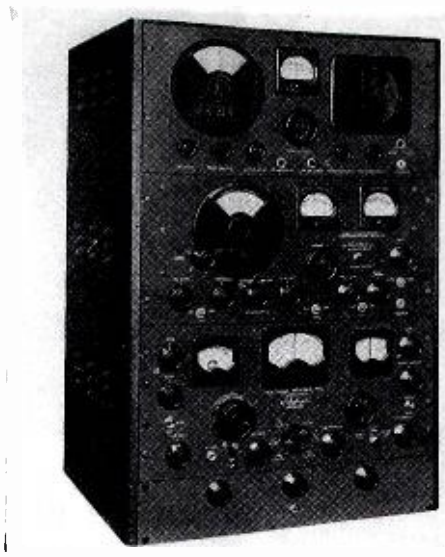
The No. 1 band covers all frequencies used by amplitude modulated broadcast stations. No. 2 band covers frequencies used by high fidelity frequency modulated broadcast stations. Changes from FM to AM with band switch. Self-contained monitoring speaker. The use of additional high fidelity speakers makes this an ideal unit for installation in hotels, schools, churches, lodge halls, etc. Complete unit is extremely flexible in operation and will provide reproduction of sparkling depth and brilliance. Model RSC-2, complete with tubes and monitoring speaker, $140.

USED BY 33 GOVERNMENTS SOLD IN 89 COUNTRIES

the hallicrafters co.
CHICAGO, U. S. A.

RECEIVING STATION

The latest addition to the Hallicrafter line is the new RSC-1 complete radio receiving station. This unit tunes continu-



ously from 1.8 to 2730 meters (110 kc to 165 mc). Monitoring speaker connects to any one of the three units. Separate speakers can be connected as desired. Hallicrafters, Inc., 2611 Indiana Ave., Chicago.

GLASS BASE DISC

Beginning June 1, Presto will be ready to make shipments on a new glass-base disc. This disc has been developed to replace the Presto Green Seal or "Q" disc which will shortly be discontinued owing to the aluminum shortage. The surface coating on the new disc is as good as any aluminum base disc, it is said. Discs will be available in any desired quantity in the 12" and 16" sizes only and will be packed in boxes of twelve discs of a size. Presto Recording Corp., 242 W. 55th St., New York City.

INJECTION MOLDED "MYCALEX"

Injection molding of Mycalex, a material consisting of ground mica and a specially developed glass, has been announced as a new development in plastics manufacture by the plastics department of the General Electric Co., Pittsfield, Mass. Mycalex has been compression-molded for some years in plate and bar form, and machined to required designs by the General Electric Company. It also has been molded by direct compression methods into various important insulating parts such as rectifier seals, and brush holder studs in which metal members are required as integral parts. By the injection process the material can be produced in more intricate shapes and many new applications should result.

DRY DEVELOPER PAPER

Owners and users of white print dry developer or ammonia vapor machines are cooperating with Frederick Post Co. in final tests on the new "VAPOpaper" blue line paper. Among the improvements claimed are: 50% rag content bond against sulphite stock used in existing papers: two "speeds" in sensitivity regular and fast; two colors—deep royal blue and "Post" red. The Frederick Post Co. say that their new sensitizing medium prints out to a cleaner, whiter background and at the same time leaves all lines in deeply colored contrast. Owners of ammonia vapor machines who care to cooperate in the "field trial" test under "on the job" con-

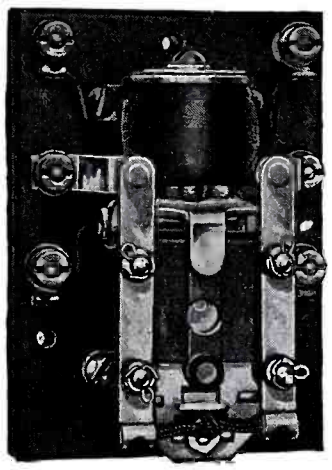
ditions may secure a free trial stock of "VAPOpaper" by sending the model or serial number of their machine with their request to the Frederick Post Co., Box 803, Chicago.

PORTABLE RADIO HAS RECHARGEABLE BATTERY

A new luggage-type portable receiver (model LB-530) has just been announced to distributors and dealers by the General Electric radio and television department, Bridgeport, Conn., which operates on a rechargeable airplane-type storage battery and eliminates dry-cell replacement. Heart of the new set is a plastic-encased non-spillable storage battery, and a built-in automatic battery charger. The new radio offers three alternatives to its owner at the turn of a switch—it may be played on battery alone; it may be operated on alternating-current and will bring in programs while the life of its battery is being renewed; it may be recharged swiftly and silently on a-c without concurrent radio operation.

