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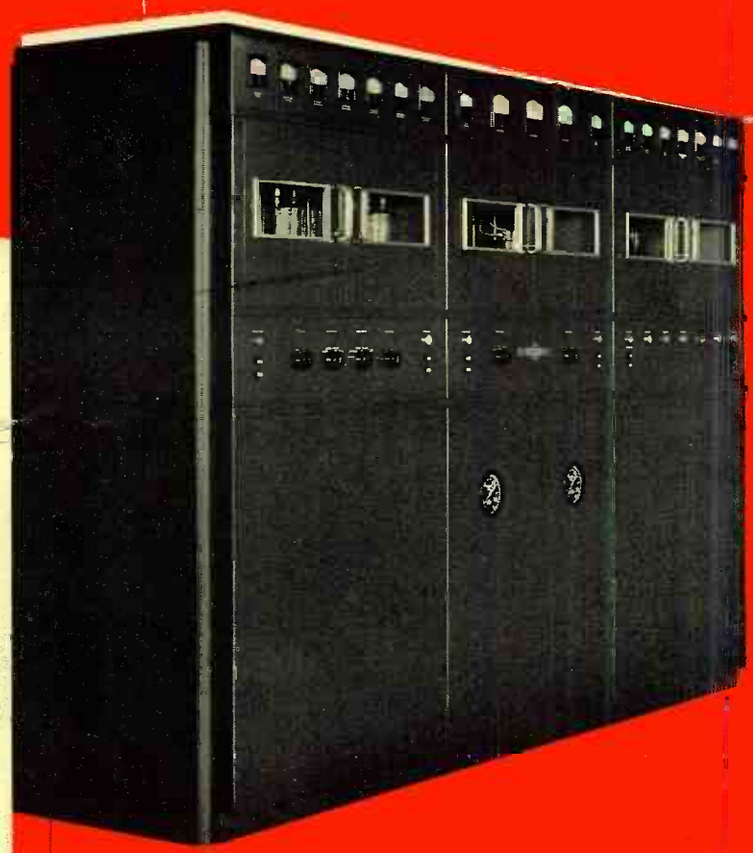
COLLINS 21D

the 2 in 1 transmitter

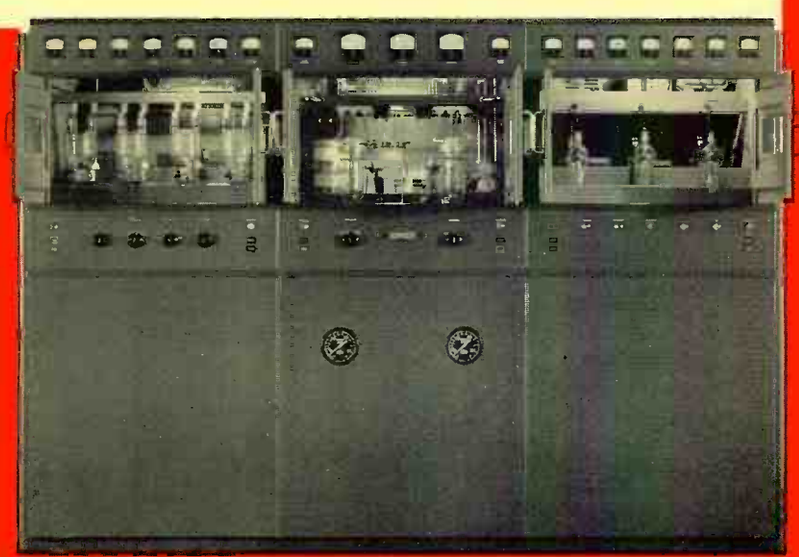
for 5 kw installations



All of those features which make for an outstanding transmitter are incorporated in the 21D. One feature can be stated briefly by saying that the 21D is, in effect, two transmitters. The standard 20K 1000 watt Broadcast Transmitter is physically and electrically separated from the remainder of the 21D assembly but forms the first of the three cabinets grouped as a unit. The 20K was specifically designed as a part of the 21D 5000/1000 watt Transmitter but is sold separately to 1000 watt stations. This 1000 watt unit is used alone for 1000 watt operation of the 21D and affords much greater tube and power economy than would be possible if the entire transmitter were operated at reduced power.

When the 21D is being operated at full power of 5000 watts the 1000 watt unit is shut down (except for low power r-f and a-f stages) and the 5000 watt section of the equipment is operated at maximum efficiency. In event of a tube failure or temporary fault in the 5000 watt section the station automatically switches back to the 20K Unit and stays on the air. This unique arrangement affords both economy (of power and tubes) and reliability by being, in effect, two transmitters in one.

The capability of the 21D Transmitter for reliable, high fidelity service exceeds the requirements of modern broadcasting. It conforms to the accepted standards of good engineering practice, to the requirements of the Federal Communications Commission, and to the various electrical codes.



performance ratings

MODULATION CAPABILITY: 100 per cent at all frequencies between 30 and 10,000 c.p.s.

AUDIO FREQUENCY RESPONSE: Constant within plus or minus 1.5 db of the mean from 30 to 10,000 c.p.s. attenuated rapidly above 10,000 c.p.s.

AUDIO INPUT LEVEL FOR 100 PER CENT MODULATION: Approximately 0 db (6 mw ref.)

AUDIO FREQUENCY DISTORTION: Less than 4 per cent R.M.S. at any single frequency between 50 and 7500 c.p.s. at 100 per cent modulation.

RESIDUAL NOISE LEVEL: More than 60 db below 100 per cent modulation level (unweighted).

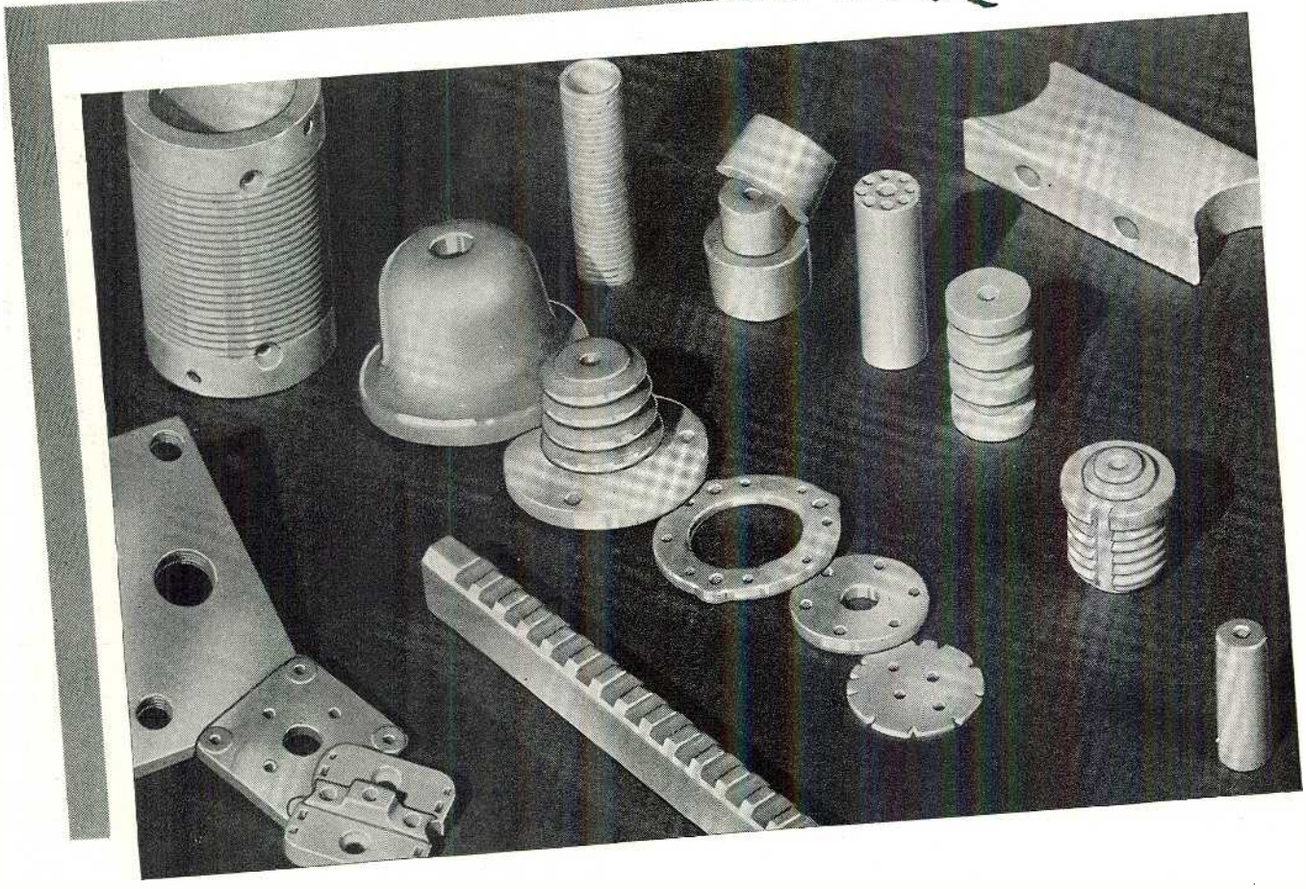
RADIO FREQUENCY HARMONIC OUTPUT: Approximately 70 db below fundamental when used with a "T" section antenna tuning unit.

CARRIER FREQUENCY DEVIATION: Less than 10 c.p.s. from assigned value.

COLLINS RADIO COMPANY

Cedar Rapids, Iowa New York, N.Y: 11 West 42 St.

no magic in this success story



Not magic, but demonstrated ability has won for AlSiMag the leader's position among steatite materials for insulation in communications. Consistently, Alco engineers have been able to solve each insulation problem as it arose, and often after the problem had been declared "unbeatable".

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VOLUME 20
NUMBER 2

RAY D. RETTENMEYER
Editor

• Contents •

COVER ILLUSTRATION

Two patterns from the projection kaleidoscope described on page 37. Changing multiple patterns are projected on the plate of an Iconoscope for television transmission.

• Editorial Comment •

AS we have often pointed out, there is a distinct need for standardization in the receiving tube industry. This fact is readily apparent when it is remembered that over 140 new tubes were announced during 1939, bringing the total number to some 470 different types . . . many of these units differing only slightly in characteristics and construction.

Perhaps the first step toward standardization has already been taken. One large manufacturer of tubes has recently announced a preference list of 36 types . . . a list which the manufacturer states will cover practically every function for any type of receiving circuit.

In general, the various tube manufacturers agree that standardization would be a good thing for the industry. However, it is likely that there will be some disagreement as to which types should be preferred, as the individual manufacturers are each likely to have their own opinion on this subject. Nevertheless, the various organizations should be able to compromise sufficiently to permit them all to derive the benefits accruing from standardization. We sincerely hope that the manufacturers will cooperate in an effort to attain this objective. In the long run the whole radio field should benefit from such a move.

THE Federal Communications Commission is giving considerable attention to broadcasting on frequencies above 25,000 kilocycles. Following the television hearing which began on January 15 and resulted in a tour through the various television laboratories, an informal engineering gathering on aural broadcasting is scheduled for February 28. This latter meeting will be devoted mainly to a discussion of the advantages and disadvantages of amplitude and frequency modulation. The data gathered at these two hearings will largely determine the FCC's action relative to commercialization, or partial commercialization, of both aural and visual broadcasting at ultra-high frequencies.

BRYAN S. DAVIS
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Secretary

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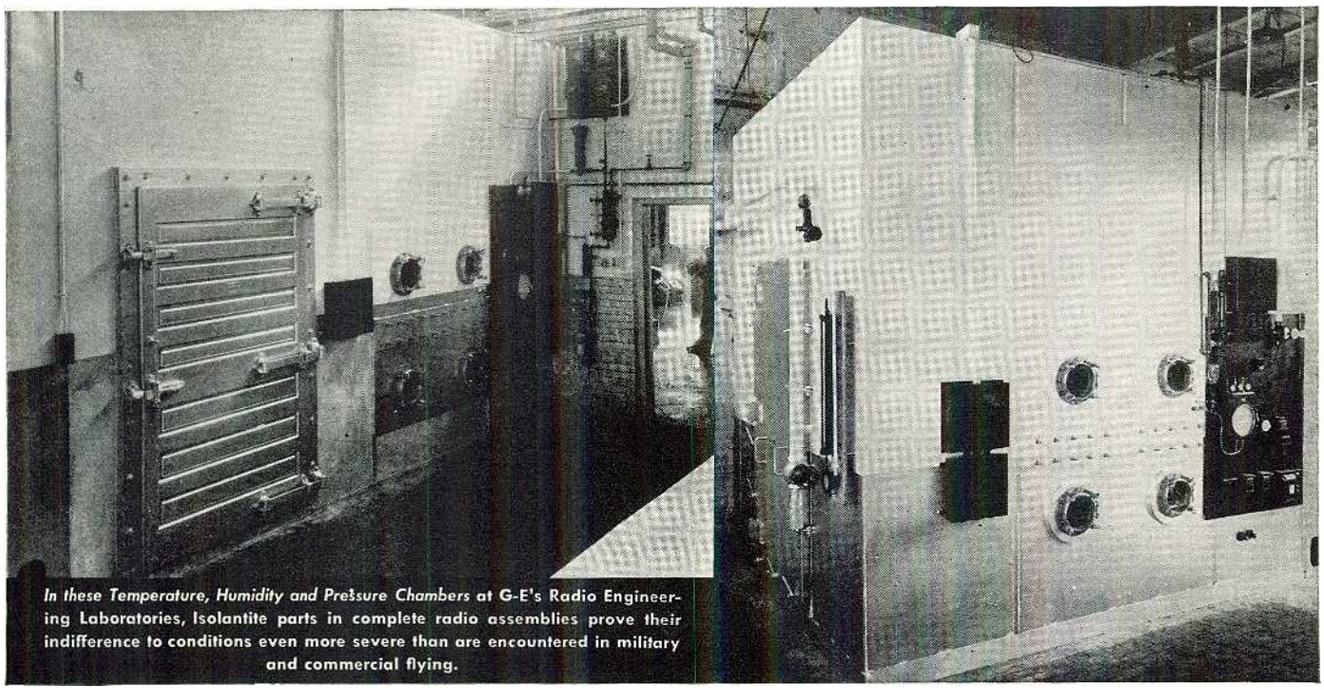

In these Temperature, Humidity and Pressure Chambers at G-E's Radio Engineering Laboratories, Isolantite parts in complete radio assemblies prove their indifference to conditions even more severe than are encountered in military and commercial flying.

Grueling Climatic Tests in These Weather Chambers Prove Isolantite Insulators Can Take It

ISOLANTITE* Insulators prove their qualities through daily use in every part of the world. And in these test chambers at General Electric's Radio Engineering Laboratories — as components of complete, operating radio equipment — they demonstrate how they withstand controlled conditions worse than those encountered in military and commercial flying: temperatures from tropic heat to sub-zero arctic cold . . . barometric pressures from below sea level to those found in the stratosphere . . . humidities from 0 to 100%.

Under such arduous conditions, does Isolantite retain all its advantages? Indeed it *does*. While in these torture chambers it still maintains its unusually low dielectric loss, high surface resistivity, and great mechanical strength. All its characteristics as a superb insulator remain unimpaired.

Isolantite is adaptable in many other ways, too. New and precise forms and unusually-shaped parts may be economically manufactured to meet requirements — whether in the widely used Isolantite body or in Iso-Q, a ceramic with still lower losses. The Isolantite engineering staff, with long, specialized insulation experience, will be glad to cooperate with you in their design. For *your* needs in high-efficiency, rugged and thrifty insulators, consult us at all times.

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Pacing the Trend to UHF . . .

Since the tremendous commercial possibilities of ultra-high frequencies first began to loom on the engineering horizon, RCA Tubes have continued to maintain unquestioned leadership in this field. Today, from the small Acorn type, to the latest high-transconductance Television Tube, RCA offers a complete, *time-tested* line for every UHF requirement:

Type No.	*Date Announced*	*Description*	*Comments*
954	March '35	Detector, Amplifier Pentode	These popular Acorn types still maintain unchallenged leadership for receiving tube applications at frequencies in the order of 300 megacycles.
955	March '35	Amplifier, Detector, Oscillator Triode	
956	Sept. '36	Super-Control R-F Amplifier Pentode	
957	Dec. '38	Amplifier, Detector, Oscillator Triode	The low filament current requirement of these Acorn types paves the way for important developments in portable UHF equipment.
958	Dec. '38	A-F and R-F Amplifier, Oscillator Triode	
959	Dec. '38	Detector, Amplifier Pentode	
1851	March '38	Amplifier Pentode	Three outstanding RCA achievements in the production of high-transconductance tubes for high frequencies and, particularly, for Television video service.
6AC7	June '38	Amplifier Pentode (Single-ended Type)	
6AB7	June '38	Amplifier Pentode (Single-ended Type)	
800	Oct. '33	R-F Power Amplifier, Oscillator, Class B Modulator	Each tube in this group, especially popular among radio amateurs, features the ability to operate at full ratings at 60 megacycles. Although some of the units date back a number of years, they remain in widespread demand today thanks to the RCA program of constant improvement which has kept their performance fully abreast of today's exacting UHF requirements.
807	Oct. '36	Beam Power Amplifier	
809	Oct. '37	R-F Power Amplifier, Oscillator, Class B Modulator	
811	Sept. '39	Class B Modulator, R-F Power Amplifier	
812	Sept. '39	R-F Power Amplifier, Class B Modulator	
813	Oct. '38	Beam Power R-F Amplifier	Can be operated at full input up to 30 Mc.
832	June '38	Push-Pull R-F Beam Power Amplifier	Can be operated at full input up to 150 Mc.
833	Sept. '37	R-F Power Amplifier, Oscillator	Large air-cooled tube with an input rating of 1250 watts in class C telephony service up to 30 Mc.
834	Jan. '36	R-F Power Amplifier, Oscillator	Operates at full ratings up to 100 Mc.
852	March '27	Oscillator, R-F Power Amplifier	A long time leader. Operates at full ratings up to 30 Mc with 300 watts max. plate-input for class C telephony.
887	May '37	UHF Power Amplifier, Oscillator (mu-30)	These two RCA developments feature input rating of 1200 watts up to 300 Mc.
888	May '37	UHF Power Amplifier, Oscillator (mu-10)	

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Radio Tubes

FIRST IN METAL—FOREMOST IN GLASS—FINEST IN PERFORMANCE

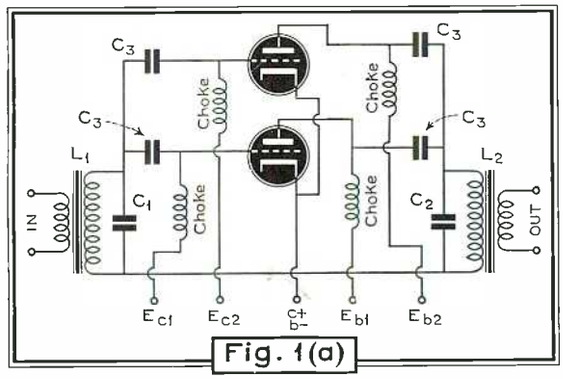


Fig. 1(a)

A HIGH-EFFICIENCY R-F AMPLIFIER

By ELWIN J. O'BRIEN & HARVEY KEES
University of North Dakota

THE systems used in obtaining an amplitude-modulated output of the final stage of a radio transmitter today involve, in general, the variation of the voltage applied to the plate and/or one of the grids of the vacuum tube, or tubes, used in the final stage in accordance with the modulating voltage; or the use of a system of tubes in the final stage whose output is capable of being varied linearly within the limits of an already modulated input voltage. The systems of commonly used modulation are, as a result, called plate modulation, grid modulation, and grid-excitation modulation. However, at present there is no widely used system of modulation involving the use of a combination of the various types of amplification listed above. This paper introduces a method for modulation which makes use of some of the features of all these types of modulation, and permits operation at higher efficiency than is obtained by using any one of the conventional systems individually.

The overall efficiency of plate, grid, or grid-excitation modulated stages rarely exceeds fifty per cent, except where the special high-efficiency systems of Chireix[1], Doherty[2] or Dome[3] are used. The use of any of these high-efficiency systems involves also the use of additional circuit elements and careful adjustments. These and other complications have restricted the use of the otherwise superior systems of modulation. An experimental transmitter using the method of modulation proposed here has been operated at an efficiency of eighty per cent, yet the system required few complicating adjustments and the circuit is surprisingly simple. See Fig. 1-a.

The Practical Circuit

The circuit diagram of Fig. 1-a shows two triode tubes used in a high-efficiency linear stage. All circuit elements are conventional. L_1C_1 represents the grid tank circuit, and L_2C_2 is the plate tank circuit, both of which are resonant at the carrier frequency. The condensers C_3 are blocking condensers which serve to isolate the unlike d-c voltages. An inverse feedback circuit is required for good linearity.

In typical operation the plate voltage E_{b2} is made twice E_{b1}, the subscripts 1 and 2 referring to tubes 1 and 2. The grid bias voltage for tube 1, E_{c1}, is made approximately equal to cut-off bias. The bias voltage for tube 2, E_{c2}, is set at the value which just keeps plate current from flowing in tube 2 when tube 1 is supplying carrier power. Hence, tube 1 supplies power when the exciting voltage does not exceed the carrier-level excitation voltage, while tube 2 operates only when the carrier-level excitation is exceeded. The carrier-level excitation is that which will cause tube 1 to operate under high-efficiency Class C conditions, such as would be the case in a plate-modulated or a telegraph transmitter. During positive modulation the power supplied by tube 1 decreases, and may be zero under certain conditions. Tube 2 supplies most of the power during the positive half of the modulating cycle.