DUNCO MIDGET RELAY

A new midget-size mechanical latch-in, electrical reset relay has been announced by Struthers Dunn, Inc., 1335 Cherry St., Philadelphia, Pa. Mounted on a base only 3¼" x 2⅜", the new relay has a non-inductive load contact rating of 110 volts, 6 amps, or 220 volts, 3 amps a-c, and 115 volts, 1 amp d-c. Coils may be obtained as specified ranging from 6 to 220 volts a-c, at



approximately 4 watts each, or 2 to 230 volts d-c, at approximately 2 watts each. A series resistor is used in the coil circuits when d-c voltages above 90 volts are specified. The new relay is known as Type ABB-IN and is available in practically any required contact arrangement and may be otherwise adapted to special requirements. Dunco Catalog listing this new development as well as larger size Dunco mechanical latch-in, electrical reset relays will gladly be sent upon request.

TUBES

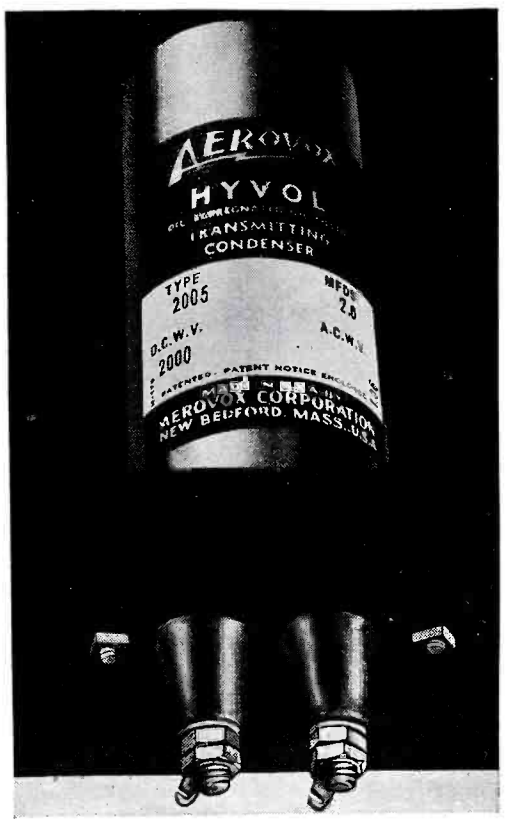
The RCA Manufacturing Co., Inc., Harrison, N. J., are making available two new receiving tubes as follows: RCA-12H6 twin diode, and RCA-117P7 rectifier, beam power amplifier.

The 12H6 is a twin diode similar to type 6H6 except for its heater rating of 12.6 volts and 0.15 ampere. It is being made available for use in applications having 12.6-volt heater supply.

The 117P7-GT is a rectifier—beam power amplifier similar to type 117N7-GT, but having somewhat lower power output capability.

SLIP-THRU CONDENSER MOUNTING

The accompanying illustration shows a simple method of mounting Aerovox high-voltage, oil-filled transmitting condensers with high tension pillar terminals. The mounting is accomplished by drilling two



holes just large enough to pass the pillar terminals, and properly spaced apart. Two smaller holes to take the bolts that hold the mounting ring will also be required. This arrangement keeps the live stuff beneath the chassis where you can't come in contact with it.

BULL SPEAKER

The new Bull type of radial 360° loudspeaker, Model 2RYR, is announced by University Laboratories, 195 Chrystie St., New York City. It is of the long exponential reflex driver unit design. A special

multiple acoustic throat is used to adapt the high-power driver units to the reflex radial horn. These driver units are housed in a mushroom shaped, weather-proof cover. Power handling capacity is 50 watts. Further information from the above organization.

MICROPHONE CONTROL

A new "pushmike" adaptor and stand has been announced by George Ewald, manager

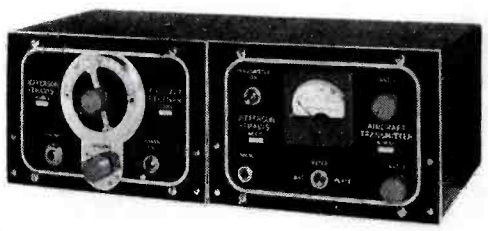
of the RCA Commercial Sound Division. The new unit is suitable for mobile or portable operation of public-address systems, or for other uses where it is desirable to cut the microphone in and out of the amplifier circuit at will. Sturdy in construction, the unit is finished in polished chromium and is available with or without a chromium-finished base. RCA Mfg. Co., Camden, N. J.

THIN HEX NUTS

For use on shear bolts where a high degree of the stress is lateral, and for general application to light and medium stress fastenings, an improved line of thin hex nuts is announced by Elastic Stop Nut Corp., 2332 Vauxhall Rd., Union, N. J. These nuts have approximately 40 percent of the strength of standard-height hex nuts and have been developed to meet the demand for a self-locking fastening which offers savings in space requirements, weight, and cost.

AIRCRAFT COMMUNICATIONS UNIT

The Jefferson-Travis Model TR-5 is a two-way communication unit. The crystal-controlled transmitter operates in the range of 2.8 mc to 6.5 mc and has a power output of 5 watts with 100% voice modulation. This transmitter is in a small cabinet that can be mounted in the panel of the plane.



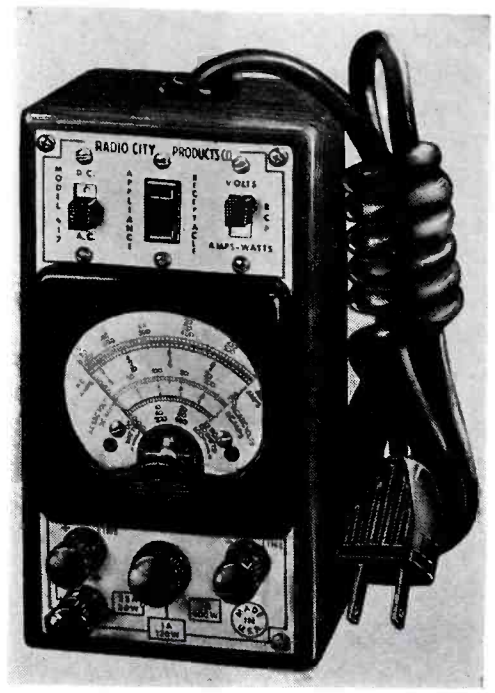
The receiver is in a case matching that of the transmitter and covers the 200 to 400 kc band. Thus, it is possible to receive all radio range beacon stations now in use and also the airport control tower frequency of 278 kc. The sensitivity of this receiver is approximately 15 microvolts. Both units are mounted on a shock mounting base. Jefferson-Travis Radio Mfg. Corp., 380 2nd Ave., New York City.

ELECTRONIC VIEW FINDER

The Du Mont electronic view-finder mounts on the side of the Du Mont Iconoscope camera, and is operated by its own power-supply unit. A high-intensity 5-inch cathode-ray tube provides a fine focused brilliant image. The tube is supplied with either green or white screen. Brightness, focus, video gain, horizontal size and vertical size controls are arranged around the tube face, for convenient manipulation by the cameraman. An eyeshield of proper length for correct viewing distance, prevents stray light from interfering with a clear view of the image on the tube screen. Three screwdriver adjustments at the side of the unit provide for horizontal and vertical centering and for vertical linearity. Allen B. DuMont Labs., Inc., 2 Main Ave., Passaic, N. J.

APPLIANCE TESTER

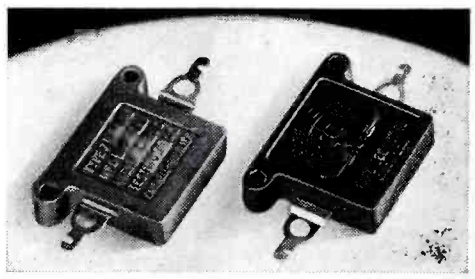
A pocket-size appliance tester has been introduced by Radio City Products Co., 88 Park Place, New York City. In using



the Model 417 it is only necessary to plug the tester into the line and the appliance, in turn, into a receptacle on the face of the tester. Two 2-position toggle switches and a 3-position rotary switch permit selection of type of measurement and meter range desired. Eighteen measurements are provided. These include a-c and d-c line voltage up to 250, four d-c and four a-c ampere ranges up to 25 amps, and four d-c and four a-c watt ranges up to 3,000 watts.

MICA CAPACITORS

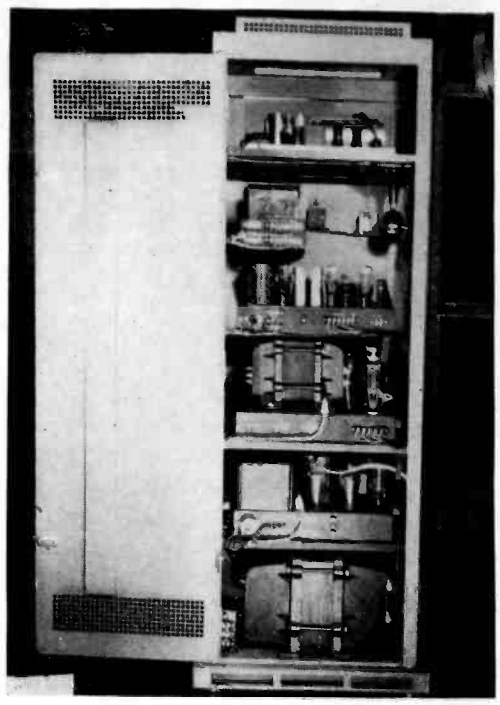
A new addition to the Cornell-Dubilier line of mica capacitors is the Type 7. This is a molded bakelite capacitor similar to the Type 4, but with wider spacing between the insulated mounting holes to meet the 1½" standard called for in a number