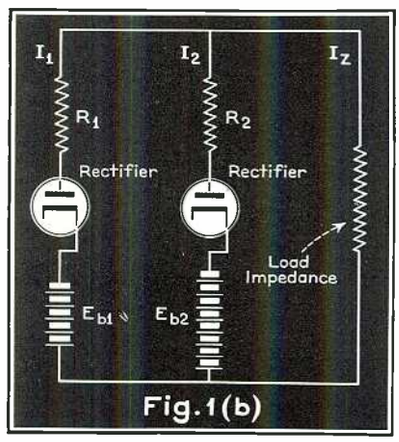


Fig. 1(b)

Other practical circuits suggest themselves: The tubes need not be operated in parallel; a push-pull arrangement can be used; dissimilar tubes might be used so that E_{c1} could be set equal to E_{c2}; the tubes could be connected to different points on the tank circuit; or separate tank circuits in plate and grid circuits, or both, are possibilities. These and other arrangements are possible. However, it is likely that the circuit of Fig. 1-a is the most simple and most easily adjusted. The use of grid-bias modulation rather than excitation modulation presents other alternatives and certain advantages. In any event, the circuit acts much like a plate-modulated amplifier, even though all modulation takes place in the grid circuit or in preceding stages, since the tube supplying

[1]H. Chireix, "High Power Outphasing Modulation," *Pros. I.R.E.*, vol. 23, pages 1370-1392, November, 1935.
[2]W. H. Doherty, "A New Power Amplifier for Modulated Waves," *Proc. I.R.E.*, vol. 24, pages 1163-1182, September, 1936.
[3]R. B. Dome, "High Efficiency Modulation System," *Proc. I.R.E.*, vol. 26, pages 963-982, August, 1938.

power on positive modulation peaks has twice the plate voltage that the carrier level tube has.

Theory of Operation

Before attempting to interpret the operation of this high-efficiency system, we will examine the features of an ordinary efficiency-modulated amplifier (that is, one using grid-bias or grid-excitation modulation). Efficiency modulation is accomplished by varying the plate resistance of the tube or tubes in the final stage in accordance with the modulating voltage. That is, the load impedance is connected in series with a vacuum tube and plate battery, and we proceed to vary the power in the load by introducing in series with the grid circuit a radio-frequency and a modulating voltage. We usually also place in series with the grid circuit a direct-current voltage which is of the correct polarity and magnitude to make the plate resistance almost infinite when the radio-frequency and modulating voltages are removed. Then we increase the radio-frequency voltage in the grid circuit to the value which causes sufficient plate current to flow in the series plate circuit to supply the required amount of power to the load impedance. The current flowing in the load impedance varies in accordance with the magnitude of the modulating voltage which is introduced in series with the grid circuit. For simplicity we will consider a circuit in which we are attempting to modulate a zero-frequency, or direct-current, voltage. Fig. 2-a shows the circuit, and Fig. 2-b shows an approximately equivalent circuit of an efficiency-modulated amplifier. The resistance R, in Fig. 2-b, represents the equivalent variable plate resistance; the rectifier

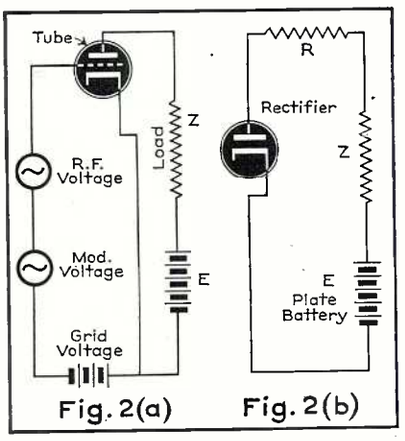


Fig. 2(a) Fig. 2(b)

stimulates the valve-like action of the vacuum tube; E is the plate battery; and Z is the load impedance. It is desired to analyze conditions that may exist at any instant during the modulating cycle. Modulation is accomplished by varying the resistance R.

It is easy to show that the efficiency of the circuit is

$$K = Z/(R + Z). \quad \ldots\ldots\ldots\ldots (1)$$

In a practical amplifier the efficiency is a linear function of the instantaneous grid voltage as is the current flowing in the load impedance. For zero efficiency R must be infinite, while for 100 per cent efficiency R must be zero. It is seen that the efficiency is dependent upon the ratio of Z/R. Let

$$A = R/Z.$$

Then, when Eq. (1) is solved for A,

$$A = (1 - K)/K. \quad \ldots\ldots\ldots\ldots (1a)$$

With the use of Eq. (1a) a graph can be prepared showing the corresponding values of K and A (see Curve A, Fig. 3). Since K is a linear function of the grid voltage, E_g, both can be represented along the same axis. The efficiency, power loss, and load current, at any instantaneous value of E_g can be computed from Curve A, of Fig. 3. The only assumption made in obtaining the curve was that K is a linear function of E_g, which is true as long as the amplifier is linear.

The circuit has inherent low efficiency when it is required to reproduce audio-frequency modulating voltages across the load impedance with good fidelity. In practical cases, such as in broadcast transmitters, it happens that the maximum efficiency is in the vicinity of 2/3, thus requiring the carrier-level, no-modulation, efficiency to be set at 1/3

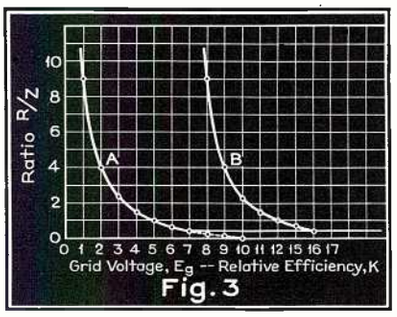


Fig. 3

when the modulation voltage is apt to involve voltages with equal positive and negative loops. The average all-day efficiency of a broadcast transmitter is near the carrier level efficiency.[4] Hence, it is desirable to keep the carrier-level equivalent plate-resistance as low as possible. Or, it is desirable to operate the amplifier so that the maximum efficiency is at carrier level. So, we introduce the circuit of Fig. 1-b.

Fig. 1-b is the equivalent circuit of two tubes operating in parallel. However, the plate voltage of tube 1 is half that of tube 2. The grid-circuit voltage on tube 2 is adjusted so that the tube operates only when the modulating voltage is positive, while the grid-bias voltage on tube 1 is set at the point where this tube will operate when the excitation voltage does not exceed the carrier-level value. Consequently, the R/Z ratios of the tubes (A for tube 1, B for tube 2) must vary as in Fig. 3, where 70 per cent is considered the maximum obtainable efficiency. Thus, we set the carrier level at the point where tube 1 has a high efficiency, such as 70 per cent. Tube 1 supplies all the power when E_g is less than 7 units. However, when E_g is greater than 7 units, on positive modulation, tube 2 joins tube 1 in supplying power, and finally, when E_g is greater than 12 units tube 2 supplies all the power, as is indicated by the following theory.

If certain limitations are observed, the following current equations for the equivalent circuit, Fig. 1-b, can be written:

$$I_z = I_1 + I_2, \quad \ldots\ldots\ldots\ldots (2)$$

$$I_2Z + I_1R_1 = E_1, \text{ and} \quad \ldots\ldots\ldots\ldots (3)$$

$$I_2Z + I_2R_2 = E_2. \quad \ldots\ldots\ldots\ldots (4)$$

Substituting in Eqs. (2), (3), and (4),

$$E_2 = 2E_1, \quad \ldots\ldots\ldots\ldots (5)$$

$$R_1 = AZ, \text{ and} \quad \ldots\ldots\ldots\ldots (6)$$

$$R_2 = BZ, \quad \ldots\ldots\ldots\ldots (7)$$

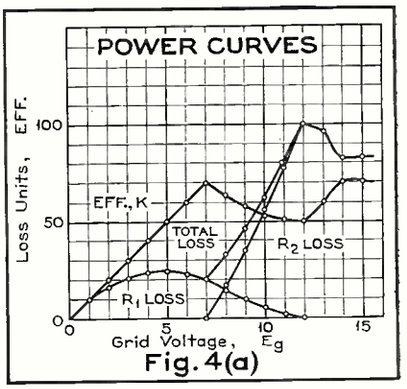


Fig. 4(a)

where A and B are read from the curves of Fig. 3, and solving simultaneously for the currents, we obtain

$$I_1 = \frac{(E_1/Z)\,(1/A - 1/AB)}{(1 + 1/A + 1/B)}. \quad \ldots\ldots (8)$$

$$I_2 = \frac{(E_1/Z)\,(2/B + 1/AB)}{(1 + 1/A + 1/B)}. \quad \ldots\ldots (9)$$

$$I_z = \frac{(E_1/Z)\,(1/A + 2/B)}{(1 + 1/A + 1/B)}. \quad \ldots\ldots (10)$$

Due to the presence of the rectifiers in the equivalent circuit, current can flow in only one direction in the branch circuits containing the voltages. In other words, current cannot flow from E_2 to E_1 or from E_1 to E_2. Therefore, Eqs. (8), (9), and (10) hold only when there is not a tendency for current to flow from one of the batteries to the other, and this tendency occurs only when the plate resistance of tube 2 is

[4] L. F. Gaudernach, "A Phase Opposition System of Amplitude Modulation," *Proc. I.R.E.*, Vol. 26, August, 1938.

less than a certain value, or when the voltage across Z is equal to E_1. It is beyond this point that E_2 supplies all the power to the load, and

$$I_z = I_2 = 2E_1/(R_2 + Z).$$

Then

$$I_z Z = 2E_1 Z/(R_2 + Z) = E_1. \quad \ldots(11)$$

Solving simultaneously (11) and (7).

$$B = 1. \quad \ldots\ldots\ldots\ldots\ldots\ldots(11a)$$

This gives sufficient information to plot the current and power curves for an amplifier using the circuit of Fig. 1-a, whose equivalent circuit is approximately shown in Fig. 1-b. These curves are shown in Fig. 4-a and Fig. 4-b, which, it must be remembered, are curves for static conditions and not sine-wave modulation.

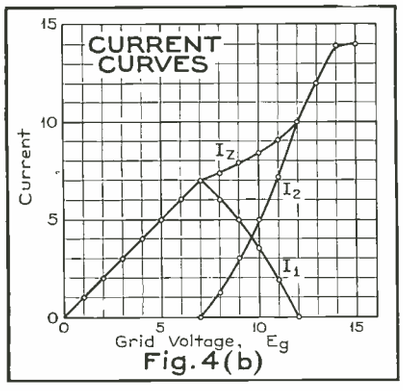


Fig. 4(b)

It is well to point out here that the equivalent circuit of Fig. 1-b represents only approximately the practical amplifier of Fig. 1-a. Our analysis is nearly exact as long as the amplifier remains linear, that is, we are apt to encounter difficulties if we try to predict practical operation in the region where the plate-current characteristic of the tubes begins to flatten off. For example, there is no value of d-c voltage which will exactly replace an alternating voltage in our calculations when the tubes operate in a condition which causes a distortion of the positive peaks of the a-c sine wave as a result of the tubes reaching saturation. However, our approximate analysis does give us an understanding of the principles of the high-efficiency circuit, and the theoretical curves do check remarkably well with those obtained in a practical circuit.

Practical Results

Two experimental transmitters were constructed. One used a pair of 203-A's in a circuit similar to that of Fig. 1-a, however, with a considerable amount of grid-leak bias on tube 1 so as to prevent the grid from becoming excessively positive during upward modulation. Using sine-wave modulation, and as high as 2000 volts on the plate of tube 2, the transmitter produced results checking closely with theory. In order to make a more complete analysis a second experimental transmitter was constructed which used a pair of 2A3 tubes in a circuit like that of Fig. 1-a, except that, again, considerable grid-leak bias was used on tube 1. A set of static curves was obtained, and these are given in Fig. 5-a and Fig. 5-b.

It will be noticed that there is great similarity between the experimental and theoretical curves, even though the theoretical curves were obtained from a

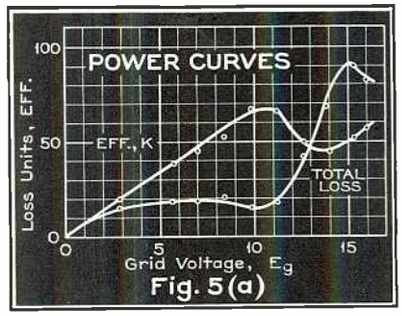


Fig. 5(a)

circuit in which a d-c voltage was to be modulated, while the experimental transmitter operated at broadcast frequencies. A greater excitation was required experimentally to cause tube 1 to reach carrier level than was theoretically predicted. This is due largely to the grid-leak biasing-resistor used with tube 1. Also tube 1 did not stop supplying power in the experimental transmitter as was forecast by theory. That is, the experimental curves show that tube 1 was supplying power even at the plus-peak level, whereas theoretically it should have gone out of operation considerably before the plus-peak was reached. This is explained by the fact that in the experimental transmitter the excitation to tube 1 was increased simultaneously with that to tube 2 as the measurements were made. It was, however, found possible to vary the point at which tube 1 stopped supplying power by changing the tube 1 grid-leak resistance.

The circuit of Fig. 1-a also presents certain advantages when the two plate voltages are made equal* and, as before, one tube is made to supply carrier-level power, and is assisted during upward modulation by the second tube. The equivalent circuit is the same as Fig. 1-b except that the two batteries, E_1 and E_2, are equal in potential. The theory of operation can be described briefly. Consider one tube operating as an efficiency-modulated amplifier. Its efficiency at carrier level is, say, 1/3. The R/Z ratio is, from curve A of Fig. 3, 2. At plus peaks of a modulation wave giving 100 per cent modulation the instantaneous efficiency is 2/3, which corresponds to an R/Z ratio of 1/2. Now, if at positive peaks a second tube is made to assist that single tube formerly used in supplying power to the same load impedance, the apparent im-

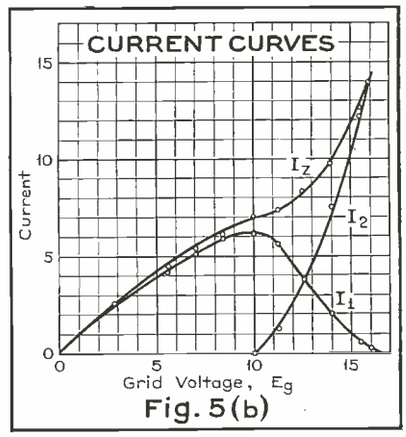


Fig. 5(b)

pedance presented to each tube is twice that which would be presented to one tube alone. Thus, the apparent R/Z ratio for each tube is now 1/4 instead of 1/2 and the corresponding positive-peak efficiency is 80 per cent. So it is not necessary to maintain the carrier level efficiency at the low level of 1/3 when two tubes are used. That is, the carrier-level efficiency can be increased to 40 per cent. The carrier-level power is correspondingly greater, by the square of the efficiency ratio of $(40/33.3)^2 = 1.44$ for the conditions just discussed. This, of course, is not as great an increase in power as would usually result from the doubling of the number of tubes in a circuit, but with careful adjustments the ratio can be made greater than 1.44 and it is sometimes possible, with this arrangement, to secure greater efficiencies at carrier level than 40 per cent. The circuit was actually checked experimentally, the results obtained agreeing with the theoretical statements just made. This system suggests a means whereby broadcasting stations using linear amplifiers might increase actual power output.

When compared to other systems of modulation, the high-efficiency amplifier first described in this paper evidences the following characteristics:

Plate Modulation. The high-efficiency system requires about twice as many tubes for the same carrier-level output as a plate-modulated stage. (This does not take into consideration the tubes required in the modulating stage.) It is advisable to use a center-tapped bridge-rectifier circuit with a practical high-efficiency amplifier so that the two plate voltages can be obtained from one power supply without resistance loss, whereas

(*Continued on page* 44)

*This condition is covered by patent No. 2,085,011, issued to Ditcham and assigned to RCA. This work was done independently.—Editor.

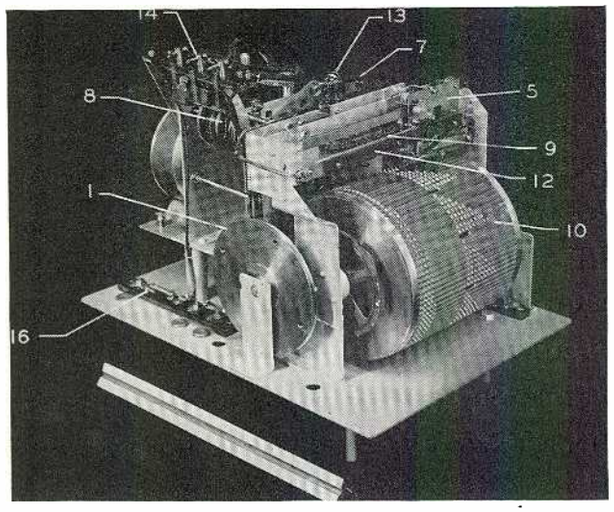


Fig. 1. View of gage showing drum.

AUTOMATIC WATER

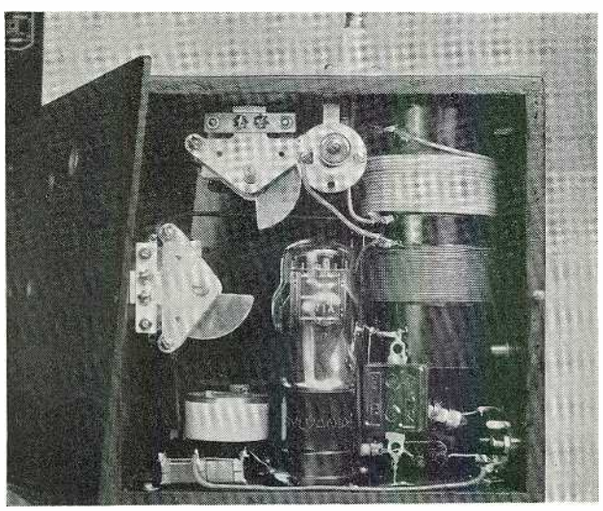
By MAURICE E. KENNEDY
Chief Communications Engineer
Los Angeles County
Flood Control District

THE use of automatic radio transmitting apparatus, for the transmission of scientific information from unmanned balloons as well as necessary operating data from remote weather stations and isolated water stage instruments, is rapidly developing a new branch in the field of radio communication.

The Radio and Hydraulic Departments of the Los Angeles County Flood Control District were recently called upon to develop a suitable device to measure the water elevation in remote mountain streams and to transmit the information by radio to a receiving tape on the particular dam being fed by the measured streams. This field was not entirely new to our engineers as the Instrument Division of the Hydraulic Department had spent some six years in the development and construction of water stage recorders of the inking type and the Radio Department had been interested in the possibilities of automatic transmitting devices for some three years. One working model had been completed in 1936 but was unsatisfactory in one or two details. With funds available in July, 1937, we started work on a modified design of the original experimental model and the completed gage with its many refinements is here described.

The water stage indicator is a simple device for keying a small battery-powered radio transmitter at pre-determined intervals giving the water elevation in dots and dashes. The timing of the indicator may be set to operate the keying mechanism once a day or once each hour. An additional automatic contact may be set to place the gage in emergency operation every fifteen minutes when the water elevation reaches a flood stage.

Fig. 4. Radio transmitter with cover removed.



Key to Figures 1, 2 and 3	
1. Float wheel.	9. Chain driving trolley.
2. Clock.	10. Brass coded elevation drum.
3. Weight cable drum.	11. Mercury switches.
4. Weight cable winding device.	12. Insulated call letter strip.
5. Keying trolley.	13. Gear locking shaft for changes in clock settings.
6. 15-Minute emergency setting disc.	14. Tilting adjustments for mercury switches.
7. Electric motor.	15. Ball bearings.
8. Timing discs.	16. Terminal strip.

Key to Parts in Figs. 1, 2 and 3.

Construction: Operation

Fig. 1, 10, shows the coded elevation drum, the position being determined by the elevation of a twelve-inch copper float in the stilling well below the gaging station. The float cable passes over the float wheel, shown as 1, with a resulting movement of the brass keying drum. The drum is free to move with the changing water elevation and the reading at the top or directly under the contact trolley is always the present elevation of the water in the well.

The contact trolley, 5, is driven by a small electric motor. This trolley normally remains in the position shown with all contacts open and the mechanical finger which obtains the movements of the contacts from the perforations in the drum, resting above the drum.

The station call letters are transmitted on the forward trip of the trolley with the code letters cut in the under side of the insulated strip, 12. The return movement of the trolley is on lower side of the driving chain, 9, and the elevation at that instant is transmitted. This information is repeated three times in one minute of operation. Then the gage shuts down, ready for the next schedule, or within fifteen minutes if a sudden cloud burst should rapidly increase the elevation of the river.

Fig. 2 shows the disc, 6, for pre-setting any elevation that could be considered dangerous, or a flood stage. The gage will continue on its normal schedule until the slot on the disc closes, the fifteen-minute contact thus completing the circuit of the fifteen-minute disc on the timing cylinder and its mercury switch.

Timing

The timing cylinder, 8, in Fig. 2, is composed of a series of clutches and timing discs, operated by the clock and motor, to start the motor and transmitter by tilting mercury contacts and timing the duration of the transmission.

This timing mechanism is by far the most complex part of the entire device but it is absolutely fool-proof and positive in its operation. The current time is read on the two aluminum

STAGE TRANSMITTERS

discs. The movement in the clock is merely used as an escapement time governor, the clock springs having been removed and a fifteen-pound lead weight and driving movement added, 3. The clock is of the "dollar alarm" variety with slight changes to compensate for temperature changes. It keeps surprisingly accurate time over long periods.

Motor

The motor, used to power the movement of the keying trolley and one of the timing discs, is of the small permanent-

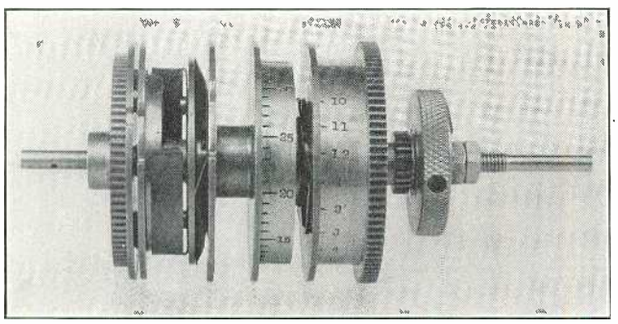


Fig. 5. The timing cylinder.

magnet field type used by builders of scale model locomotives. It operates at 6 volts d-c and approximately ½ ampere under load. The motor speed under full operating load is 9000 r-p-m. Needless to say the power developed in the eighty-to-one reduction worm gear, plus a further reduction in the chain driving gears, is far in excess of the power required to drive the keying trolley.

Contacts

The electrical contacts operated by the slots in the timing discs are small evacuated mercury contacts mounted on metal fingers which tilt the mercury contacts as the fingers drop in the slots on the timing discs. The keying contacts are of the wiping silver type, operated by the metal finger dropping in the perforations of the elevation drum or by the call letter code cut in the under side of the contact strip, 12.

Radio Transmitter

The radio transmitter is capable of radiating four watts into a semi-directional antenna. The transmitter must be able to start radiating instantly or within a few seconds after the motor starts. Hence, a type 71-A tube is used in a conventional crystal oscillator circuit.

Power is supplied to the tube filament and to the electric motor by a 100 ampere-hour lead-acid storage battery capable of giving two months' service on the emergency schedule if necessary. The plate power for the transmitter is supplied by 270 volts of heavy-duty "B" batteries which should give at least a year of dependable service. It is our intention to service the gages at least once a month and replace the storage battery with one that has been freshly charged.

It will be necessary to rewind the clock weight at the end of a thirty-day period as we are using the first two gages in fifteen-foot wells. The weight falls at the rate of six inches a day so a deeper well, or doubling the weight and returning the end of the cable to the top of the well, would give longer operation of the gage without attention.

The signals from the transmitter are in the form of pure

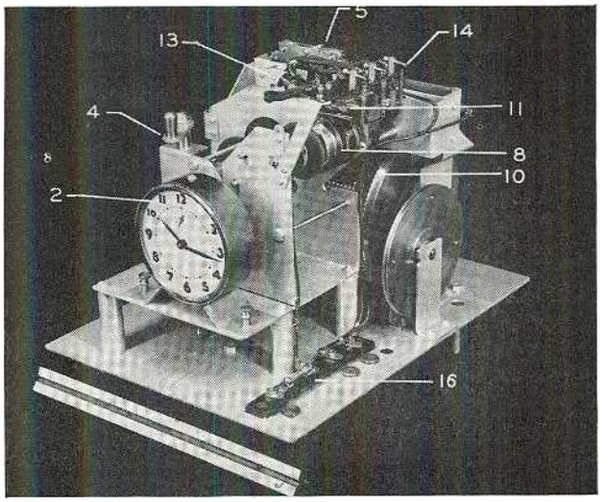


Fig. 3. View of gage showing clock.

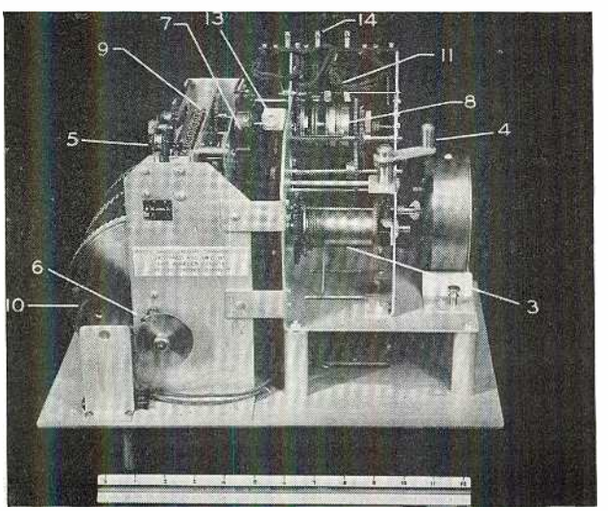
continuous wave and may be received on any short-wave receiver (within the radius of the transmitter) equipped with a beat oscillator or with regeneration. The signals from our first two gages will be concentrated in the direction of the automatic tape receiver, thus giving considerable signal gain and reducing any possible interference in other directions.

The signals will all be in dashes and dots and the station's call letters will be heard first at about ten words per minute. The water elevation will then be heard with a group of dots to indicate feet, a pause and the second group of dots to indicate tenths. The zero figure is indicated by a dash.

If the stream elevation was seven feet four-tenths at this instant and the transmitter schedule was due, you would see the recording inker start with the first dash of the call letters from the remote transmitter, the pen indicating call letters, then seven sharp peaks, a straight line and four sharp peaks in the line on the moving paper tape. This would be repeated for three times and the transmitter shut down. The inking device on the dam would draw a straight line for twenty seconds, the time relay would click and the signal recording device would stop.

The transmitting gage is also suitable for transmitting the same impulses over a telephone circuit or wire line. However, the radio transmitter is much more dependable during periods of mountain storms and floods.

Fig. 2. Another view of the radio gage.



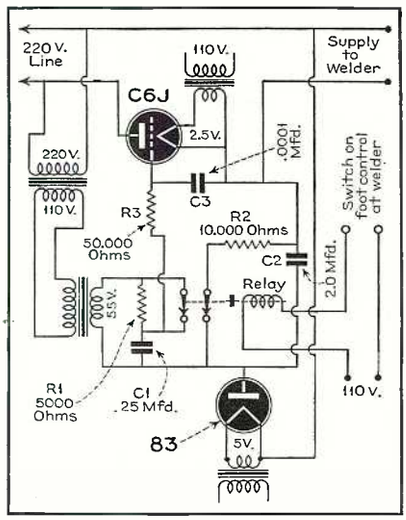
AUTOMATIC TIMER FOR SMALL PARTS WELDING

IN welding small parts or thin materials it is important that the welding time be rigidly limited to a matter of a few milliseconds. With such materials the weld comes up to temperature almost instantly and the continued application of current beyond this required time only serves to heat the electrode and increase the tendency for the work to stick to it.

Callite engineers have developed an electronic timer for automatically controlling such welding operations. This timer functions by allowing current to flow for each weld only for the full duration of a single half-cycle of the 60-cycle supply, and by blocking further current flow until the manually operated switch at the welder is again tripped for the next weld. By this means the time for each weld is absolutely uniform and limited to a few milliseconds duration.

The control action is entirely electronic. Briefly the operation is as follows:

A grid-controlled rectifier (type C6J)



capable of handling welding currents up to 77 amperes is utilized in the circuit shown herewith. In normal idling position relay contacts 1 and 2 are closed and as a result the rectifier grid and plate are maintained exactly 180 degrees out of phase and no current can flow.

When the manual control switch at the welder is closed it opens contacts 1 and 2. This results in a slight phase shift in the applied grid voltage through the introduction of R_1. This results in the grid going positive at the beginning of the next half-cycle. Once the current flow starts, the grid loses control and the current flow continues to the end of this half-cycle. However, while current is flowing to the welder it is also charging capacitor C_2 through the 83 rectifier. At the end of the positive half-cycle this places a high negative bias on the C6J grid, blocking further current flow. This bias is maintained until the manual switch is released at which time the original 180-degree out-of-phase condition is resumed. This closes the two relay contacts, shorting out R_1 and discharging C_2, and leaves the circuit ready for the next weld.

A typical unit as supplied by the Callite Electric Products Co., is housed in a standard switch-box with the knock-outs providing ample ventilation. Its compact size simplifies installation.

BOOK REVIEWS

STANDARDS ON ELECTROACOUSTICS 1938, *published by The Institute of Radio Engineers, Inc., 330 West 42 Street, New York City,* 1938, *37 pages, paper covers, price 50 cents.*

Of the various books in this I. R. E. series on standardization none was as badly needed as *Standards On Electroacoustics* 1938. The carelessness with which electroacoustical terminology and reference levels were employed by engineers is sufficiently notorious as to need no comment.

The first portion of the book is devoted to definitions of electroacoustical terms. These definitions are taken verbatim from the tentative standards of the Acoustical Society of America. This latter organization has, since its inception in 1929, attempted to standardize acoustical terminology, and these definitions are the result of nearly ten years work.

Attention should be called to a misprint which appears in section 1A18 which gives the definition of pressure level. The reference pressure is given as 0.002 dyne per square centimeter, whereas, of course, this should be 0.0002 dyne per square centimeter. A precaution to be observed when using 0.0002 dyne per square centimeter as a reference pressure is that this value is consistent with the other reference levels given only when the specific acoustic resistance, namely, the product of the density of the medium and the velocity of sound in that medium, is equal to forty. This product for air is generally nearer to forty-two than to forty.

The definitions are followed by graphical and letter symbols, and by a chart listing the corresponding electrical, mechanical, and acoustical units in tabular form. The remainder of the book is devoted to methods of testing loud speakers.

It is to be sincerely hoped that *Standards On Electroacoustics* 1938 becomes a best seller in engineering literature, for the information contained therein is of invaluable importance to the communication engineer. R. L.

ENGINEERING ELECTRONICS, by D. G. Fink, published by McGraw-Hill Book Company, Inc., 330 West 42 Street, New York City, 1938, *358 pages, price* $3.50.

This volume offers the engineer a survey of the theory and applications of electron tubes. The book is divided into three distinct but related parts: (1) Physical Electronics, in which the production and control of electrons in a vacuum and in gases and vapors is discussed; (2) Electron Tubes, which is comprised of an explanation of thermionic vacuum tubes, gas-filled thermionic tubes, photosensitive tubes and cells, electronic sources of light, and specialized electron tubes including cathode-ray tubes, the electron camera, electron multipliers, and the strobotron; and (3) Electron-Tube Applications, which discusses power transformation circuits, communication circuits, and industrial control and measurement circuits.

The style and presentation of the material in this book is of such extraordinary clarity as to place Mr. D. G. Fink among the top-ranking technical writers of our time. Such high praise for Mr. Fink's ability as a writer must, however, be qualified by a remark regarding his carelessness as a proofreader. One example of this is exemplified by the illustrative problem on page 26, where, on one line the exponent of ten is incorrect, while on the next it is correct.

In order that the reader may obtain a thorough grasp of the subjects discussed the author works out numerous problems in detail, so that the reasoning processes employed may be followed step by step. Where necessary, problems to be solved by the reader are given at the end of each chapter, thereby greatly enhancing the value of the book for the purpose of self-study. Unfortunately, the answers to these problems, which are given at the end of the book, are not always correct, an example of the poor proofreading already referred to. The issuance of a sheet of errata by the publishers will, however, nullify this objection.

The treatment is mainly of a descriptive nature but where mathematics is employed there is required of the reader only a knowledge of algebra and trigonometry. The two exceptions to this have been relegated to footnotes.

Engineering Electronics is undoubtedly one of the finest treatments of the subject that this reviewer has encountered. Whether or not your library already has a text on this subject this book is of such excellence as to constitute an imperative addition. R. L.

THEORETICAL MECHANICS, by C. J. Coe, published by The Macmillan Company, 60 Fifth Avenue, New York City, 1938, *555 pages, price* $5.00.

With some exceptions, the communications engineer has, in the main, been able to disregard the subject of mechanics. The

(Continued on page 44)

TELEVISION ENGINEERING

Registered U. S. Patent Office

TELEVISION ECONOMICS

Part XIII—Conclusion

By
Dr. ALFRED N. GOLDSMITH
Consulting Industrial Engineer

N. THEATRE TELEVISION

WHILE large-screen television receivers have been under development for a number of years, it is only comparatively recently that the results have been applied to theatre television and that it has been justified to consider the practical use of television in the theatre. Manifestly, television presentations in the theatre constitute a radical change in entertainment methods which may well have profound effects not only on the nature of the program but also on both the motion-picture and radio industries. The theatre is, in fact, a possible meeting ground of these industries under the same roof and with parallel aims.

N-1. Theatre Television Programs

The first and major question confronting any organization planning theatre television is the selection of subject matter for presentation by television in the theatre. It is relatively simple to decide, in the present state of development of television, what type of program should *not* be presented by television in the theatre. The present-day reproduction of feature films and the usual shorts in the theatre, in black-and-white or color, is of such high technical quality and is so readily handled that there is at this time little or no inducement to transmit feature films, for example, by television to theatres. The delivery and pick-up of a can of film at the theatre is a reasonably economical process. There are hardly enough theatres in any given district to make the film delivery and pick-up problem a really major one. Furthermore, television could not present feature films as well as they are now projected. Color would necessarily be missing at this time. Even if television performances in the theatre were equal in quality to film presentations, they would involve the establishment of transmission facilities for each district including a group of theatres as well as reception facilities for each individual theatre, and also the rigid coordination of the time schedules of the theatre. The last-mentioned factor is not a serious one; and it must be recognized that at some later stage in the development of television it may become practical even to send the film portions of the program by television into the theatre (which will already be equipped for television reception of other types of material). As an immediate prospect, however, this is less appealing than certain other possibilities.

Foremost among the attractive present possibilities of theatre television is the use of spot news and similar material, such as sporting events, contests, and other interesting happenings. Here the element of simultaneity between the actual event and its presentation in the theatre may prove to have great audience appeal. It is unnecessary to list the wide variety of such events which could be brought instantly into the theatre. Aside from the scheduling of such material with necessary careful control of program timing, there seems no special problem which the exhibitor at least must face in this connection.

Going further afield, but still within the range of material likely to appeal to the theatre audience through television, there are what may be termed "personality presentations". If prominent people are visiting a city, if a debate between opposing noteworthy persons is taking place, or if any other picturesque happening is in progress, the theatre audience may be greatly interested in "looking on". Such events may, however, require more scheduling and rehearsing than the theatre audience will be aware of, since the smoothness and acceptability of the performance may depend on such rehearsals. Included within this general group would be a certain amount of popularly presented material of cultural value, for example, musical material, sculptural presentations, views of paintings and the artists, stories of travel with pictorial illustrations, and the like.

Syndicated vaudeville material, sent to the theatres by television, may be capable of development and commercially successful presentation. Many vaudeville acts are brief, sparkling, and sufficiently simple and intimate to permit highly satisfactory television presentation in the theatres. It would be curious, though not inconceivable, if the ancient art of vaudeville were to be revived and brought back into the theatre through the later and ultra-modern agency of television (from which very theatre it was ignobly banished by the modern motion picture). If two-way television-telephone circuits between the theatres and the central transmitting studio were provided in such instances, it is likely enough that the skilled showman would find a wide and attractive group of possible forms of entertainment, for example, back-and-forth repartee or quizzing between the performers at the studio and a sequence of audiences which were viewing him remotely by television. In effect the performer would thus be brought before the footlights in *each* theatre, but with those advantages of large-screen presentation of which the motion-picture close-up is so striking an example.

Assuming adequate coordination of program scheduling in the theatres

served by television, and acceptance by the public of this service, it is likely that the question of introducing advertising into such programs will arise. Brief pictorial advertising might prove very effective. It is widely enough used at present in the trailers of "future attractions" shown in the theatre. In all likelihood, the quality of the program, for a given price of admission, could be greatly improved if a certain measure of commercial sponsorship were available, always assuming that the entertainment value of the program were rigorously maintained and jealously guarded.

N-2. Theatre Television Program Production

It is clear that mobile pick-up units as well as fully equipped studios would be necessary to any organization planning a systematic and profitable television program service to theatres. In the case of news material, the mobile pick-up will be desirable, particularly if the corresponding trucks are sufficiently flexible so that they can be used under trying conditions and on brief notice. One of the major difficulties will be arranging to have events or news occur when the theatre is ready to receive them. Of course an event of transcendent importance, e.g., a major catastrophe, might take possession of the theatre screen regardless of previous planning. In the main, however, it will not be practical (except in television theatres devoted particularly to very brief subjects), to inject news material whenever destiny decrees that the event shall occur.

Any organization planning this type of service must accordingly have wide reportorial contacts and a highly efficient news desk. It must so to speak stimulate the news, and more or less affect its timing. Unless something of this sort is done, it is going to be a nerve-racking job to keep the stream of news flowing smoothly into the television theatre. One expedient doubtless would be to have on tap "feeder" or reserve news events to be introduced during slack periods as required. Another expedient would be occasionally to send out a slightly delayed film version of an event which occurred at a completely inconvenient time, e.g., in the early morning. Film might also be used occasionally for repeat performances where time differences or audience preferences made this desirable.

The natural area to be covered by such a service from a given transmitting station to a group of theatres would be that served by the station, to wit the usual marketing area of some thousands of square miles. However, with the advent of radio relaying or other means of syndication, there is no special reason why such theatre news programs should not be instantaneously syndicated over wider areas.

N-3. Theatre Television Networks

It will probably not prove necessary to separate urban and surburban districts for syndication purposes, since by suitable selection of the transmitter location, both such areas may be served by one station. Inasmuch as theatre television service will permit no apologies, fully adequate transmitter power must be used and really effective receiving installations provided.

In this connection it is interesting to speculate on the possible exclusivity of such programs, that is, their restriction solely to theatres. There are several ways in which such a result may be accomplished. Assuming that earlier precedents and analogies hold good, the television programs might be specifically addressed to the individual theatres and none other, thus becoming in effect "multi-addressed television messages". Possibly such communications would then fall within the protection of national and international radio regulations which prohibit the disclosure of such effectively private communications to or by anyone other than the addressee or his authorized agent. If this procedure were to be approved by the governmental regulatory group, it would seem proper to assign to this service either unused television channels within the public broadcasting band, or perhaps preferably, higher frequencies lying outside of this band. In the latter case, the public would not receive these theatre transmissions nor would public broadcasting facilities be used by the theatres. Further, interference and allocation problems in the public television broadcasting band would be avoided by the theatre transmissions.

Still another method of separating public and private (theatre) television transmissions might be through the use of radically different transmission standards. For one thing the theatre picture might, for example, be a 729-line, 945-line, or even 1215-line picture transmitted on the frequencies somewhere between 200 and 500 or more mc where such extremely wide-band transmission may be practicable. Even color-television transmission to the theatre cannot be excluded from ultimate consideration.

It is obvious that much material sent to theatres exclusively may be further protected from unauthorized use by copyright or other legal protection.

There are interesting possibilities of cooperation or even consolidation between the news-gathering groups for public television broadcasting and for theatre television broadcasting.

N-4. Theatre Television Reception

As previously indicated, the theatre receiver installation should be of highest quality. It would be economically justifiable to install efficient, highly directional, and suitably wide-band antennas on the theatre roof or even on a mast above the roof. Attention may be required by electrical equipment in the theatre and its surroundings to avoid interference. The transmission and reception methods should of course be such as to minimize interference from electrical disturbances; and on the very high transmission frequencies which may be used, advanced modulation methods which reduce interference may prove economically as well as technically desirable. The receiving equipment will also be of professional calibre and handled by skilled and trained theatre personnel. It would be highly desirable if possible to control such equipment from the film projection room. If, however, the projection throw for television is comparatively short, it may be necessary to project television pictures from a point in the front of the orchestra and at stage level to a tilted screen as far back on the stage as convenient. This plan has the advantage of keeping the distance between the first row of the audience and the screen at an acceptable minimum which will avoid difficulty due to visibility of the line structure of the picture or other deficiencies. If the screen is well forward on the stage (e.g., with rear projection on a translucent screen from the back of the stage), it may be expedient not to use a number of the front rows of the orchestra for the previously-mentioned reason.

Television projection equipment on the stage might even be remotely controlled from the film projection room, although it is unlikely that this can satisfactorily be done using arc illuminants. In theatres showing mixed film and television programs, it is likely, for the present at least, that separate projectionists will be required for each class of work. It is conceivable, however, that ultimately even the film projection equipment will be moved from its present location to one more suitable for *both* film and television projection. Thus television may basically influence future theater design.

The screen construction for theatre television will certainly require most careful engineering. Television screen illumination is difficult and costly to produce, and the exhibitor cannot afford to lose more than an unavoidable minimum of such illumination. Accordingly the television screen should be carefully adjusted in its polar reflection (or transmission) characteristic to the thea-

(*Continued on page* 46)

TELEVISION RECEIVING ANTENNAS

and transmission lines

By ALFRED W. BARBER

Consulting Engineer

THE antenna in a television receiving system is called upon to perform its evident function of intercepting a television signal coming over a preferred path from the transmitter. It must also pick up as little noise as possible and discriminate against television signals arriving by other paths than the one desired. The transmission line from the antenna to the receiver is called upon to transfer the signal with as little attenuation as possible without introducing image-distorting reflections. The transmission line, together with its receiver-end termination is also used to load the antenna to kill or greatly reduce its selective characteristics.