of applications. Standard units are molded in brown bakelite and are available in capacities beginning at .00005 mfd and running up to .03 for those rated at 600 volts (d-c working), .01 for the 1200-volt rating, and .003 for the 2500-volt rating. Standard tolerance in capacity ratings is plus or minus 10%. Insulation resistance is 20,000 megohms. Further data from Cornell-Dubilier Electric Corp., South Plainfield, N. J.

REGULATING MOTOR SPEED

It is common practice to use the 60-cycle power line as a substitute standard



frequency source for modulation, measurement and timing purposes. But in the equipment illustrated here a 60-cycle tone generator is utilized to drive a half-kilowatt electric motor through the medium of a high-power audio amplifier system. The purpose is to provide mechanical driving power of constant speed. For most purposes a synchronous motor operated directly from commercial power lines provides adequate stability of speed. But such lines are subject to instantaneous and short-period frequency variations and are therefore not capable of precise speed regulation.

In this apparatus a 60-cycle audio-frequency standard generator capable of maintaining its frequency accurate to one part in 100,000 constitutes the source of excitation. Its output is fed into an amplifier capable of 500 watts output and this in turn supplies the driving power for the synchronous motor.

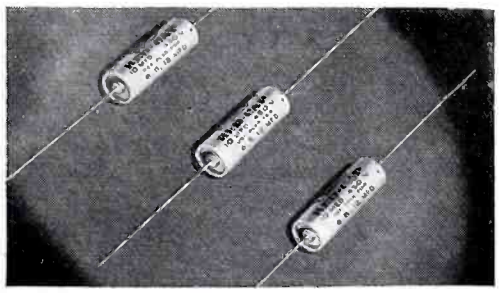
The design of this system is a development of the Research Section at the Propeller Division of the Curtiss-Wright Corporation to meet the requirements of certain critical test applications in the Curtiss-Wright plant. The actual equipment as shown in the accompanying photograph was built by the Transformer Corporation of America, 69 Wooster St., New York City.

MARINE RADIO

A new marine radio telephone that can communicate with any shore station serving U. S. territorial waters—either inland or seaboard—has been announced by the Western Electric Co., 195 Broadway, New York City, for use aboard towing, fishing, and pleasure craft. Known as the 226-D, the new instrument features instantaneous selection of any one of ten pre-tuned frequencies, quartz crystal control of both transmission and reception, extreme signal clarity, low noise, and semi-automatic operation. Installation involves connection only to antenna, ground and power supply.

PLASTIC TUBES FOR ELECTROLYTICS

To conserve needed materials a new series of dry electrolytic capacitors encased in plastic tubes has just been developed by the Solar Manufacturing Corp., Bayonne, N. J. These new units, known as "Red Caps," will be available in single capacity values, ranging from 5 to 50 mfd, with d-c



working voltages of from 50 to 600. Five types of double units with nominal capacity ranges of from 10-10 to 30-30, offering a variety of capacity arrangements of from 5-5 to 25-25, with working voltages (d-c) of from 25 to 525 will also be available. To simplify identification, the new plastic tubes will be in color, the colors to conform to the RMA code, for voltage rating. Each of the tubes will be 2 3/16" in length, and vary in diameter from 9/16" to 15/16". The plastic tubes are self-sealed with a safety vent.

DRAFTING MATERIALS

The John R. Cassell Company of New York City announce that they have just recently taken on the line of Post drafting materials. These materials are manufactured by the Frederick Post Company. This line will be found in the Cassell store located at 110 W. 42nd St.

MERCURY RECTIFIER

The new United Z-225 tube has the same rating as types 866-866A, yet, including the overall clearance, occupies less than one-half the cubic space in an installation. Bulb Type T-14, overall height 5½ inches, overall diameter 1¾ inches. United Electronics Co., 42 Spring Street, Newark, N. J.

PORTABLE LEAR AVIA RECEIVER

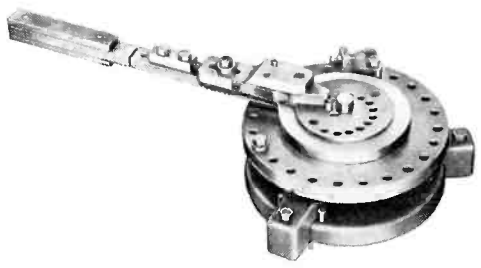
The new three-band "Learavian" portable is now in full production at Lear Avia's new 71,000 sq. ft. plant at Piqua, Ohio, it was announced by William P. Lear. Advance orders for these new receivers are said to exceed 1,000, and deliveries are now being made. On the ground it may be operated from its own, self-contained dry cells or from a-c or d-c household lines; when used on board aircraft, the electric cord is neatly folded into a small compartment in the back of the case, and the unit operated from its own dry cells. Provides complete coverage of aeronautical and broadcast frequencies in three bands: 195-410 kcs, 540-1560 kcs, and 2200-6300 kcs.