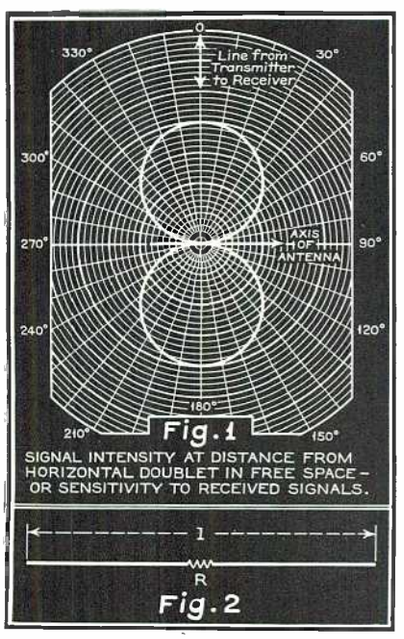
The present intention is to point out design considerations and some methods of measurement which are thought to be novel. The references given may be consulted for additional information.

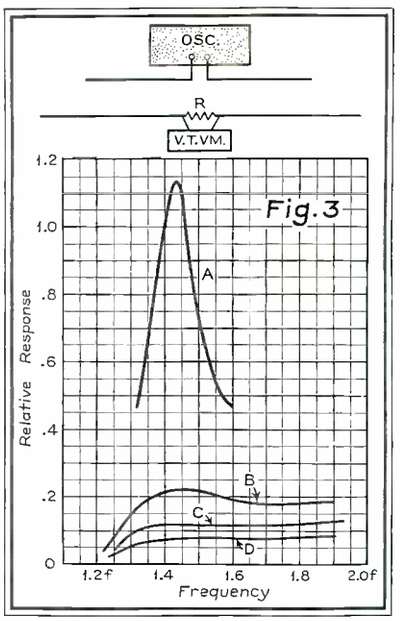
THE ANTENNA

Horizontally-polarized transmission will be considered here since there seems to be general agreement on its desirability for television. While elaborate antenna and antenna driving systems are being used to provide non-directional transmission, a simple dipole receiving antenna at low angles has the directional characteristic shown in Fig. 1. As long as transmitting stations are confined to a small area, as for instance

Fig. 1. Directional characteristic of dipole antenna.

Fig. 2. A dipole antenna.





Showing the selectivity characteristic of a dipole antenna system.

at the Empire State and Chrysler buildings in New York, those receivers located at a distance may benefit from this directional characteristic by directing the antenna broad-side in the direction of these stations. It may be anticipated, however, that cases will arise in which two transmitters will be located in mutually perpendicular directions from a given receiver, in which case optimum reception may not be enjoyed from both stations. Rotating the antenna 45 degrees will, of course, provide a compromise condition for reception from the two stations.

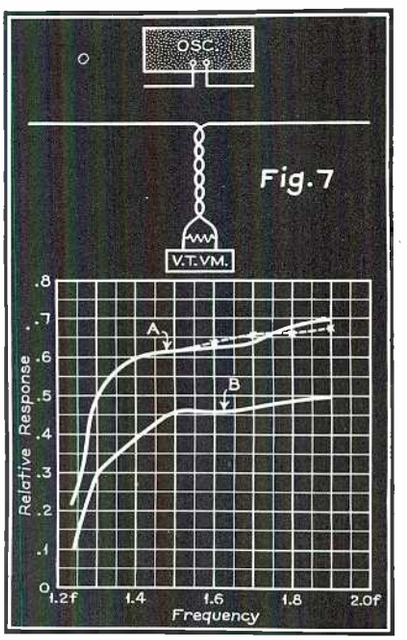
The best simple form of receiving antenna for horizontally-polarized waves is a dipole as shown in Fig. 2 with signals taken off at the center where loading is represented by resistance R. If the antenna length L is comparable with one-half wavelength of the carrier wave, its selectivity characteristics must be considered. Since for television frequencies this length L will be of the order of 10 feet, a practical pick-up will usually be concerned with the selectivity characteristics of the antenna.

In order to show the selectivity characteristics of a dipole antenna the system shown in Fig. 3 was set up. An oscillator feeding two short dipoles was set up and the driving current was kept constant as the frequency was varied. A dipole antenna resonating in the middle of the oscillator range was set up and the received voltage was measured across resistance R at the center of the antenna.

Curve A of Fig. 3 shows the response of the antenna loaded only by the vacuum-tube voltmeter which had an effective impedance of the order of 10,000 ohms. This curve shows a sharp maximum at the point where $L = \lambda/2$. Such a characteristic would be quite unsuited to television reception. The slope of the response is approximately 2 db per megacycle. If the measurements had been extended to higher frequencies, a series of peaks would have been found at frequencies corresponding to $L = \frac{n\lambda}{2}$ where n is an odd number, 1, 3, 5, etc.

Curve B of Fig. 3 shows the effect on the amplitude and selectivity of the response due to the damping effect of resistance R = 500 ohms. The response rises rather rapidly somewhat below resonance and then goes into a broad peak at $f = \lambda/2$. The drop in response preceding the next peak provides an essentially flat region followed by a

Curves of antenna and transmission line response for different loads.



gradual rise. Single side-band operation with the carrier at the lower end of the band could take advantage of a rising characteristic in the high-modulation frequency range if operated with the carrier in the valley preceding the second peak.

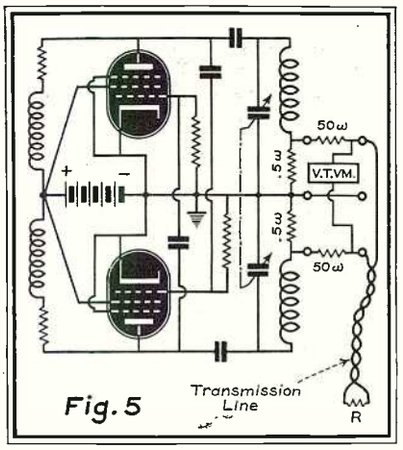
Curve C of Fig. 3 shows still further flattening due to making resistance R = 200 ohms while curve D shows the effect of making R = 100 ohms.

Since the characteristic impedance of a dipole antenna of length equal to $\lambda/2$ is between 72 and 100 ohms, operation with a 100-ohm load provided by a 100-ohm transmission line terminated with 100 ohms at the receiver has been recommended. As pointed out above and as may be seen from Curve B, a greater response plus a compensating effect may be obtained by using an antenna of the order of 50 percent greater length feeding an impedance of 300 to 500 ohms. The transmission line and its terminating impedance must both be raised to the same value in order to prevent reflections from the receiver end of the line and consequent image distortion due to multiple images.

THE TRANSMISSION LINE

Since an improperly terminated transmission line will have a frequency selective characteristic and may reflect enough signal to cause multiple images in a television picture, its surge impedance must be known. The surge impedance Z_o of a transmission line is given by the equation $Z_o = \sqrt{Z_1 Z_2}$ where Z_1 is the impedance looking into the line with the far end open and Z_2 is the impedance with the far end shorted.

Fig. 4 shows curves of the input impedances of three different lines with the far ends open and shorted. As the frequency is varied the lines show successive peaks of maximum and minimum impedance with the points of maximum impedance for the shorted condition substantially opposite the points of minimum impedance for the open condition. The cross-over points of the two curves represents the true characteristic impedance of the line.



Circuit of apparatus used for making impedance measurements.

Fig. 5 shows a diagram of the apparatus used to make impedance measurements of the transmission lines. It comprises a pair of tubes in a symmetrical push-pull oscillator circuit tuned by a two-gang variable condenser. Voltage for measurement purposes is taken off across two 0.5-ohm resistors connected in series with the tank circuits. Coupling to the line to be measured is made through two 50-ohm resistors and a vacuum-tube voltmeter is connected across the input to the line. The vacuum-tube voltmeter readings were transformed to impedance by replacing the transmission line with various known resistances as shown in the curve of Fig. 4. Attenuation in the various lines was measured by measuring the input and output voltages of the lines when terminated by resistors R equal to their surge impedances.

Photo of apparatus shown in Fig. 5.

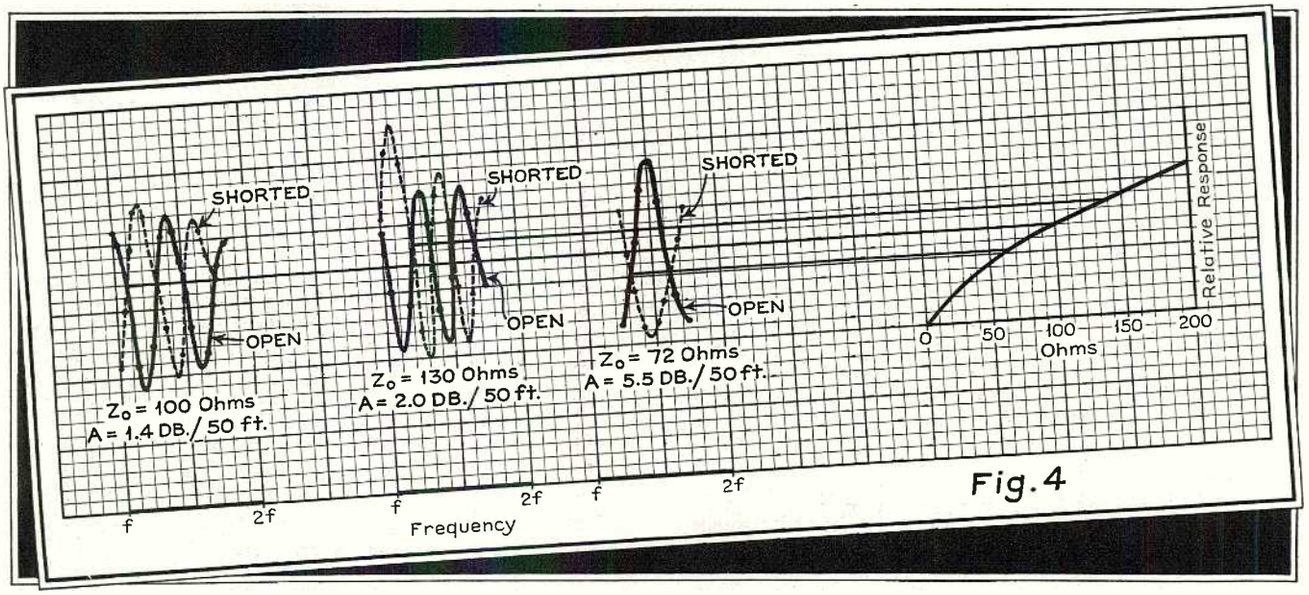
Fig. 6 shows a picture of the apparatus of Fig. 5 with a transmission line connected for measurement. The method and apparatus are simple and rapid measurements may be made with an accuracy entirely satisfactory for practical purposes.

As shown in Fig. 4 the vacuum-tube voltmeter readings were plotted for three different transmission lines with the far ends open and shorted. The line of intersection between the curves for the open and shorted conditions were projected across to the impedance calibration curve showing that the lines had surge impedances of 72,100 and 130 ohms. With these resistors terminating the respective lines, losses were measured in 50-foot lengths of line and found to be 5.5 db, 1.4 db and 2.0 db respectively.

Transmission lines exposed to the weather may absorb moisture. The result is that the capacity between the

(*Continued on page* 48)

Curves of input impedance of three different lines.



1940 SOUND

By S. GORDON TAYLOR

THE time is definitely ripe for sound men to take stock of themselves and their markets. If preliminary reports on the volume of sound sales during 1939 are correct, the business is somewhat off from the peak year 1937, although ahead of 1938. Does this mean that the market is approaching saturation? That it will be necessary to scratch even harder for business than in the past? Before going into a dither of pessimism let's look at the facts.

At best, such reports and forecasts are of limited value to individual sound men. If local economic conditions result in a buying slump in one community, the dealer located there is going to get little satisfaction from the fact that the nation as a whole is on a buyer's spree. Of far greater importance to those who depend on sound sales and service for a livelihood are numerous other indicators found by keeping one's eyes and ears open. During the past year, for instance, scarcely a week passed without extensive reference in the newspapers

- Orchestras
- World's Fair
- Home Recording
- Replacements
- Legislative Halls
- Electronic Equipment
- Window Displays
- Intercommunications
- Schools and Churches
- Stadiums and Auditoriums
- National Election
- South America

to new applications of sound systems among musicians and orchestras.

Both the Cracraft and Buddy Wagner orchestras received column after column of publicity, introducing the novelty of completely electrified orchestras in which each instrument had its own amplifier system and speaker but with the volume, individually and as a group, controlled from a multiple panel on the leader's table. Here was beautiful propaganda, setting the stage in readiness for the sound man to step in, aiming at sales not of single sound systems but of perhaps a half dozen or more individual systems to a single orchestra.

Rubinoff, playing his famous Stradivarius under an umbrella rather than disappoint a rain-soaked crowd of 5,000 people at an outdoor concert, likewise provided grist for the press, whose incidental mention that he employed a contact mike and amplifier overnight made thousands of instrumentalists sound-system conscious.

When a famous director of a symphony orchestra went into temporary seclusion with the expressed intention of emerging with a fully electrified orches-

Fig. 1. The Cracraft Electronic Orchestra is credited with being the first in which every instrument is electrified. Inset shows a close-up of the director's control panel by means of which he can regulate volume of individual instruments, certain groups or of the orchestra as a whole.

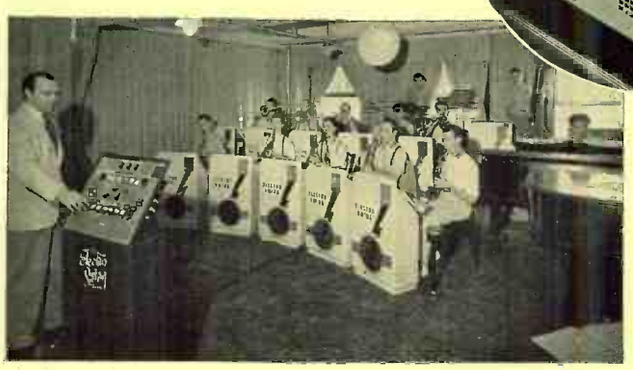


Fig. 2. Buddy Wagner's Electro Swing Band introduced the novelty of electronic wind instruments, utilizing magnetic pickups attached to the individual standard instruments.

Fig. 3. The Wurlitzer String Symphony employs a wide variety of string instruments, each with the pick-up built in and working into its own amplifier and speaker.

Fig. 4. The sale and servicing of electronic pianos such as this Krakauer Electone opens up a new field for sound men which is destined to become a highly promising one.

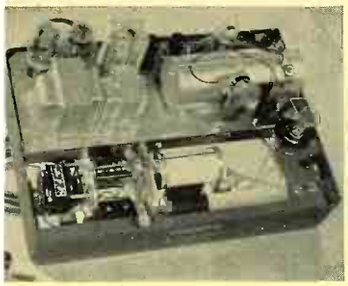


Fig. 10. Manufacturers of commercial and industrial electronic devices, such as this unit, for instantly checking the accuracy of watches, encourage sound men to function as local service representatives.

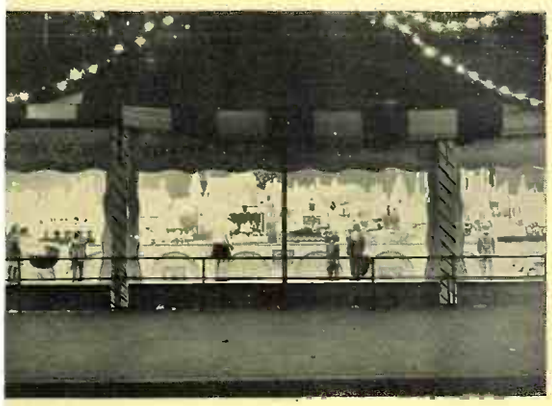
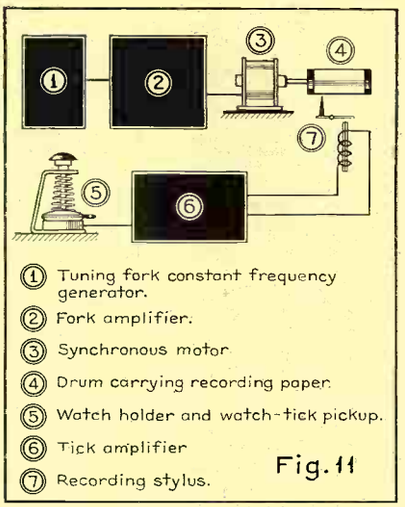


Fig. 13. Sight and sound window displays such as this Lafayette installation in Macy's department store in New York offer a medium through which sound men can cooperate with advertising men with mutual benefit.

Fig. 16. An unusual intercommunication installation by Morlen Electric Co. in the Metropolitan Life Insurance Co.'s main offices links five executives' desk sets with 10 talk-back speakers in the supply department, the latter so sensitive to pick-up that supply clerks can talk back from any point without interrupting their work.



1. Tuning fork constant frequency generator.
2. Fork amplifier.
3. Synchronous motor
4. Drum carrying recording paper
5. Watch holder and watch-tick pickup.
6. Tick amplifier
7. Recording stylus.

Fig. 11

tra, that was *page one* news, creating still further interest among orchestra and band leaders.

Such publicity not only points the way to expanding markets for the sound man, but provides invaluable propaganda to aid him in developing and interesting prospects.

But all the possibilities do not lie along musical lines. There are constantly developing new applications of amplifier equipment for non-sound purposes. Many industrial and commercial applications are being found for systems that differ from standard sound installations only in that input and output devices are other than the conventional microphone and speaker. Standard amplifiers with contact pickups or photocell inputs are serving innumerable purposes and the future market for this equipment is limited only by the imaginations of sound men themselves—and by their willingness to spend the time to ferret out the needs of potential prospects.

Then, finally, there is the replacement market. The public address and sound games have been active now for well over a decade and much of the equipment installed in the earlier years is definitely outmoded if not actually inoperative. A check up on old business will sometimes provide surprising results in the form of new sales.

To keep posted on all of these possibilities is the business of every progressive sound man. The information he gleans in this way is of infinitely greater value to him than whole flocks of statistical data on the dollar value of last year's p-a equipment production, or someone's guess as to the volume for the coming year.

The following brief descriptions and illustrations are presented to indicate trends; ideas from here and there which it is believed will prove suggestive to all sound men.

Fig. 21. Prospects appreciate the compactness, wide utility and simple control of modern school systems. This neat Clarion equipment provides general sound distribution from radio, voice or records, plus 2-way intercommunication facilities.

electronic music

Nowhere are the opportunities more striking than in the musical field. The introduction of completely electrified orchestras such as those of Cracraft and Wagner referred to above indicates one highly important line of development. From the standpoint of the sound man such an arrangement involves not alone the sale of several complete sound systems to a single orchestra but perhaps commissions on special electrified musical instruments as well. He may also supply the special music stands to accommodate the amplifier equipment, the remote multicontrol panel for the leader, and so on.

The amplifier and speaker equipment utilized in this service is standard in

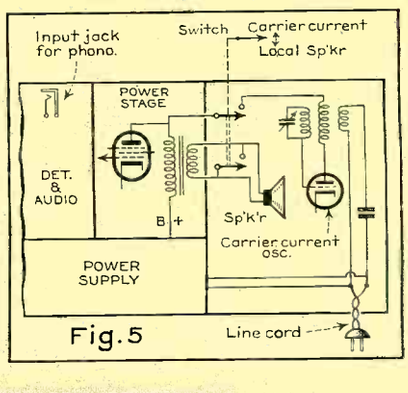


Fig. 5

Fig. 8. A complete sound system including a microphone on the desk of each legislator increases comfort and expedites business in the North Dakota State Legislature.

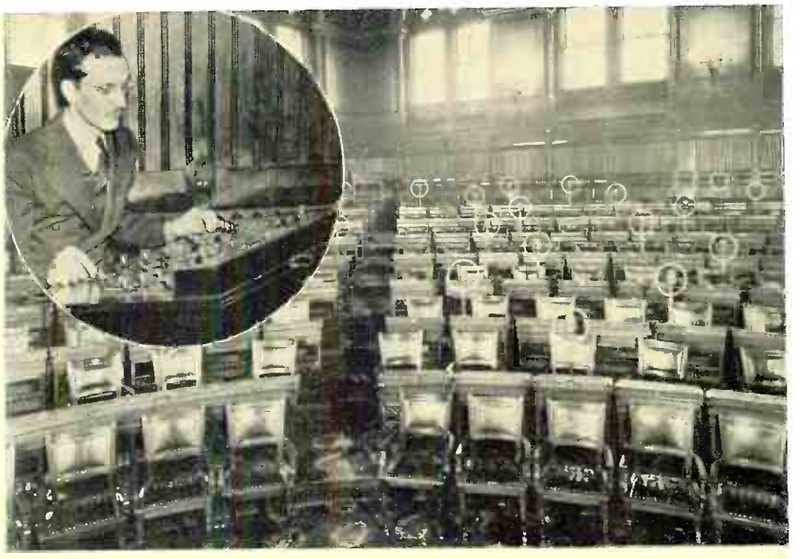


Fig. 9. (Right) The sound system in the Connecticut State Capitol successfully overcomes the former serious problem of dead spots and reverberation. Inset shows the control panel which brings individual microphones into action as required.

every respect. Buddy Wagner (Fig. 2) employs Lafayette Model 440TDF amplifiers throughout, for instance. These are 25-watt units and provide a maximum combined output of well over 200 watts for his orchestra.

In his case the pickups consist partly of Amperite Kontak mikes and partly of special magnetic units developed by his own technical expert for attachment to the reeds of wind instruments. Cracraft (Fig. 1) on the other hand employs instruments especially designed for this service. Novel among these is the set of electronic kettle drums which, in a small unit not more than a couple of feet square, provides the equivalent output and playing flexibility of eight great drums. The Wurlitzer String Symphony (Fig. 3) likewise employs instruments designed for the purpose. These are the Epiphone "Electars"—a complete variety of plucked-string instruments with pickups built in during construction.