SPEAKER ENCLOSURES

The Vibraloc "Clusterette, Jr.," assembly of Tri-Tilt speaker enclosures have recently been placed on the market. This model takes speakers up to 9". The Clusterette, Sr., takes speakers from 8 to 12". Choice of several colors. Supplied for 3, 4, 5 and 6-unit operation. Catalog available from Vibraloc Mfg. Co., 325 Miguel St., San Francisco, Calif.

MICRO DIE DUPLICATING BENDER

In the accompanying illustration is shown the Micro Die Duplicating Bender



No. 2. This instrument is designed to duplicate ductile materials of solid cross-section to shapes and outlines of regular or irregular radii to tolerances usually expected with forming dies. It can be used for forming round or square tube, angle, channel, half round or flat wire and strip stock formed on edge and vertically. Further information available from O'Neil-Irwin Mfg. Co., 316 8th Ave. South, Minneapolis, Minn.

AMPLIFIER

The 1941 Audiograph 25-watt amplifier has just been announced by John Meck Industries, 1313 W. Randolph St., Chicago. Three input channels are available

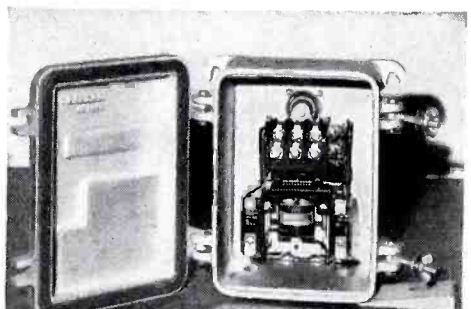
to permit use of a phonograph record player and two microphones simultaneously. Each channel is provided with individual volume control. It is available with two speakers. Both plug-in sockets and terminal board speaker connections are provided with choice of 2, 4, 8, 166, 250, and 550-ohm impedance. Additional information may be secured from the above organization.

GLASS BASE DISCS

Glass will be used as the base for the Columbia Recording Corporation's instantaneous acetate recordings in order to release the aluminum, which has been used, for U. S. defense requirements. Use of the new-type discs is to start soon.

MAGNETIC SWITCH

A magnetic contactor which operates as quietly as an ordinary domestic flush-mounted electric light switch has been announced by the General Electric Company, Schenectady, N. Y. The quietness of the switch especially suits it for use around broadcasting studios and transmitters for the control of motors up to 5 hp (220 volts), it is said. It is also adapted for other control circuits, such as for the control of tube filaments up to 600 volts.



DUOTONE CUTTER

A new point protecting felt folder encloses the steel cutting stylus of the Duotone Co., Inc., 799 Broadway, New York, N. Y. This needle is for home recordings. It will remain constant for from 15 to 25 cuttings, it is said. Further information available on request.

INSULATING MATERIAL

Explaining the technical applications and use of a new insulating material which may be of the greatest importance in the rapid repair of electric light and power cable in air raids as well as other more ordinary uses, T. R. Scott, chief engineer of the Power Cable Division of Standard Telephones and Cables, Ltd., of London, addressed the Power Group of the American Institute of Electrical Engineers in New York on April 29. These new applications of Styrene were developed recently in England under Mr. Scott's direction.

During his brief stay in the United States, Mr. Scott will also address engineering bodies in Boston, Chicago and Detroit and will give practical demonstrations of the installation methods employed in repairing broken cables quickly with Styrene for the large power companies in New York and other principal cities. His trip here is with the special permission of the British Government and is arranged by International Standard Electric Corporation, the supply and manufacturing division of the International Telephone and Telegraph Corporation of which Standard Telephones and Cables is the principal associated company in Great Britain.

"SPEECH-MASTER"

A new type AP "Speech-Master" reproducer, has recently been announced by Jensen Radio Mfg. Co., 6601 S. Laramie Ave., Chicago. Two models are available—the AP-10 for desk or wall mounting, and the AP-11 for panel mounting. A special p-m unit, employs Jensen Peri-Dynamic principle. Power rating is 5 watts maximum.

SUN-SWITCH

The United Cinephone Corp., Torrington, Conn., announces the "Sun-Switch," a new photo-electric relay for lighting and power. The sun-switch is used to control electrical circuits in accordance with the rise and fall of natural illumination. The user chooses the two lighting levels at which he wishes the load switched on and off, and he adjusts the calibrated dials to the corresponding foot candle readings. Operation is entirely automatic, no resetting being necessary. It is suited for use with aircraft beacons, airport lights, factory lighting, etc.

F-M NETWORK

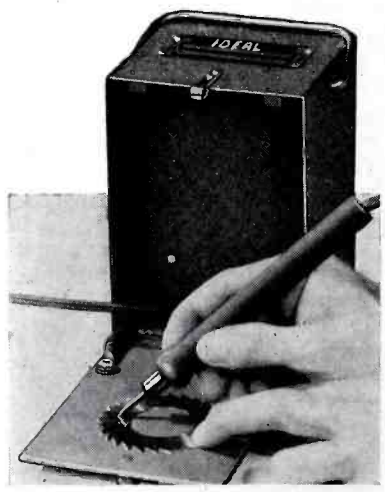
Another significant step forward in the growth of frequency modulation as a new broadcast service occurred April 11 when The American Network, Inc., opened its offices in the Lincoln Building, 60 East 42nd Street, New York City. An outgrowth of the FM Program Research Committee which, during recent months, has probed the possibilities of f-m network operation on a nationwide scale, The American Network, Inc., was organized during a meeting of some 45 f-m broadcast groups interested in the network project. Its New York office will be headed by Jack Latham, former advertising executive and ex-president of the American Cigar and Cigarette Company, who has also conducted preliminary research. The organization contemplates a continuance of the FM Program Research Committee's work, leading to the eventual establishment of a coast-to-coast f-m network with outlets in all principal markets.

CBS CHANGES ATLAS

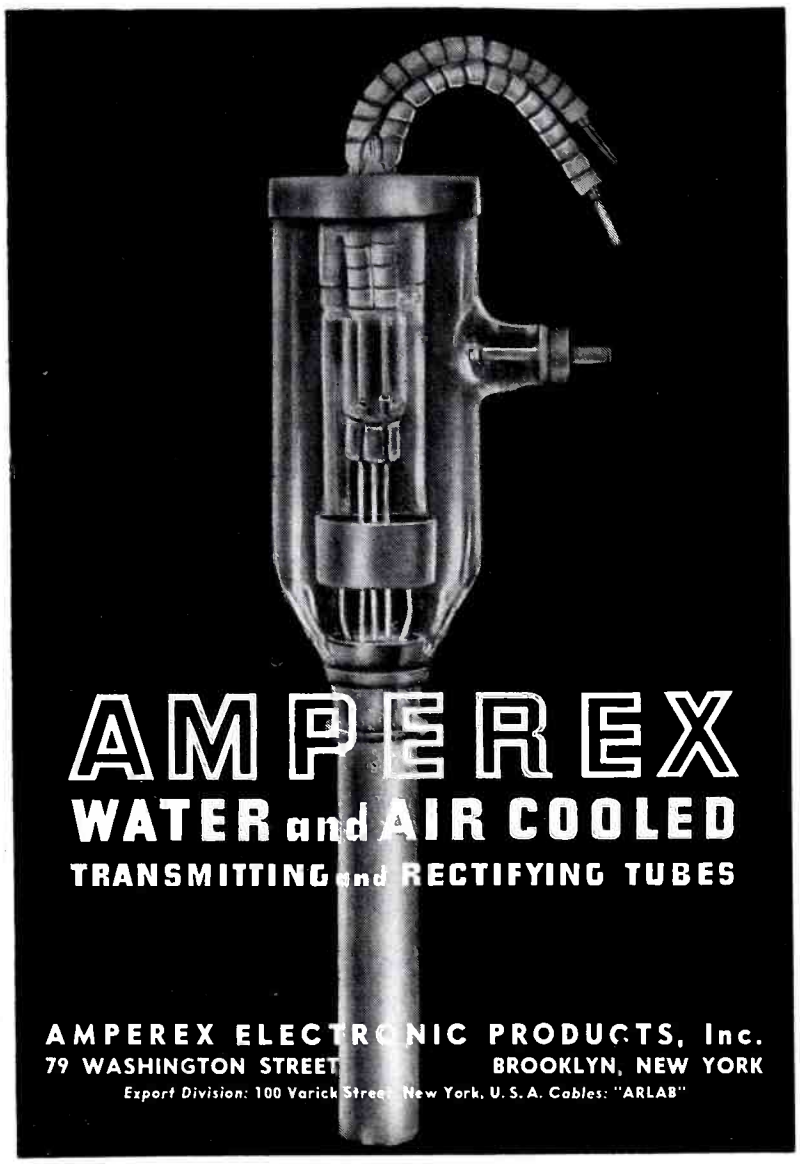
The Columbia Broadcasting System has made the world atlas just a little bit different. Little Pea Island was a tide-swept pinpoint of land in the Long Island Sound when Columbia engineers chose it as the location for the new WABC transmitter. Now the island is an octagonal mass rising out of the sea, for CBS has built sea walls and has sunk four concrete pillars into bedrock as a base for the 410-foot antenna. When this had been done, the name Pea Island seemed inappropriate, so the island has been rebaptized Columbia Island.