Electronic pianos offer increasing service possibilities for sound men—and perhaps more important, sales opportunities. Inquiry shows that piano manufacturers are glad to cooperate with sound men in the matter of discounts in territories where they do not have established dealers, and in dealer territories the dealers are entirely willing to allow satisfactory discounts. The unit value of each sale is large here and these discounts can mount into important figures. To date the largest sale for these pianos is among orchestras, theatres, amusement spots, etc. With rapid development work now going on, aimed at size and price reduction, they are certain to become popular in the home, opening an entirely new and lucrative service field for qualified men. Electronic organs likewise may become an important factor both from the sales and service angles.

A novel stunt which means added service or installation revenue is that shown in Figs. 5 and 6. It is a simple means for adapting a piano, organ or other amplifier system for the reproduction of a remote radio tuner or record player. The system is shown with the Krakauer "Electrone" piano. In this case the RCA "Little Nipper" Model 5X5 (shown atop the piano in Fig. 4)

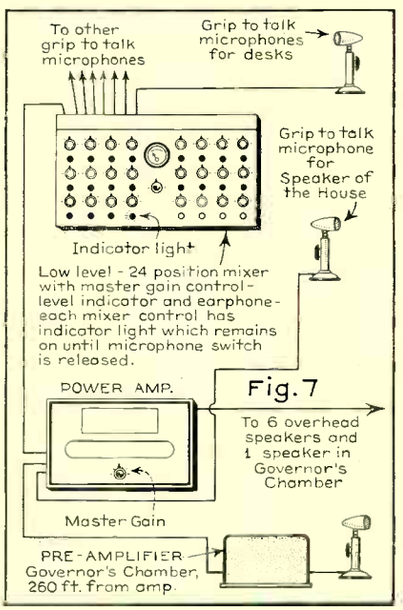


Fig. 12. (Below) Technically very similar to an ordinary sound system is this portable device which accurately locates underground leaks in water mains. Another item which logically lends itself to merchandising and servicing by sound men.

Fig. 14. This relatively simple window display, with sound effects from chime records reproduced through speakers above the sidewalk attracted wide attention at Lord & Taylor's department store during Christmas week.

Fig. 17. Signal lights, annunciator drops, elimination of manual push-to-talk switch operation, and privacy through use of a hand-set when desired, mark the latest intercom equipment.

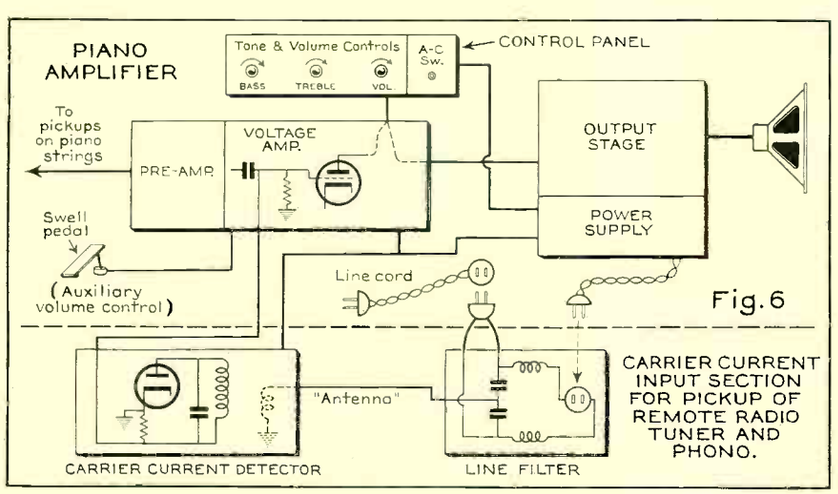


Fig. 15. A 10-day "Buy at Home" campaign by the Plainfield, N. J., Chamber of Commerce provided a nice rental job for the owner of the Clarion equipment, shown below.

Fig. 19. St. Andrews Church, Calumet City, Ill., is fully sound equipped with two 60-watt Thordarson amplifiers. These drive directional speakers behind the cross-shaped grill in the ceiling from four Shure uni-directional microphones at the pulpit and altar, and reproduce recorded chimes through heavy-duty speakers in the belfry.

is employed as the remote tuner and its built-in phono jack provides for record pickup. This is a complete superhet receiver but also includes an r-f oscillator and switching arrangement (Fig. 5) such that the output of the radio (or phono) can be employed to modulate the oscillator output. This modulated carrier is then fed into the power line through the line cord and can be picked up from any other point on the line by means of a simple detector circuit tuned to the same frequency. To adapt any amplifier for such use it is only necessary to build in this detector circuit and a line filter. These circuits are shown at the bottom of Fig. 6 as they are in the "Electrone" piano. No changes are required in the "Little Nipper." It might be added that such a scheme provides the answer to the problem of radio and phono inputs to p-a systems where the amplifier is located at some distance and interconnecting wires are either undesirable or expensive to install.

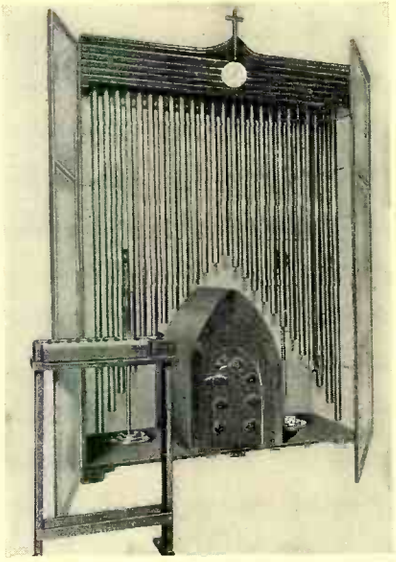


Fig. 18. (a) (Above) This Amplified Carillon marketed by Sundt Engineering Co., provides outputs suitable for indoor and outdoor reproduction, the latter with a range of several miles if desired. (b) (Below) The Singing Towers automatic equipment of the AMI Distributing Co. includes not only chimes but a vibro-harp (right) and record player (left) and provides the utmost in variety and automatic operation.

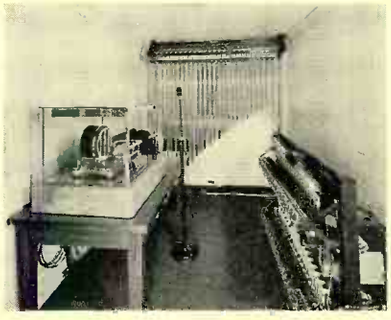


Fig. 20. The interior design of St. Peter and Paul's Cathedral, San Francisco, Calif., presented a difficult acoustic problem which was overcome by a carefully planned RCA sound system. Speakers are mounted in appropriate housings on the pillars.

legislative halls

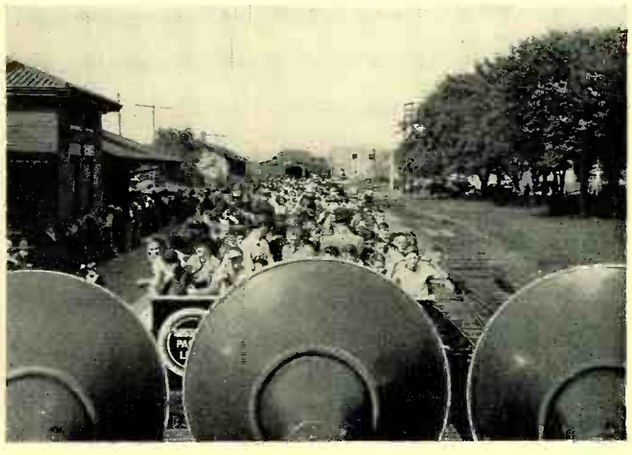
State legislatures and city councils can use p-a installations to excellent advantage. Not only are their meeting halls usually of large size, making it difficult for an individual speaker to be heard comfortably, but are often of outmoded design with acoustic conditions badly in need of correction.

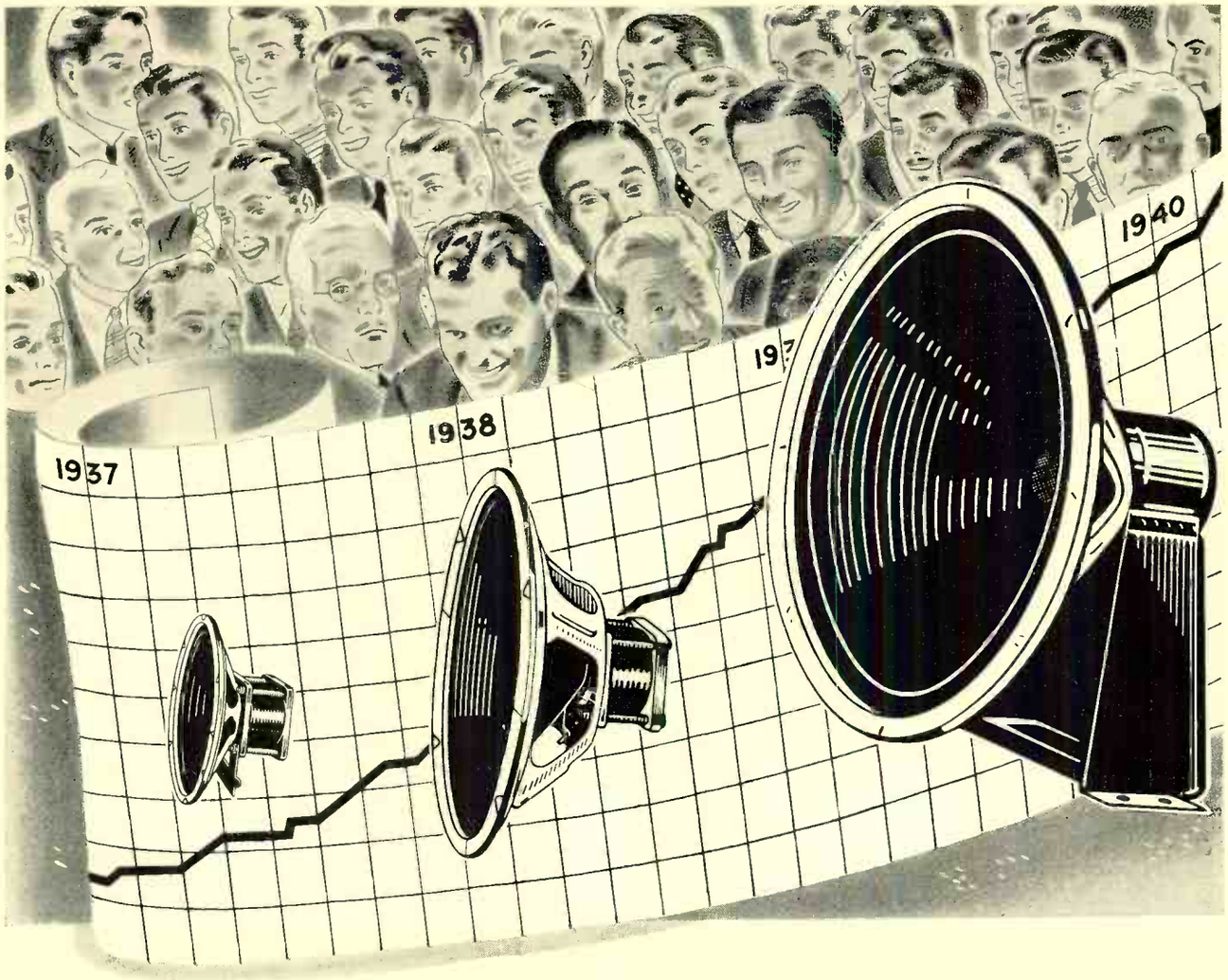
This field is made particularly promising by the fact that the equipment re-

(*Continued on page 23*)

Fig. 23. Sound distribution on a moving train was one man's sound problem with only 24 hours' notice. The solution is shown in the two pictures below.

Fig. 22. Uni-directional microphones aid materially in overcoming feedback tendencies inherent in many school auditoriums. They solved the problem for the Radio Equipment Co., Dallas, Texas, in making this installation in the Woodrow Wilson High School. Shure Uniplex mikes were used.





Preference FOR UTAH SPEAKERS CONTINUES TO RISE RAPIDLY

The *balanced line* of Utah Speakers has won a continually increasing preference from every branch of the radio and sound equipment industries. It is a preference earned by time-proven dependability, uniformity and consistent high quality.

Last year 1,676,622 Utah Speakers were selected to meet the specific requirements of engineers and service men in every part of the country. Ruggedness and adequate power handling capacity are built-in characteristics of service-free Utah Speakers.

Utah engineering keeps abreast of the developments and improvements in both industries. Outstanding tone quality is obtained by the careful selection of high quality materials and the precision manufacturing and treatment of each individual part—a special plasticizing process insures voice coils against mechanical failure or heavy overloads—cones are treated to give minimum absorption—heavier gauge metal assures ample overall rigidity—they are completely dustproof throughout—these and many other features assure "audience approval."

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SPEAKERS

VIBRATORS • TRANSFORMERS • UTAH-CARTER PARTS

MICROPHONE CHARACTERISTICS

(COMPILED FROM DATA SUPPLIED BY MANUFACTURERS†)

CRYSTAL MICROPHONES

MANUFACTURER	MODEL	IMPEDANCE (Ohms)	(1) OUTPUT	FREQ. RANGE (c.p.s.)	db. VARIATION OVER RANGE	(4) DIRECTIVITY	FINISH	NET W'G'T (Lbs)	DIMENSIONS (Inches)
AMERICAN MICROPHONE COMPANY, Inc., Ltd.	C6	High	-44	30 to 9000	±5	SD	Polished chrome	8 oz.	2 3/8" Dia. 3" High
ASTATIC MICROPHONE LABORATORY Inc.	CI44 (8)	5 Meg.	•	•	•	—	Chrome & Black	3 oz.	2 1/8" X 11/16"
	D2	"	-61	30 to 10,000	•	ND	Chrome	1 1/8	2 17/32" X 3 7/8" X 1"
	D104	"	-48	30 to 7500	•	SD	"	1	3 13/32" X 4 1/16" X 1 1/16"
	JT series	"	-52	30 to 6000	•	"	Gray or Chrome	3/4	2 5/16" X 3" X 3 1/16"
	K2	"	-60	30 to 10,000	•	ND	Chrome	1 1/4	1 19/32" X 2 1/8" X 3 5/16"
BRUSH DEVELOPMENT CO.	AP (6)	228,000 (7) 50, 200 or 500 ohms	-48	100 to 5000	•	SD	Satin Chrome	2 Lb. 4 oz.	3 19/32" X 3 5/32"
	AR26 (5)	79,000 (7)	-66	30 to 10,000	±3	ND	"	11 oz.	3" dia.
	AR43 (5)	320,000 (7)	-60	30 to 10,000	"	"	"	9 oz.	"
	BL1 (5)	160,000 (7)	-72	30 to 7000	±2	SD	Black Rubber	11 oz.	1 1/4" X 1 1/4" X 3/8"
	BR2S (5)	320,000 (7)	-66	30 to 8000	±3	ND	Satin Chrome	7 oz.	2 1/8" dia.
	HL (6)	228,000 (7)	-48	100 to 5000	±5	SD	"	1 Lb. 6 oz.	2 7/8" X 8 3/4"
SHURE * BROTHERS	7A	5 Meg.	-52	30 to 10,000	±5	SD	Satin Chrome	3/4	2 3/8" X 2 7/8"
	7S	over 0.5 Meg.	-50	SPECIAL (c) RISING CHARACT.	—	"	Irid. Gray	3/4	"
	70H	5 Meg.	-44	30 to 10,000	±7½	"	Satin Chrome	1	2 3/4" X 1 1/4"
	70ST	over 0.5 Meg.	"	SPECIAL (c) RISING CHARACT.	—	"	"	"	"
	76B (10)	5 Meg.	-50	SPECIAL CHARACT.	—	"	Irid Gray	1 1/2 oz.	1 7/8" X 3/4"
	700D	"	-52	30 to 10,000	±5	"	Satin Chrome	7/8	2 3/8" X 3 1/2"
SUNDT ENGINEERING CO.	211	100,000	-52	60 to 6000	±5	UD	Black	10 oz.	•
TIBBETTS LABORATORIES	B	over 1 Meg.	-42	30 to 8000	±4	SD	Black crinkle enamel & Polished chrome	2 1/2	11" X 5" X 3"
	BC63	"	-44	"	±3	"	"	1 1/8	2 1/2" X 3 3/4" X 3 3/8"
TURNER CO.	L40	High	-50	•	±2	ND	Black enamel	•	•
	R55	"	-54	40 to 7000	±5	SD	Chrome & Black	•	•
	224	"	-52	30 to 7000	±4	"	Satin Chrome	•	•
UNIVERSAL MICROPHONE CO., Inc.	309 Series	•	-58	50 to 5000	•	•	Chrome	11 oz.	2 1/4" X 2 3/8"

MANUFACTURER	MODEL	IMPEDANCE (Ohms)	(1) OUTPUT	FREQ. RANGE (c.p.s.)	db VARIATION OVER RANGE	(4) DIRECTIVITY	FINISH	NET W'G'T (Lbs)	DIMENSIONS (Inches)
BUSH DEVELOPMENT CO.	LI (10)	5 Meg.	-62	30 to 10,000	•	ND	Telephone Black	3/8	1 1/2 X 3/4"
	MU2/MU4	"	-56	"	±3	"	Chrome & Black	1 5/8	3 3/4" X 2 1/16" X 2 5/8"
	T3/T4	3 to 5 Meg.	-52	30 to 10,000	±5	SD	Chrome	1 Lb. 5 oz.	2 5/16" X 5 7/8" X 3 1/16"
	VP (8)	5 Meg.	•	•	•	—	"	9 oz.	2" X 1 1/16"
	218	"	-46	30 to 5500	•	SD	Telephone Black	7 oz.	2 1/8" X 7 1/8"
SHURE * BROTHERS	QO (6)	795,000 (7)	-54	30 to 9000	±5	SD	Satin Chrome	1 Lb. 6 oz.	2 1/2" X 3 3/8"
	QOM (6)	795,000 (7)	"	"	"	"	Black Plastic	1 Lb. 7 oz.	2 11/16" X 2 7/8"
	R22 (5)	530,000 (7)	-70	30 to 10,000	±2	ND	Satin Chrome	7 oz.	2 1/8" dia.
	R34 (5)	450,000 (7)	-67	"	±2	"	"	11 oz.	3" dia.
	US (6)	1,060,000 (7)	-44	100 to 5000	±5	SD	Gray Plastic	10 oz.	2 11/16" X 2 7/8"
	VM1 (8)	1,200,000 (7)	•	50 to 6000	•	•	Black Rubber	6 oz.	1 7/8" X 3/4" X 5/16"
	701D	5 Meg.	-52	30 to 10,000	±5	SD	Satin Chrome	1 3/16	3 1/2" X 2 1/4" X 1 3/4"
	702D	"	"	"	"	SD-ND	"	3/4	2 1/4" dia.
	705D	"	"	"	"	SD	"	1 1/4	2 3/8" X 3 7/16"
	720B	"	-74 (d) -69 -74	30-10,000 40- " 40- "	±5 ±7.5 ±7.5	ND	"	2	2 3/4" X 7 5/8"
	730A	"	-62 (d)	30 to 10,000	±7½	Cardioid (e) Uni-dir.	"	1	3 3/32" X 3 3/8"
	750A	"	-50	"	"	— (f)	Irid Gray	3/4	3 3/4" X 2 3/4" X 1 3/4"
TIBBETTS LABORATORIES	BH50	over 1 Meg.	-42	30 to 8000	±4	SD	Black crinkle enamel & Polished chrome	12 oz.	2 1/2" X 3" X 3 3/8"
	XTL99 (9)	10 Meg.	-36	20 to 8000	±5	"	No outside finish case	•	1 5/8" X 5/8"
TURNER CO.	31	High	•	•	•	SD	Chrome Blk or Red	•	•
	33X	"	-52	30 to 10,000	±3	"	Satin Chrome	•	•
	44X	"	-58	"	"	"	"	•	•

DYNAMIC MICROPHONES

MANUFACTURER	MODEL	IMPEDANCE (Ohms)	(1) OUTPUT	FREQ. RANGE (c.p.s.)	db. VARIATION OVER RANGE	(4) DIRECTIVITY	FINISH	NET W'G'T (Lbs)	DIMENSIONS (Inches)
AMERICAN MICROPHONE COMPANY Inc., Ltd.	D5	50	-54	40 to 8500	±3	SD	Polished Chrome	1 1/2	3 3/4" X 2 1/2"
	D5T	200, 500 or High	"	"	"	"	"	"	"
	D7	50	-56	50 to 8000	±4	"	"	8 1/2 oz.	2 1/2" X 1 1/2"
	D7T	200, 500 or High	"	"	"	"	"	"	
	D6	50	-46	55 to 8000	±2½	"	"	1 1/2	3 3/4" X 2 1/2"
ASTATIC MICROPHONE LABORATORY Inc.	DN Series	50, 200, 500 or 50,000	-55	50 to 7000	±5	SD	Opalescent Gray & Chrome	1 7/8	2 1/8" X 3 1/4"
CARRIER MICROPHONE COMPANY	105D	30, 200, 500 or High	-65	40 to 8000	±5 Approx.	ND	Satin Nickel, Full Nickel	3 1/2	4" X 3 3/4"
RCA MFG. CO. Inc.	88A MI4048	50, 250	(3) -54	60 to 10,000	±3 Approx.	•	Chromium and Black	1	4 1/2" X 2 1/8" X 4"
SHURE * BROTHERS	5E	35-50	-91	70 to 7000	±5	SD (a)	Satin Chrome	3/4	2 3/8" X 2 7/8"
	5F	200-250	-82	"	"	" "	"	"	"
	5G	over 100,000	-63	"	"	" "	"	"	"
	5S	"	-62	SPECIAL RISING CHARACT.	—	" "	Irid. Gray	"	"
	50A	35-50	-91	70 to 7000	±5	" "	Satin Chrome	1 1/4	2 3/8" X 3 7/16"
	50B	200-250	-82	"	"	" "	"	"	"

MANUFACTURER	MODEL	IMPEDANCE (Ohms)	(1) OUTPUT	FREQ. RANGE (c.p.s.)	db VARIATION OVER RANGE	(4) DIRECTIVITY	FINISH	NET W'G'T (Lbs)	DIMENSIONS (Inches)
	D6T	200,500 or High	-46	55 to 8000	±2½	SD	Polished Chrome	1 1/2	3 3/4" X 2 1/2"
	D8	50	-55	40 to 9000	±5	"	Platinum Chrome	13 oz.	3 1/4" X 2
	D8T	200,500 or High	"	"	"	"	"	"	"
	D9	50	-54	50 to 8000	±3	UD	Satin Chrome	2 1/2	7" X 2 1/4" X 2 1/2"
	D9T	200,500 or High	"	"	"	"	"	"	"
	DS Series	50, 200, 500 or 50,000	-55	50 to 7000	±5	SD	Opalescent Gray & Chrome	1 7/8	2 1/8" X 3 1/4"
	702D	30, 200, 500 or High	-60	30 to 10,000	±2½	ND	Dark Statuary	4 1/2	7 1/4" X 5"
	MI4015	250	(3) -51	200 to 2500	•	•	Chromium and Black	1 1/2	•
	MI6226A	250, 40,000	(3) -66	100 to 6000	•	•	Chromium	1 1/4	2 5/8" X 3 3/8"
	50C	over 100,000	-63	70 to 7000	±5	SD (a)	Satin Chrome	1 1/4	2 3/8" X 3 7/16"
	55A	35-50	-83	60 to 7000	±3	Cardioid UD (b)	"	2 1/2	4 1/2" X 3 1/4" X 3 1/2"
	55B	200-250	-74	"	"	"	"	"	"
	55C	over 100,000	-55	40 to 8000	±5	"	"	"	"
	555A	35-50	-83	40 to 10,000	±7½	"	"	2 3/4	"
	555B	200-250	-74	"	"	"	"	"	"

For additional information, such as price, accessories included, etc. write to the individual manufacturers.

† * ALL FOOTNOTES ON NEXT PAGE.

(Continued on Next Page)

1940 SOUND

(*Continued from page 20*)

quired is usually extensive, involving an individual microphone for each legislator, a central control system whereby individual mikes are cut in as members are recognized by the Chairman, several speakers for proper sound distribution and oftentimes special output circuit arrangements to permit proceedings to be relayed to local stations for the broadcast of special proceedings.

A general circuit arrangement suitable for such installations is shown in Fig. 7. This is the circuit employed in the Webster (Chicago) installation made by the Technical Radio Supply Co. of Mandan, N. D., in the North Dakota

Fig. 24. 5000 sight-seers visit the Schultz Brewery weekly. A sound system and recorded talk provide the description, as the guided tours move along, easily over-riding the noise of the machinery.

State Capitol as shown in Fig. 8. In this installation over a hundred microphones are employed. Fig. 9 shows a Western Electric installation in the Connecticut State Capitol and the central control panel with its operator. Here the circuit layout is similar to that of Fig. 7 but bad reverberation characteristics of the hall made it necessary to group the speakers and train them directly on the legislators. To avoid feedback under these conditions advantage had to be taken of the sharply directional characteristics of the W. E. 639A cardioid microphones.

non-sound applications

Indicative of opportunities for servicing commercial electronic equipment is an invitation recently extended by American Time Products, Inc., to radio and sound service men to apply for appointments as official service agents for the "Watch Master," a device widely used by high-grade jewelers for checking the

(*Continued on page 27*)

- DYNAMIC MICROPHONES - (Continued)

MANUFACTURER	MODEL	IMPEDANCE (Ohms)	(1) OUTPUT	FREQ. RANGE (c.p.s.)	db VARIATION OVER RANGE	(4) DIRECTIVITY	FINISH	NET W'G'T (Lbs)	DIMENSIONS (Inches)	MODEL	IMPEDANCE (Ohms)	(1) OUTPUT	FREQ. RANGE (c.p.s.)	db VARIATION OVER RANGE	(4) DIRECTIVITY	FINISH	NET W'G'T (Lbs)	DIMENSIONS (Inches)
SOUTH BEND MICROPHONE COMPANY	D3	50, 200, 10,000	−53	40 to 10,000	±5	SD	Chrome	1½	2½" dia.									
TRANSDUCER LABORATORIES	TR56	50, 200, 50,000 or 500,000	−42	100 to 6000	±8	SD	Black Bakelite	1 Lb. 10 oz.	5"X3"									
TURNER CO.	U9	30-50, 200 500 or High	−52	40 to 9000	±3	SD	Battleship Gray	2½	3⅛"X3½"	88	30-50, 200 500 or High	−54	40 to 9000	±3	SD	Deep Chrome	•	•
	22D	"	−54	40 to 8000	±4	"	Satin Chrome	•	•	99	"	−52	"	"	"	Gunmetal	•	•
	33D	"	"	40 to 8500	±3	"	"	•	•									
UNIVERSAL MICROPHONE Co., Inc.	300 Series	33, 200, 500, High	−58	50 to 8000	•	•	Chrome	11	2¼"X2⅜"									
WESTERN ELECTRIC CO.	630A	20	−89	40 to 10,000	+4 (11)	ND	Black	1	2½" dia.	639A	35	−84	40 to 10,000	−4 (11)	Cardioid	Aluminum Gray	3¼	3 7/16"X4 7/16" X 7½"
	633A	"	"	"	+3 (11)	"	Aluminum Gray	⅝	2" dia. X 3½"	639B	"	"	"	" (11)	Hyper-Cardioid	"	"	"

VELOCITY MICROPHONES

MANUFACTURER	MODEL	IMPEDANCE (Ohms)	(1) OUTPUT	FREQ. RANGE (c.p.s.)	db VARIATION OVER RANGE	(4) DIRECTIVITY	FINISH	NET W'G'T (Lbs)	DIMENSIONS (Inches)	MODEL	IMPEDANCE (Ohms)	(1) OUTPUT	FREQ. RANGE (c.p.s.)	db VARIATION OVER RANGE	(4) DIRECTIVITY	FINISH	NET W'G'T (Lbs)	DIMENSIONS (Inches)
AMPERITE COMPANY	ACH ACL	2000 200	−70	60 to 7500	±2 Approx.	BD	Gunmetal or Chrome	¾	1½"X2⅜" X1⅜"	RBHk RBMk	2000 200	−65	40 to 11,000	±2 Approx.	BD	Gunmetal or Chrome	3	3"X3½" X8"
	KKH (8) SKH (8)	2000 2000	−40	60 to 6000	•	•	"	•	•	RBHn RBMn	2000 200	"	"	"	"	"	"	"
	KTH (8) KF (8)	2000 200	"	40 to 9000	•	•	"	•	•	RSHk RBSk	2000 200	−68	60 to 8000	"	"	"	"	"
	RAH RAL	2000 200	−68	60 to 7500	±2 Approx.	BD	"	2	3"X2½" X8"	SR80Hn SR80n	2000 200	−56	40 to 15,000	"	"	"	5	3½"X3" X9"
	RBBHn RBBn	2000 200	−65	40 to 11,000	"	"	"	3	"	7JH 7J	2000 200	−70	60 to 7500	"	"	"	½	2½"X1½" X2½"
BRUNO LABORATORIES Inc.	H (2)	High	−55	70 to 9000	±5	BD	Silver Crystalline	5 oz.	4¼"X1" X2¼"	PR	High, 500, 200 or 50	−61	30 to 14,000	±1	BD	Telephone Black	5	9"X4⅝" X3¾"
	MB (2)	"	−50	"	"	"	Gunmetal or Chrome	2	8"X2¾" X3"	OR	High or 200	−65	50 to 12,000	±2	"	Gunmetal or Chrome	3	3¾"X7" X2"
	MP (2)	"	−55	"	"	"	"	4 oz.	2⅞"X2¾" X½"	VR	High, 500 or 200	−67	"	±3	"	"	"	7¼"X3⅛" X2 7/16
	MS (2) MS-S	"	−45	"	"	"	Silver Crystalline	2	7"X3⅛" X2"	WM	High	−65	"	±2	"	"	3¾	7¼"X3⅛" X2¼"
CARRIER MICROPHONE COMPANY	300V	200, 500	−70	30 to 10,000	±3	BD	Dark Statuary	7	9¾"X4"									
ELECTRO-VOICE MFG. CO., Inc	L15	High, 500 200, 50	−68	50 to 7500	±5	BD	Chrome	1¼	•	V2	High, 500 200, 50	−64	35 to 11,000	±3	BD	Gunmetal, Chrome Trim	2¾	•
	V1	"	−65	40 to 10,000	±4	"	Gunmetal, Chrome Trim	1¾	•	V3	"	"	30 to 12,000	±2	"	"	3	•
RCA MFG. CO Inc.	30A	250	−80 (3)	80 to 7000	•	BD	Black	•	•	77B	50, 250	−66	30 to 10,000	±5	UD	Chromium and Black	2	10"X3¾" X2½"
	44BX	50, 250	−61	30 to 15,000	±1	"	Chromium and Black	8½	12"X4¾" X3⅜"									
	74B	50, 250, 15,000	−63	70 to 8000	±4	"	"	2½	7¾"X4" X2½"	77C MI4042	50, 250	−68	30 to 10,000	±3	UD, BD, or ND	"	3	8½"X3⅜" X2¼"
SOUTH BEND MICROPHONE CO.	R, RV	50, 200, 10,000	−64	30 to 12,000	±3	BD	Chrome, Bronze, Black, Nickel	1½	2"X3" X7"									
UNIVERSAL MICROPHONE CO., Inc.	AV	33, 200, 500 or High	−56	30 to 12,000	±1 Approx.	BD	Satin Chrome	3	3⅞"X5½"	800 Series	33, 200, 500 or High	−60	40 to 10,000	±2 Approx.	BD	Chrome	1	1¼"X4½"
	M4	"	−58	40 to 10,000	±2 Approx.	"	Black & Chrome	2½	"									

For additional information, such as price, accessories included, etc. write to the individual manufacturers.

FOOTNOTES —

(1) FROM 1 VOLT/BAR.
(2) VELOTRON (ELECTROSTATIC VELOCITY).
(3) 10 DYNES/SQ.CM., 12½ MW. ZERO LEVEL.
(4) BD = BI-DIRECTIONAL, UD = UNI-DIRECTIONAL. SD = SEMI- " , ND = NON- "
(5) SOUND CELL
(6) DIAPHRAGM TYPE
(7) AT 100 C.P.S.
(8) CONTACT MICROPHONE.
(9) FOR HEARING AIDS, ETC.
(10) LAPEL-MICROPHONE.
(11) AT MOST EXTREME POINT FROM 1000 ~.

* (a) DIRECTIVITY CONSIDERED IN BOTH HORIZONTAL AND VERTICAL PLANES.
(b) FRONT TO REAR DISCRIMINATION, 12 TO 15 db. FOR WIDE RANGE.
(c) COMMUNICATIONS TYPE — R-F PROTECTED.
(d) AT END OF 25 FT. CABLE.
(e) FRONT TO REAR DISCRIMINATION, 20 db. FOR WIDE RANGE.
(f) HAND MIKE
• INFORMATION NOT SUPPLIED.

(COMPILED FROM DATA SUPPLIED BY MANUFACTURERS)

RECORDER CHARACTERISTICS

(COMPILED FROM DATA SUPPLIED BY MANUFACTURERS†)

MANUFACTURER	MODEL	TYPE	TURN-TABLE DIA. (Inches)	TURN-TABLE SPEED R.P.M.	SPEED CHANGE SYSTEM	TYPE OF MOTOR (1)	TURN-TABLE DRIVE SYSTEM	PITCH LINES PER INCH	CUTTER FEED SYSTEM	FEED DIRECTION (2)	CUTTER TYPE	CUTTER IMPED-ANCE (Ohms)	MICRO-SCOPE	PICKUP TYPE	AMPLIFIER							
															INTERNAL OR EXTERNAL	OVERALL GAIN db	ADDITION-AL INPUTS	INPUT LEVEL db	INPUT IMPED. (Ohms)	UNDISTORTED OUTPUT (Watts)	SPEAKER DIA. (Inches)	LEVEL INDICATOR
ALLIED RECORDING CO.	12	Portable	12	33⅓ and 78	Panel Control	Sync.	Rim	96-104 112-120	Overhead lead screw	I-O or O-I	Magnetic	500 or 15	Yes	Crystal or Mag.	Separate	110	Mike and Line	•	2-High 1-500	10	10	Meter
	16		17								Mag.-Ind.							•				
	A		17											Crystal	Int.	115		•	1-High 1-Int.			
BELL SOUND SYSTEMS, Inc.	RC1M	Portable	•	78	—	•	•	•	•	O-I	Crystal	158,000 @ 100 c.p.s.	No	Crystal	•	•	•	•	•	•	•	•
DAVID BOGEN CO., Inc.	16RC	Portable	17½	78-33⅓	See Note (10)	S.S. (11)	Rim	90-130	Overhead	I-O or O-I	Mag.	500	No	Magnetic	Int.	120	1 Phono.	−88	500,000	10	10	Meter
	16RP	"	"	"		"	"	"	"	"	"	"	"	"	Ext.	"	"	"	"	"	Not Supplied	"
	212RC	"	12	"	Rubber pulley reversed	S.S. Induction	"	"	"	"	"	"	"	"	Int.	"	"	"	"	"	10	"
	212RP	"	12¼	"	"	"	"	"	"	"	"	"	"	"	Ext.	"	"	"	"	"	Not Supplied	"
	JR112	"	12	78	—	S.S. Sync.	"	110	•	O-I	"	6	"	Crystal	Int.	114	—	"	"	5	6	"
BRUNO LABORATORIES Inc.	B12	Portable or Stationary	12½	33⅓ - 78	By inverting idler wheel	S.S. Split Capacitor	Rim	90- (4) 100-110 120-130	Overhead lathe type	I-O or O-I	Magnetic	6 or 500	No	Magnetic	with or with-out Amp.	117	2 Mikes 1 Phono	−112	High	10	10	Meter
	BR16		17½	"	Cam shifts either of two idlers	S.S. Sync.	"			"	Mag., Cry. (4) or Hi-Fidelity	"	No (4)	"		"			o	10	10	"
	RA12	Portable	12	78	—	S.S. Constant Speed	"	100	See (12)	O-I	Magnetic	6	No	Crystal	Int.	112	1 Mike 1 Phono.	−88	•	6	6	"
DUPLEX RECORDING DEVICES CO.	A16 (5)	Portable	17	33⅓ and 78	Turn Dial	S.S. Sync.	Gears	96, 108 (4) 112, 120	Permanently fixed overhead feedscrew	I-O (4) or O-I	Magnetic	5000	No (4)	Crystal	Ext.	•	•	•	o	•	•	•
ELECTRICAL INDUSTRIES MFG. CO.	812 Kit CA12	Portable	12⅝	78	—	S.S. Permanent split capacitor	Rim	100	Subpanel fan gear	I-O or O-I	Magnetic	10	No	Crystal	Int.	115	1 Radio	−50	5 Meg.	4½	8	Meter
	E12 (13) (14)	"	"	"	—			"	Subpanel lead screw	"	"	"	"	"	"	125	"	"	"	12	"	"
	L16 (13) (14)	"	17	33⅓-78	Manual cont. Knob			"		"	"	"	"	"	"	"	—	"	"	15	12	"
FAIRCHILD AVIATION CORP.	F26-3 F29-3	Portable	16	33⅓ and 78	Press down shaft	S.S. Sync.	Worm gear and adhesion	98, 118, 141, 161	Overhead feedscrew	I-O or O-I	Crystal	500	No (4)	Crystal	Ext.	105	Mike Pickup 500ω Line	−35 −60 −60	50, 125, 200* 250, 333, 500* & Bridging high imp.	2.5 Watts/500ω @ 5% distortion	10	Meter
FEDERAL RECORDER CO.	Little Pro 12	Portable	12	33⅓-78	Double size pulley	S.S. Induction	Pulley	100	Overhead	O-I	Magnetic	8	No	Crystal	Int.	•	2	•	•	15	8	Meter
	Symphonic 16	"	16	"	Two pulley		"	120	"	I-O or O-I	"	"	"	"	"	•	2	•	•	"	12	"
POINSETTIA, Inc.	—	Station-ary	17	33⅓ and 78	Lever	S.S.	Belt and Gears	88 to 150 (7 changes)	Feed screws	I-O or O-I	None supplied	—	No	—	—	—	—	—	—	—	—	—
PRESTO RECORDING CORP.	A	Stationary	16 (3)	33⅓-78	Lever	S.S. Sync.	Idler wheels	112	Overhead screw	I-O or O-I	Magnetic	500	Two	Magnetic	Ext.	135	3-Position mixer	−105	50, 200, 500	10	—	Meter
	B	"	" "	"	"	"		"			"	"	Optional	"	"	"		"		"	—	"
	C	Portable	16 (3)	"	"	"	"	"	"	"	"	500	"	"	"	125	1 Mike	−105	50, 200, 500	"	8	"
	Y	"	16	"	"	"	Rim	"	Worm and gear beneath table	"	"	8	No	"	"	"	2 Mikes and Radio	−95	100,000	"	10	"
	F	Stationary	16 (3)	"	"	"	"	"		"	"	"	"	"	Int.	125	2 Mikes & Wire line	"	50, 200, 500	"	—	"
	K	Portable	12	"	Change motor pulley	S.S. Constant speed ind.	"	100		"	"	"	"	"	"	110	1 Mike and Radio input	−80	100,000	8	8	"
RADIO ELECTRONIC ENG. CO.	65R15 65R30 65R72	Cabinet (4)	12	33⅓ and 78	By change of drive wheels	S.S. Induction	Rim	96 to 120	Overhead lead screw	I-O or O-I	Magnetic	500	No	Crystal	Ext.	•	•	o	•	15 30 72	12	Meter
RCA MFG. CO. Inc.	MI 12700	Stationary	16	33⅓-78	•	S.S. Sync.	Rim	112	Overhead feed scr.	I-O or O-I	Magnetic	•	No	Magnetic	Int.	100	o	•	250	3	12¼	Meter
	MI 12701	Portable	12	78	—	•	"	"	Quadrant	O-I	"	•	"	"	"	o	o	•	100,000	"	—	"
SCULLY MACHINE CO.	— (6)	Stationary	16	33⅓ and 78	Shift lever	S.S.	Belt	88, 96, 104, 112, 120, 128, 136	Lathe type	I-O or O-I	None supplied	—	Yes	Magnetic	—	—	—	—	—	—	—	—
SOUND APPARATUS CO.	A5	Portable	12	78	—	S.S.	Belt	96 (7)	Simplex mechanism	O-I	Magnetic	15 (8)	No	Crystal	Int.	o	o	•	•	5	6	Neon bulb
	A6	"	"	"	—	"	"	" "	Built in Simplex	"	"	" "	"	"	"	o	o	o	o	"	8	Meter
	VIBROGRAPH COMBINATION	Stationary	See (9)	33⅓-78	Switch	M.S. Sync.	•	96	Simplex mechanism	I-O or O-I	"	" "	"	"	Ext.	o	•	9	o	•	"	Output Meter
SPEAK-O-PHONE RECORDING & EQUIP. CO.	1-52	Portable	12	78	—	S.S. Induction	Rim	96	Under panel-worm gears	O-I	Magnetic	15	No	Crystal	Int.	112	1 Phono.	o	45,000	4.2	5½	Meter
	9M	Stationary	"	"	—	"	"	"		"	Crystal	"	"	None supplied	—	—	—	—	—	—	—	—
UNIVERSAL MICROPHONE CO.	16" Port.	Portable	16	33⅓ and 78	Flat Belt	S.S. Sync.	Flat Belt	90-110 130	Lead screw	I-O or O-I	Magnetic	15	Separate	Crystal	Ext.	112	3	−80	High	12	12	Meter
	PROFESSIONAL	Stationary						Variable	Friction				Yes	"	"	"	4	"	High & 500ω	"	Extra	"
	MASTER												"	None	"	115	"	"	High	25	"	"
	5150-5160	Portable	12	78	—	"	Gear	122	Gear and screw	O-I	Magnetic	15	No	Magnetic	Int.	110	1	−80	High	6	10	Floor
	5151-5161	Console															"				12	
	5152-5162	Chassis															"				—	
	5153-5163	"									None	—		None	—	—	—	—	—	—	—	—
WILCOX-GAY CORP.	A70	Console	10	78	—	S.S. Cons. Ind.	Idler wheel	109	•	O-I	Crystal	50,000	No	Crystal	Int.	•	Mike-Radio	•	•	7½	12	Visual Indicator
	A72	Portable	"	"	—			"	•	"	"	"	"	"	"	•	"	•	•	3	6½	
	A81	Console	"	"	—	"	"	"	•	"	"	"	"	"	"	•	"	•	•	7½	12	"
	A82	"	"	"	—	"	"	"	•	"	"	"	"	"	"	•	"	•	•	"	"	"

† *For additional information such as price, accessories included, etc., write to the individual manufacturers.*

• INFORMATION NOT SUPPLIED. * BALANCED CENTER TAP.