ELECTRIC ETCHER

A small, inexpensive etcher for permanently marking small tools and parts is announced by the Ideal Commutator Dresser Co., 4025 Park Ave., Sycamore, Ill. As its name "Thin Line" implies, this etcher



writes with a fine line, burning the mark, identification number or name right into the metal, so it cannot become blurred or worn off with ordinary usage. All parts are fully enclosed and out of the way when not in use. Etching heat 125 watts. Weight 5¼ lbs. Size only 4¼" x 4¼" x 7".



AMPEREX

WATER and AIR COOLED

TRANSMITTING and RECTIFYING TUBES

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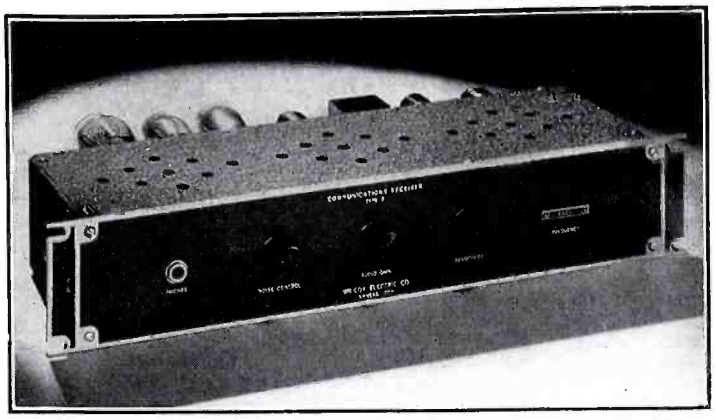
79 WASHINGTON STREET BROOKLYN, NEW YORK
Export Division: 100 Varick Street, New York, U. S. A. Cables: "ARLAB"



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CRYSTAL CONTROLLED RECEIVER

The type F single frequency crystal controlled receiver may now be furnished for any frequency in the range of 2 to 200 megacycles.

These receivers open new possibilities for airline, police, and government communication service where a precision receiver is desired.

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Write for Information.

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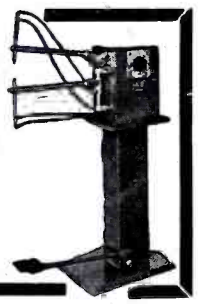
741 S. 13th St. (Avon Ave.) Newark, N. J.



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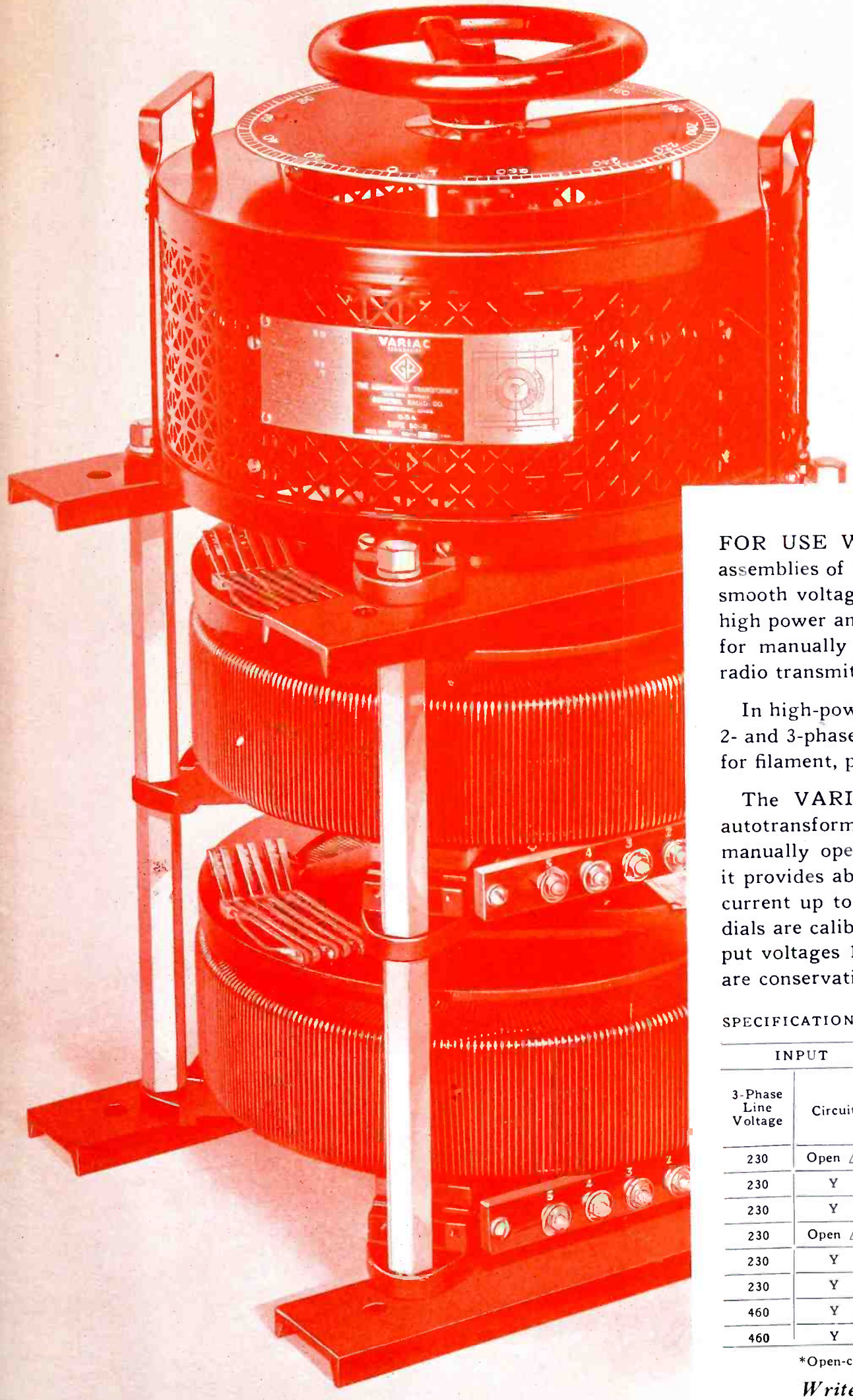
VARIACS