FOOTNOTES (1) S.S. = SELF STARTING. M.S. = REQUIRES STARTING PUSH.
(2) I-O = INSIDE-OUT, O-I = OUTSIDE-IN.
(3) DUAL TURNTABLES. (4) OPTIONAL.
(5) SYNCHRONOUS CAMERA DRIVE, OPTIONAL.
(6) SUCTION NOZZLE, CHIP COLLECTOR JAR & SUCTION MOTOR.
(7) AVAILABLE IN 100, 110. (8) 500 OHMS ON REQUEST.
(9) 12" FOR RECORDING, 16" FOR PLAYBACK.
(10) PULLEY CHANGEOVER BY MEANS OF HAND KNOB.
(11) SYNC. WITH CENTRIFUGAL STARTING WINDING.
(12) RADIAL ARM, GEAR DRIVEN UNDER CHASSIS.
(13) BUILT-IN RADIO.
(14) CAN BE OBTAINED WITHOUT CUTTING MECHANISM, FOR TRANSCRIPTION WORK OR WITHOUT AMPLIFIER.

(*Continued from page 23*)

accuracy of watches.

The reason for this choice is evident from Fig. 10 which shows the instrument with its cover removed to disclose the special Clarion amplifier designed for this job by the Transformer Corporation of America. As illustrated in Fig. 11, this amplifier actually consists of two separate channels. One is employed to build up the output of a tuning-fork type constant frequency generator sufficiently to drive a small synchronous motor which in turn drives a recording drum. The other amplifies the ticks of the watch under test, driving a stylus which records them on a paper strip on this drum in the form of dots. The drum speed is precisely 300 rpm, and standard watches, if accurate, tick exactly this same number of times per minute (believe it or not). If the watch is accurate there will be one recorded dot for each revolution and with the stylus automatically moving along the drum these dots will form a straight line across the paper. If the watch is slow or fast even to the extent of a second per day this line will slope up or down, indicating the exact amount of error.

Another interesting non-sound development is a water leak detector developed by Lafayette. A problem of municipal and private water supply organizations, and of large industrial consumers of water, is the location of leaks in underground water mains. Inability to determine the exact location of a leak may mean tearing up large sections of

Fig. 26. Roller rinks are good sound prospects, with electronic organ music most adaptable to the tempo of this sport. That such organs can operate through standard amplifiers is indicated by the use of Lafayette amplifier equipment in this great rink in New Jersey.

paving in the search.

The Lafayette leak detector (Fig. 12) is in effect a completely portable, battery-operated noise meter with a sensitive pickup which is placed in contact with the ground. Built-in filters prevent the pick up of traffic and other interfering noises. The sound of even a tiny

trickle of escaping water many feet below ground is picked up readily and it is only necessary to move the pickup along the ground until the maximum indication is obtained on the meter.

Water companies, city water departments, large industrial properties, all include prospects for such equipment and for occasional service.

Fig. 25. Chandelier-type speakers with their 360-degree, slightly downward distribution pattern provide complete sound coverage of this roller skating floor of 100,000 sq. ft. with an acoustically deadened ceiling only 15 feet above the floor.

specialized equipment

In the sound and in the commercial and industrial electronic fields, the need for highly specialized equipment is frequently uncovered; equipment which the sound man may have neither the facilities nor time to design. In such cases it is well to bear in mind that many of the larger manufacturers of sound equipment have a wide variety of special designs in their laboratories for equipment which they have developed on special order, and some have engineers who devote their entire time to cooperating with sound men in the development of special apparatus.

window displays

The effectiveness of window displays in department and other stores can be greatly heightened through the addition of sound. Not the stentorian sound aimed to attract the attention of persons from afar, but sound adequate to reach only those close to the windows. Permits for such low-level jobs can often be obtained even in cities with rigid anti-noise laws.

Fig. 13 shows an animated presentation of the "Wedding of the Wooden Soldier and the Painted Doll" in one of the show windows of R. H. Macy's in New York. The increased effectiveness lent by accompanying music can readily be imagined—and is demonstrated by the iron pipe rails which it was found necessary to erect on the sidewalk to

protect the windows from the immense crowds.

Another display with sound was that of the Lord & Taylor department store. A group of bells in the window (Fig. 14) with chimes records reproduced through a Bogen DX30 sound system and trumpet speakers above the sidewalk so aptly interpreted the spirit of Christmas cheer that even passing buses slowed down to afford passengers a moment's enjoyment.

The Christmas season, incidentally, provides excellent rental business. The Woolworth stores in New York contracted for a special musical service (Telemusic) throughout the shopping period and in Plainfield, N. J., the Chamber of Commerce arranged with one of its members, the Standard Sound Service, for rental of the equipment shown in Fig. 15 as part of its "Shop in Plainfield" campaign. This was installed in the Plainfield National Bank Building and gave three half-hour concerts of appropriate chimes and harp recordings daily. In addition to the rental fee the sound equipment owners obtained write-ups in the local papers to which they attach much value as publicity.

intercommunication

A little study of requirements, tinctured with imagination, can produce results in selling these systems. They are not necessarily limited to combinations involving a few desk installations. In the Metropolitan Life Insurance Company's offices in New York an installation (Fig. 16) consisting of five executives desk stations and ten two-way (12-in. Cinaudagraph) speakers distributed throughout the two floors of the supply room enables executives to carry on two-way conversations with supply clerks without the necessity for the latter leaving whatever work they are engaged in at the moment. The large speakers are ceiling mounted and so located that every clerk is within range of some one of them at all times and can talk back through it without even raising his voice.

The newest types of desk equipment offer some excellent selling points. Webster (Racine) for instance has introduced equipment (an example of which is shown in Fig. 17) which eliminates manual "push-to-talk" switch manipulation, includes a telephone handset for privacy, cutting out the speaker when lifted from its hook, pilot lights which indicate if a station called is busy and again when that station is clear, an annunciator system which shows stations that may have called during an absence, etc. These added refinements should hook holdout prospects whose requirements could not be satisfied by the more ordinary intercom systems.

An especially interesting installation is a Bogen Communi-Phone system which permits communication between elevators in a Jacksonville building. These are units of the "wireless" type and utilize the grounded leg of the power line for one side of the circuit and actual grounding (through the car) for the other side. This arrangement eliminates the drawback in many power-line carrier systems of not being able to communicate between different phases of a power system, opposite sides of a three-wire system or between a-c and d-c power lines. Such a system as this, operating two-way, can solve many problems involved in the efficient operation of elevators—and freight elevators in particular.

schools and churches

These markets are too widely recognized to warrant extensive discussion here. It may be well to point out, however, that with the present steady trend toward better economic conditions, churches in particular are becoming better prospects. Sound systems for correction of poor acoustics, amplified chimes, group equipment for the hard of

hearing, etc., are all of intense interest to them. As always, well-to-do members of the church sometimes are the best prospects for the purchase of such equipment, contributing it to the church as an anonymous gift, or perhaps a memorial.

In selling sound to churches, chimes offer a very special appeal. It is the ambition of every sizable church, and many of the smaller ones as well, to provide constant reminder of its presence and purpose. Chimes present the most effective and far-reaching means to this end—a fact that has been recognized for hundreds of years. And the amplified chimes of today cost only a fraction of the real bells that they so effectively simulate. Modern equipment of this type is shown in Figs. 18(a) and 18(b).

The school field has been extensively sold but still offers excellent prospects, not only for new equipment but for replacement. The modern centralized school equipment is compact, flexible and highly practical. There is a marked trend toward standard equipment and away from the older system of selecting a miscellaneous assortment of odd units and combining them all on a rack which required a Houdini to operate. It is of interest in this connection that the Clarion installation at the exclusive St. Francis Academy pictured in Fig. 21 won out over competitors partly because ". . . it fitted the school's needs perfectly without the need for adding a lot of extras" according to Will County Radio Supply Co. of Joliet, Ill., the sound organization that made the installation.

For greatest effectiveness a school system should include not only intercommunication and program distribution facilities but radio pickup as well. Every sound man should be familiar with the important place that radio holds in education and should, by all means, obtain literature on the subject available from the National Association of Broadcasters and the Federal Radio Educational Committee of the Federal Communications Commission.

miscellaneous

In Beaumont, Texas, each of the 11 fire houses has been equipped with one or more sound units which not only replace the old gong for fire alarms but permit two-way voice communication between stations and headquarters. Further, similar units are placed in the homes of the fire chief, his assistants, city executives and police stations to provide complete coordination of all activities when an alarm is sounded. In all there are 70 Oxford 12-inch speakers.

Fire departments have been slow to give up the old gong systems but there is much to be said for the substitution

of city-wide sound systems which permit alarms to be spoken, accompanied by detailed directions for apparatus, etc. It is understood that many cities have evidenced interest in such installation, indicating possibilities of an important market.

Perhaps one of the most unusual rental jobs on record is one handled by Carroll Radio Service of Coffeeville, Kansas, on the occasion of this town's annual Industrial Festival Day. With only 24 hours' notice this organization was called upon to install complete sound equipment in an observation train scheduled to tour the industrial sections, the system to be used in describing points of interest along the way. Arthur Carroll solved the problem by rolling his 200-watt, Clarion-equipped sound truck onto a flat car included in the train and with its speakers aimed at the box cars in which much of the younger generation rode. Additional individual speakers were installed in the coaches. One coach was fixed up to serve as a studio and here the announcer and special guests (many of whom were introduced over the speakers) rode. Fig. 23 shows part of the train, looking forward from the sound car roof, while the inset shows the sound car enthroned on its flat.

Every week some 5,000 guests make a sight-seeing tour of the Schlitz Brewery in Milwaukee. Life has now been made easier for the guides through the use of a recorded descriptive talk and the introduction of a novel sound system installed by the Continental Engineering Corporation of Milwaukee. Formerly the guides found it difficult to make themselves heard above the noise of machinery. Now twelve Atlas marine type speakers distributed along the path (Fig. 24) do the job for them. The novelty of the system lies principally in the switching arrangement employed. First a complete recording of the description was made. This was divided into sections each applying to one portion of the inspection tour. As guests are conducted to the first point in the tour the guide presses a button and the first section of the talk comes from the speakers in that area. Then the record stops. Moving to the second part of the tour a button located there is pressed and the appropriate description follows, and so on throughout the entire trip. This is an idea that could logically be applied by many plants which have similar sightseer problems.

Roller skating rinks with their terrific noise level present a real problem for sound men. An interesting installation is one in Perth Amboy, N. J. Here the great floor, 360 feet long and 300 wide, is covered by a fabric canopy to deaden the noise. Rather than simplifying the sound system problem, however, this

introduced the additional problem of distributing sound over such a large area when the effective height of the room was only about 15 feet. The solution was found in the use of 14 speakers suspended overhead in Atlas Chandelier-type baffles as shown in Fig. 25.

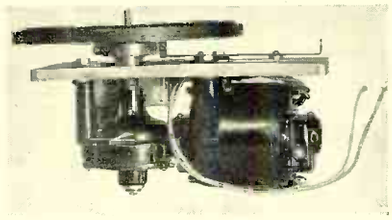
Fig. 26 shows the studio of this rink. Two turntables, a microphone and a Hammond organ constitute the input equipment to two Lafayette 70-100 watt Model 490's (one of which is missing in the photo, having been taken to another rink in an emergency due to the failure of the original equipment there). Each amplifier operates seven speakers, these speakers being staggered so that, should either of the two systems fail, the other will provide coverage over the entire floor area. As a further precaution against failure, the driver stages of the two amplifiers are connected in parallel so that the voltage amplifier stages of either amplifier will drive the output stages of both.

And so sound progresses! The novelties of today are the standards of tomorrow.

As for the market being saturated, that is ridiculous. There isn't a single phase of the market that has even approached within gunshot of saturation.

PLAYBACK TURNTABLE

Universal Microphone Co., Inglewood, Cal., has started to distribute its new syn-



chronous motor and turntable for playback. The new equipment is manufactured particularly for radio stations and recorders who dub or re-record from other records.

RECOTON BULLETIN

The Recoton Corporation, 178 Prince Street, New York City, have recently issued a bulletin covering their line of cutting and reproducing needles, recording blanks and record renewer. A copy can be secured from the above organization.

AUDIOGRAPH SOUND CATALOG

The new low-priced Audiograph sound equipment line is described in a new catalog just offered by John Meck Industries, Randolph at Elizabeth Sts., Chicago. A copy of the catalog will be sent on request.

RECORDING BLANKS

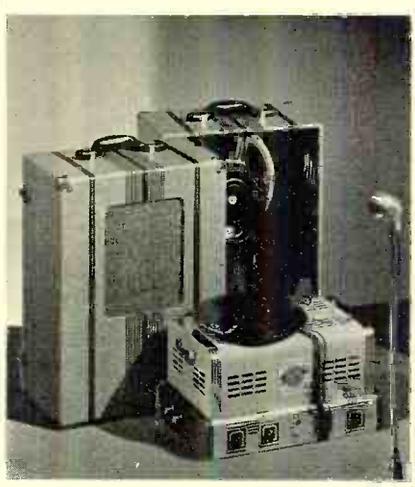
A new instantaneous recording blank, known as Phonoflex, has been announced by Bruno Laboratories, Inc., 30 W. 15th St., New York City. According to the manufacturer, the blanks will not dehydrate, are non-inflammable, flexible, economical and will play back over 100 times. A bulletin describing these blanks may be secured from the above organization.

BOGEN CATALOG

"The 'Blue Book' of Sound Equipment" is the title of a new catalog made available by David Bogen Co., Inc., 663 Broadway, New York City. Rather complete data are given.

PORTABLE SOUND SYSTEM

Model A12132, 30-watt high-gain sound system is presented in portable form with all components housed in a single split modern carrying case. For operation from 110 volts, 60 cycles a-c. Allied Radio Corp., 833 W. Jackson Blvd., Chicago.



RECORDING TURNTABLE

The Presto type 8-B recording turntable is shown in the accompanying illustration. A 16-inch dynamically balanced cast-iron turntable, weighing 30 lbs., revolves on a single ball-bearing at the base of a bronze shaft well. It is driven at the rim by a heavy-duty self-starting synchronous motor. A speed shift lever controls the motor switch and changes speed instantly from

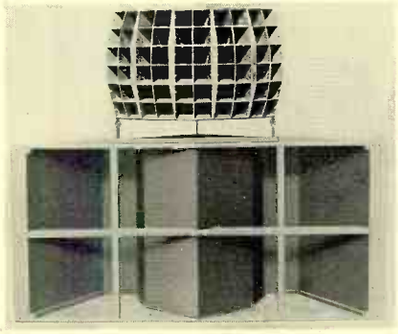
78 to 33⅓ r-p-m. Complete information may be secured from Presto Recording Corp., 242 W. 55th St., New York City.

TRANSDUCER ANNOUNCEMENT

Transducer Laboratories has assumed all the manufacturing and experimental facilities of Transducer Corporation. The Laboratories are handling all microphone repairs and sales that were carried on by Transducer Corporation, as well as new experimental work in the electro-acoustic and allied fields. Transducer Laboratories, under the direction of Mr. B. Eisenberg, are located at 42 West 48th Street, New York City.

JENSEN SPEAKERS

Jensen has recently announced a new line of full range speaker equipment of unusual character. Type B System, illustrated, consists of a multicellular high-frequency horn utilizing two annular diaphram speaker units, and one of the new Jensen "folded"



type horns equipped with two low-frequency loudspeakers. A catalog describing the entire new line is being distributed. Jensen Radio Mfg. Co., 6601 South Laramie Avenue, Chicago.

MIKE BOOM STAND

A new microphone boom stand for broadcast and other microphone applications is now available from the Atlas Sound Corporation, 1447 39th Street, Brooklyn, N. Y. The new stand features "Floating Action" which permits movement of the boom arm in every direction without moving the adjustments.

EICOR ELECTRIC PLANTS

A new line of Utilite electric power plants has just been announced by Eicor. These new units are rated at 450 watts a-c and 500 watts d-c. The a-c models operate at 1800 rpm and furnish 450 watts 110-volt 60-cycle current with ample reserve for temporary overloads. Electric push-button starting is built in—with 6-volt starter battery which can be charged automatically. A-c types are also available with remote control starting and stopping stations. Other Eicor products include a complete line of electric plants from 300 to 2000 watts, a-c and d-c: also dynamotors and rotary converters. Eicor, Inc., 515 S. Laflin Street, Chicago, Illinois.

Public Address Speakers

UTC Public Address speakers are designed for indoor and outdoor PA service, high power radio and PA units, portable sound on film service, and other general applications. These speakers combine high power sound projection with good bass response and true high frequency reproduction.

FEATURES OF PUBLIC ADDRESS SERIES

- HIGH POWER handling ability in these speakers has been provided through careful design consideration of distortion elements, voice coil heat dissipation, and cone structure.
- FREQUENCY RESPONSE characteristics of these speakers are ideal for general applications. The design features provide full, true, low notes instead of the false lows frequently encountered, and excellent high frequency definition for voice reproduction.
- HIGH EFFICIENCY is obtained through quality Feralnic magnet structures and good voice coil space factor.
- RIBBON WIRE—ACIM voice coils on heavier units.
- POLYFIBROUS CONES—MOISTURE PROOF CENTERING assure permanent quality and dependability.
- RUST PROOF—DUST PROOF.

New PA PERMANENT MAGNET SPEAKERS

Type No.	Cone Housing Dia.	Undistorted Peak Watts	Undistorted Normal Watts	Peak Power Watts	Voice Coil Dia.	Voice Coil Ohms	Wt. Lbs.	List Price
PM-18-33	18"	33	28	43	3½"	6-8	70	$115.00
PM-15-28	15"	28	25	33	2½"	6-8	58	65.00
PM-15-18	15"	18	15	23	1½"	6-8	20	30.00
PM-13-25	13¼"	25	21	29	2"	6-8	30	40.00
PM-12-18	12"	18	15	23	1½"	6-8	16	27.50
PM-12-16	12"	16	13	21	1¼"	6-8	11	18.50
PM-12-13	12"	13	10	18	1"	6-8	8	12.50
PM-10-14	10½"	14	11	18	1¼"	6-8	10	15.50
PM-10-12	10½"	12	9	16	1"	6-8	7	10.00
PM-10-10	10½"	10	7	14	1"	6-8	6	8.50
PM-8-11	8"	11	8	15	1"	6-8	6	8.50
PM-8-9	8"	9	6	13	1"	6-8	5	6.75
PM-6-9	6½"	9	7	13	¾"	6-8	6	8.00
PM-6-7	6½"	7	5	11	¾"	6-8	4½	4.25
PM-5-5	5"	5	3	8	¾"	6-8	4	4.00

New PA ELECTRODYNAMIC SPEAKERS

Type No.	Cone Hsg. Dia.	Und. Peak Watts	Und. Norm. Watts	Peak Power Watts	Field Voltage	Field Ohms	Field Watts	Voice Coil Dia.	Voice Coil Ohms	Wt. Lbs.	List Price
PE-18-40	18"	40	35	46	110V. DC	300	35/50	3½"	6-8	78	$95.00
PA-18-40	18"	40	35	45	110V. AC			3½"	6-8	88	120.00
PE-18-30	18"	30	25	40	110V. DC	350	22/35	3½"	6-8	60	60.00
PA-18-30	18"	30	25	40	110V. AC			3½"	6-8	70	80.00
PE-15-25A	15"	25	20	30	110V. DC	850	14/21	1½"	6-8	28	26.50
PE-15-25B	15"	25	20	30		2500	14/21	1½"	6-8	28	26.50
PE-13-30	15"	30	25	35	110V. DC	350	22/35	2½"	6-8	40	35.00
PE-12-20A	12"	20	15	25	110V. DC	1000	14/21	1½"	6-8	20	16.75
PE-12-20B	12"	20	15	25		2500	14/21	1½"	6-8	20	16.75
PE-12-16A	12"	16	13	21	110V. DC	1000	10/15	1¼"	6-8	12	10.80
PE-12-16B	12"	16	13	21		2500	10/15	1¼"	6-8	11	10.50
PE-10-12A	10½"	12	10	16	110V. DC	1000	8/12	1"	6-8	10	9.00
PE-10-12B	10½"	12	10	16		2500	8/12	1"	6-8	10	9.00
PE-8-10A	8"	10	8	14	110V. DC	1000	8/12	1"	6-8	8	7.00
PE-8-10B	8"	10	8	14		2500	8/12	1"	6-8	8	7.00

STANDARD UNIVERSAL MATCHING TRANSFORMERS

Universal Primary Transformers are tapped to accommodate all popular tubes.

Type No.	Undistorted Peak Watts	List Price
ST-1	up to 4	$1.00
ST-2	up to 6	1.50
ST-3	up to 10	2.25
ST-4	up to 15	2.75
ST-5	up to 25	3.50

Universal line matching provide primary impedances of 500, 1000, 1500 ohms.