for HIGH Power

FOR USE WITH 2- and 3-phase loads, the ganged assemblies of VARIACS offer a convenient, efficient and smooth voltage control. Ganged units will handle really high power and are particularly suited as master controls for manually adjusting the line voltage to the entire radio transmitter.

In high-power stations ganged VARIAC controls with 2- and 3-phase loads are widely used as voltage adjusters for filament, plate and bias supplies.

The VARIAC, the original, continuously-adjustable autotransformer, has many advantages over any other manually operated control. Its regulation is excellent; it provides absolutely stepless control of any alternating current up to its full load rating; its efficiency is high; dials are calibrated in output voltage; it will supply output voltages 15% above line voltage; and all VARIACS are conservatively rated.

SPECIFICATIONS FOR 2- and 3-PHASE VARIAC COMBINATIONS

INPUT		OUTPUT				
		KVA				
3-Phase Line Voltage	Circuit	At Input Voltage	At Max. Voltage	3-Phase Line Voltage	Type of Assembly	Price
230	Open △	3.6	4.2	0-270	100-RG2	$ 85.00
230	Y	3.6	3.6	0-460*	100-RG3	130.00
230	Y	7.2	7.0	0-270	100-QG3	130.00
230	Open △	12.5	9.3	0-270	50-BG2	225.00
230	Y	12.5	8.0	0-460*	50-BG3	335.00
230	Y	18.0	17.5	0-270	50-AG3	335.00
460	Y	7.2	7.2	0-460	100-RG3	130.00
460	Y	25.0	25.0	0-460	50-BG3	335.00

*Open-circuit voltage—regulation is poor for this connection.

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GENERAL RADIO COMPANY
CAMBRIDGE, MASSACHUSETTS
Branches in New York and Los Angeles

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WHEN you board a Stratoliner for a hop across country, you fly in a hermetically sealed, insulated cabin. It retains sea-level pressure of fresh, pure air . . . no matter how high you go. In one of these, any regular aircraft transmitter or receiver will function just as normally as you do yourself.

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TO keep hearts from bursting at dizzy stratosphere heights, men put on individual oxygen masks. And to keep the very hearts of aircraft radio-power supplies (vibrators) from bursting, Mallory has developed a vibrator in a "space suit".

Yet important as they are, Mallory Stratosphere Vibrators are only one bright thread in a tapestry of leadership that is woven through practically every industry. Mallory is the acknowledged leader in the manufacture of essential parts for all radio communications and electronic devices.

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Mallory standardized welding-tips, wheels, and dies have contributed tremendously to the lowered costs of producing better, stronger automobiles. And over 80% of all automobiles produced employ Mallory electrical contacts in the ignition systems. In general industry, it is nearly impossible to name a type of product, if it is made of metal, or operated electrically, that does not rely upon Mallory for electrical contacts or resistance welding electrodes.

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