Type No.	Undistorted Peak Watts	List Price
ST-6	up to 4	$1.00
ST-7	up to 6	1.50
ST-8	up to 10	2.25
ST-9	up to 15	2.75
ST-10	up to 25	3.50

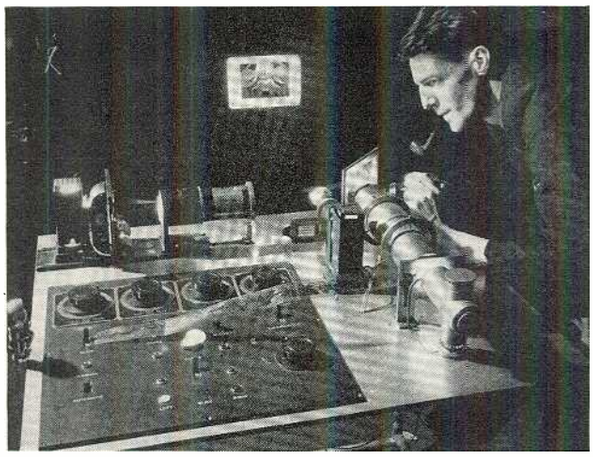
NO FINER SPEAKER MADE IN ALL THE WORLD

UNITED TELETONE CORP.

150 VARICK STREET ★ NEW YORK, N. Y.

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

A PROJECTION KALEIDOSCOPE



W. C. Eddy operating the projection kaleidoscope.

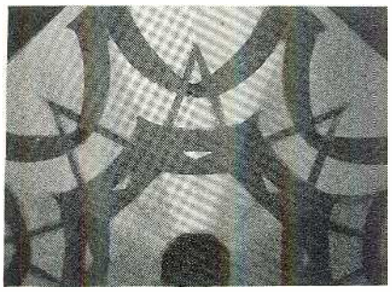
A "VISUAL curtain" for television, with changing multiple patterns corresponding to the polyphonics used extensively in sound broadcasting as a "musical curtain," has recently been developed by William C. Eddy, video effects engineer of the National Broadcasting Company.

Actually the aggregate of projectors, mirrors and a lens system constitutes a projection kaleidoscope, previous attempts at which, according to the Encyclopedia Britannica, have met with but "indifferent success." The instrument, both with and without synchronized music, has been used during NBC's television programs and has met with wide and enthusiastic audience approval.

About eighteen months were spent in the development of the projection kaleidoscope, which in operation projects the moving and abstract design directly onto the plate of an Iconoscope. Eddy describes his device as "a projection kaleidoscope in which pictorial material is multiplied quadrentially by means of mirrors placed at angles to each other. Although the whole device simulates the general action of the common form of kaleidoscope, certain new arrangements of mirrors and lenses were necessary to adapt it for television work." Through the use of more than one projector, it is possible to superimpose a second design against the moving kaleidoscopic pattern.

Any design, according to Eddy, can be reproduced and multiplied in the projection kaleidoscope. A full range of halftones is stressed to satisfy the needs of composition. Since the patterns consist, essentially, of shifting light values, manual control of light volume is impossible. An automatic gain control is, therefore, incorporated in the unit.

Another pattern similar to those shown on the front cover.



The material to be multiplied in the kaleidoscope is recorded on film. The film is fed continuously through an intricate gate system, thus permitting the constant movement necessary for the formation of this type of abstract design. The rate of feed is less than one foot of film a minute and it has been reduced to as low as the equivalent of three motion picture frames a minute, or five minutes to the foot of finished film. The usual rate of feed is about one one-hundredth the speed of film in motion picture projection.

Nearly a year was spent in perfecting a satisfactory method of recording material for projection on film and synchronizing it against a musical score. Eddy says that practically any musical device may be given a visual counterpart through the kaleidoscope method.

CENSUS SEEKS FACTS

WHILE the radio industry is busy casting its lines into the future by pushing television, facsimile, frequency modulation and other new developments during 1940, its progress through 1939 will be recorded by the United States Bureau of the Census, which in January begins taking nation-wide Censuses of Business and Manufactures. All manufacturers, wholesalers and retailers of radios, phonographs and other sound apparatus will be covered.

While the 1923-1937 period shows tremendous gains in quantity of production, the 1940 Census will report developments in the products themselves during the last two years which seem destined to have even greater significance. This coming Census, for example, will ask for the first time statistics under number and value of television sets, facsimile transmitters and receiving sets manufactured.

Among other new items included in the products schedule are central receivers, such as those used in hotels; battery portables, which have returned to popularity since the 1937 Census; automobile radios with range beyond the standard broadcast band; remote control units; automatic tuning devices; new transmitting tubes, and a breakdown of short-wave transmitters into relay, international and high frequency.

Data based on answers to a question on expenditures for plant and equipment will reveal factory expansion being undertaken in expectation of demand for production of these new lines.

Concurrently with the inquiry into radio manufacture will be taken the Census of Business, covering retail and wholesale distributors, and radio repair shops. Every establishment in the industry will receive from an enumerator a Census questionnaire, to which answers are required by law. The same statute provides that reports to the Census Bureau are confidential and cannot be used for taxation, investigation or regulation. Census material is made public only in the form of totals for states, counties, and cities, by each kind of business.

Valuable merchandising information will be made available to radio marketers through the Censuses of Business and Manufactures. Figures on production of sets by price range will reflect consumer demand, or at least manufacturers' anticipation of it. Size of inventories reports for the beginning and the end of the year will indicate how accurately the demand was gauged.

Data on value of other radio apparatus manufactured will show relative possibilities of sales revenue. How many dealers are aware, for example, that in 1937, according to figures reported to the Census Bureau, value of public address systems produced was more than half the value of phonographs?

Directly bearing on radio retailers' problems will be figures gathered in the Census of Business. Comparative sales will be shown for independents, chains, utility-operated stores and department stores handling radios. Revenue from non-radio items often carried will be listed—household appliances, sporting goods, photographic equipment, etc.

OVER THE TAPE . . .

NEWS OF THE COMMUNICATIONS FIELD

ANDREW APPOINTMENT

The appointment of Mr. C. R. Cox, formerly of Bell & Howell Company, Chicago, to the position of Chief Engineer with Victor J. Andrew, has been announced. This appointment was effective January 1.

TRANSMITTER BUILDING DESIGN

A competition for the design of an ideal building in which to house a 1,000-watt radio broadcasting transmitter has been launched by the Beaux Arts Institute of Design. It is open to students of all architectural schools and ateliers in the country. Announced purpose of the competition, which is sponsored by the Western Electric Company, is the stimulation of interest in the design of specialized structure for radio broadcasting purposes.

By offering three cash prizes of $250, $100 and $50, the sponsor hopes to attract the best undergraduate talent and plans to make the final designs available generally to the broadcasting industry.

The competition opened January 8, according to an announcement in the December issue of the institute's monthly bulletin, and closes May 1, 1940, at which time all entries must be filed at the institute's headquarters, 304 E. 44th Street, New York City.

Final awards and announcement of the prize winners will be made by the judges on or before May 15. The jury will include Andre Fouilhoux of Harrison and Fouilhoux; Ralph T. Walker of Vorhees, Walker, Foley and Smith; Alfred Fellheimer of Fellheimer and Wagner; J. R. Poppele, Chief Engineer of radio station WOR; and Ely Jacques Kahn.

WILLIAM BRAND EXPANDS

After occupying a prominent position in the sales and service field of the specialized electrical insulating materials industry for nearly 20 years, William Brand & Company announces the establishment of its own manufacturing plant, located at Willimantic, Conn. The process to be followed in the manufacturing technique at the new plant is one that has resulted in the saturated sleeving and flexible varnished tubing marketed under the trade-marked name of "Turbo."

ALLIED CONTROL BULLETIN

The Allied Control Co., Inc., 227 Fulton St., New York City, have recently made available a bulletin covering their line of relay switches. Write to the above organization to secure a copy.

SELENIUM RECTIFIERS

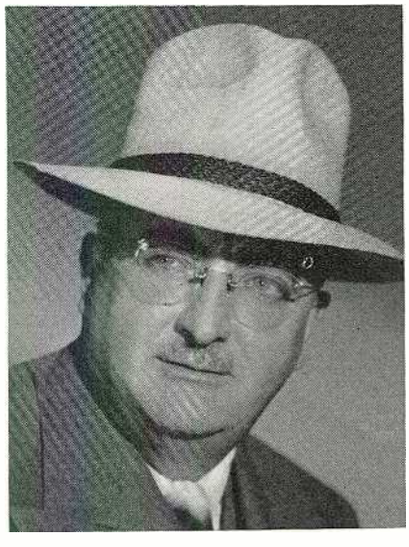
The manufacture and sale of Selenium Rectifiers in the United States has been placed in charge of Mr. George Lewis as Manager of the Rectifier Division, International Telephone Development Co., with factory and sales headquarters at 137 Varick St., New York City. The Selenium Rectifier is manufactured exclusively in the

George Lewis, Manager, Rectifier Division, International Telephone Development Co.

United States by the International Telephone Development Co., a subsidiary of the International Telephone and Telegraph Corporation.

Mr. Lewis has been a radio officer in the United States Navy, Assistant to the President of Crosley Radio; Vice President and General Manager of Kenrad Corporation; Vice President and General Manager of Arcturus Radio Tube Co., and he has played a prominent part in recent development work in the laboratories of I. T. & T. associated companies in Europe, serving for a considerable period as Commercial Director of the large laboratory at Paris, France.

Dr. Ralph L. Power, Advertising Manager, Universal Microphone Co., who recently returned from a four months' tour of Australia and New Zealand.



KNOWLES JOINS WESTINGHOUSE

Dewey Deforest Knowles, inventor of the grid-glow tube and numerous other electronic devices, has joined the Research Engineering Staff of the Special Products Department, Westinghouse Lamp Division, Bloomfield, N. J. Announcement of Mr. Knowles' appointment was made by H. J. Hoffman, Manager of the Special Products Department.

NEW COMPANY

It has been announced that Mr. C. A. Harvey, Mr. James B. Parker and Mr. R. A. Mahler have severed relations with Harvey Radio Laboratories, Inc., of Cambridge, Mass., and, in conjunction with Mr. John M. Wells, have incorporated a new concern, Harvey-Wells Communications, Inc., organized for the manufacture and sale of radio communication equipment of all types. Mr. Harvey, founder of Harvey Radio Laboratories and its former Vice-President and Chief Engineer, is now acting as Chief Engineer of the new firm. Mr. Parker, former President of the abovementioned firm, is now Office Manager and Assistant Treasurer. Mr. Mahler is acting in the capacity of Sales Manager. Mr. John M. Wells, former Vice-President in charge of research of the American Optical Company of Southbridge, Massachusetts, and at present a member of its Board, is President and Treasurer of the newly formed Harvey-Wells Communications, Inc.

Manufacturing facilities are now being set up at Southbridge, Mass., where the main plant and offices will be located by March 1, 1940. Initial production will consist of a line of marine radio telephones which have already been displayed at the Sportsmen's Show in Boston, Mass. Following the introduction of the marine units, operations will be broadened to include police, aviation and allied communication markets.

DOOLITTLE BULLETIN

Doolittle & Falknor, Inc., 7421 S. Loomis Blvd., Chicago, Ill., have issued an interesting bulletin entitled "Transmission Lines and Fittings." Copies are available on request.

SPRI BOOKLET

An information booklet on a "Practical Radio and Communication Engineering Course" for home study has been made available by the Smith Practical Radio Institute, 1311 Terminal Tower, Cleveland, Ohio. This booklet gives an outline of the course, biographical notes on instructors, and other interesting data. A copy may be secured from the above organization.

SHURE APPOINTMENT

Jack Berman, associated for the past six years with Shure Brothers, has just been appointed Sales Manager of the firm. He takes over the position left vacant by his brother, Gene Berman, who has formed his own company in the camera field.

TecDeCo EXPANDS

Technical Devices Corporation, Bloomfield, New Jersey, has recently increased its plant area and production facilities. This, the second expansion the corporation has undergone in the past two years, has made possible the continuation of prompt deliveries despite increasing volume of business. The development staff has also been increased by the addition of M. K. Gordon, Jr., and R. G. Cantrell.

The Corporation manufacturers radio, communication, sound, measurement and photo devices under the trade name of TecDeCo. A. H. Hotopp, Jr., is President, and is in charge of Sales and Product Development. F. W. Boesche is Vice-President, in charge of Production and Purchasing.

NATIONAL CARBON APPOINTMENTS

A reorganization involving personnel changes in the sales, advertising and promotion activities of National Carbon Company, Inc., has been announced. R. P. Bergan, former assistant to J. M. Spangler, General Sales Manager, and H. M. Warren, former Advertising Manager, are the new Assistant Sales Managers. J. M. Meldram, member of the advertising staff for the last two years, has been made Manager of the recently organized Advertising and Sales Promotion Division. A. H. Housman and H. A. MacMullan, for several years associated in the company's advertising and sales promotion, are now Assistant Managers of that division.

LEAR AVIA MOVES

Lear Avia, previously Lear Developments, has moved its main factories and research laboratories to a new plant at the Municipal Airport at Dayton, Ohio. Lear Avia will retain its building at Roosevelt Field, Long Island, N. Y., as headquarters for its Atlantic sales and service division.

IRC EXPORT SALES MANAGER

Effective January 1st, Hans Mannheims was appointed manager of the Foreign Sales Department of the International Resistance Company, 401 N. Broad Street, Philadelphia, Pa. He succeeds Robert E. Keiser who has entered another line of work.

INSULATOR DATA

Complete data on steatite and ultra-steatite low-loss insulators, coil forms, bases, etc., is contained in a new 24-page indexed booklet just issued by General Ceramics Company 30 Rockefeller Plaza, New York. Copies of this booklet are free on request. Ask for Catalog 1000.

INTL. NICKEL APPOINTMENT

Mr. A. J. Wadhams, Vice-President and Manager of the Development and Research Division of The International Nickel Co., Inc., has announced the addition of Dr. William A. Mudge to the Technical Service Division of the New York Office. For the past 17 years Dr. Mudge has been Superintendent of Research, Superintendent of the Refinery and Works Metallurgist at the company's Huntington, W. Va., Rolling Mill.

RESISTANCE HAND BOOK

Wilbur B. Driver Co. have just made available a resistance handbook. This 108-page publication is one of the most complete handbooks of its kind and should be of interest to engineers in this field. Copies may be secured by writing to the above organization at Riverside Ave., Newark, N. J.

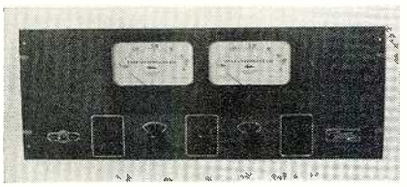
(*Continued on page* 43)

THE MARKET PLACE

NEW PRODUCTS FOR THE COMMUNICATIONS FIELD

PHASE MONITOR

A new Type 798 rack and panel Victor J. Andrew phase monitor for adjustment and maintenance of the phasing networks



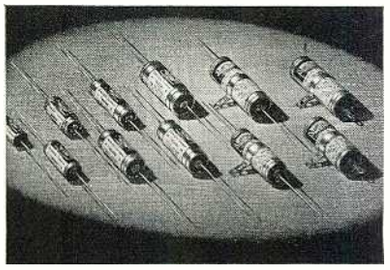
of a three element directional antenna has just been announced. The new Type 798 consists of two complete monitors built as a single unit, allowing simultaneous monitoring of phase between the center and both outside towers. Each phase angle is indicated directly in degrees between 0 and 180, by a large panel d-c meter which may also be used for third and fourth quadrant angles. Victor J. Andrew, 6429 S. Lavergne Avenue, Chicago, Illinois.

F-M TRANSMITTERS

Western Electric Company is prepared to manufacture frequency-modulated radiobroadcast transmitters, according to an announcement made by F. R. Lack, Manager of the Company's Specialty Products Division. Under an agreement recently made with Major E. H. Armstrong, these transmitters will make use of the wide-swing frequency-modulation system developed by him, and will include also several important features which have been developed by Bell Telephone Laboratories. An initial experimental transmitter of 1 KW capacity will go into operation about March 1st. This installation will be made by Western Electric in cooperation with Radio Station WOR to study the transmission characteristics of this new system and it will carry the programs of the Mutual network on an experimental frequency allocation.

METAL-CASED ELECTROLYTICS

A new BR series of tiny, tubular electrolytic capacitors has been announced by Cornell-Dubilier. Only about one-fifth the size and weight of the older "can" type electrolytics for equivalent capacity and voltage ratings, these new units are available in a wide variety of capacity and voltage ratings—from 4 to 40 mfd, 25 to 500 volts, working. Each BR capacitor is hermetically sealed, inclosed within an aluminum container over which is fitted a varnished cardboard sleeve. Bare wire leads are riveted to rubber-capped bakelite ends. Available in single and dual capacity ranges. Described in Catalogue No. 175A free on request from Cornell-Dubilier Electric Corporation, South Plainfield, N. J.

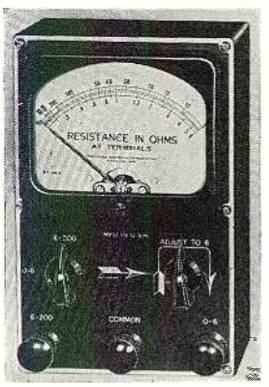


F-M RECEIVERS

Stewart-Warner Corporation will introduce in May a representative line of table and console radio sets equipped to receive programs transmitted by the Armstrong system of wide-swing frequency-modulation broadcasting, according to L. L. Kelsey, Manager Stewart-Warner Radio Division. Stewart-Warner engineers have been studying the Armstrong principle of frequency modulation for several years, Mr. Kelsey said.

LOW-RANGE OHMMETER

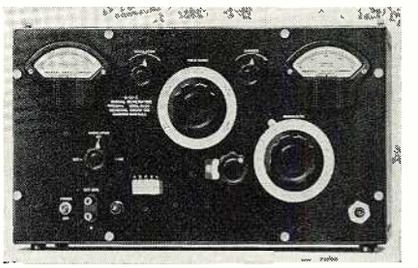
This instrument, equipped with a Hickok 4" rectangular meter having 3¾" scale length, gives measurements at low values of resistance on two ranges—0-6 and 6-600. The special feature of the scale is the non-overlapping of the two ranges—permits battery adjustment at the logarithmic center of the accurate section of the scale. Overall accuracy is approximately plus or minus one degree of scale deflection, the scale being 100 degrees.



The instrument is completely self-contained, utilizing 3, easily replaceable, flashlight cells, connected in parallel to prevent frequent replacing of batteries. Change in battery voltage does not affect the accuracy, it is said. For additional information write the Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio.

U-H-F SIGNAL GENERATOR

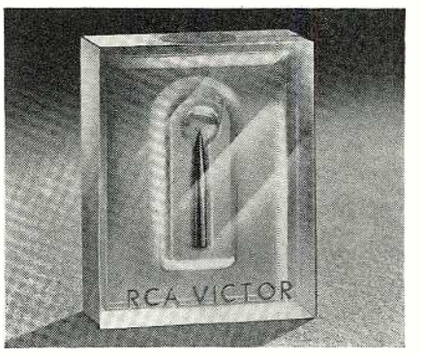
The new Type 804-A u-h-f signal generator is intended for use in testing radio receivers in the ultra-high-frequency range. It produces carrier frequencies over a wide range, extending from 7.5 to 320 megacycles. The output voltage range is 10 microvolts to 20 millivolts. The instrument is direct-reading in both frequency and output voltage. Internal 400-cycle modulation up to 60% is provided. External modulation can also be used. A voltage-regulated a-c power supply is included.



Operation at frequencies as high as 330 megacycles is achieved through a compact and efficient oscillator circuit. The tuning condenser is small and is driven by a worm and gear assembly. The coils are mounted on a mycalex disc which can be rotated by means of control knob on the panel. The switching system is designed to give short leads and low contact resistance. The attenuator is capacitive and is provided with a compensating mechanism in order to present a constant capacitance to the oscillating circuit. An output cable is furnished. Modulation percentage and carrier level are indicated directly on easily-read, fan-shaped meters on the panel. General Radio Co., 30 State St., Cambridge, Mass.

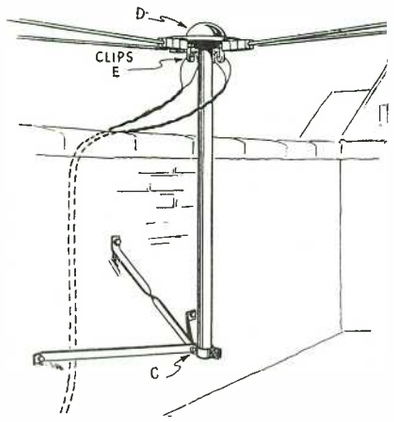
LONG LIFE NEEDLE

A new "long life" phonograph needle capable of 1,000 playings under normal conditions has been announced by RCA Victor. Individually packaged in a crystal-clear, rectangular block of transparent plastic, the needle has display and promotion possibilities. RCA enumerates four main points for the new needle: long life, kindness to record surfaces, faithful reproduction, and comparatively low cost. It utilizes an alloy of the platinum group of which the rarer are ruthenium, osmium, iridium and rhodium. Molecular structure of the alloy is extremely uniform and fine-grained, making possible a minimum of friction to the semi-circular bottom of the record groove, it is said. RCA Manufacturing Co., Inc., Camden, N. J.



TELEVISION ANTENNA

The Verti-flex television antenna consists of crossed dipoles with convenient



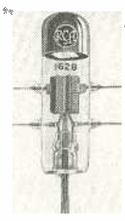
switching means at the receiver for choosing either dipole. In addition the switching means allows alternate halves of the dipoles to be connected together so as to receive from the 45° direction also. This means that by switching the antenna can be adjusted to within twenty-two and one-half degrees of the best receiving position . . . and hence is convenient for locations where it is desired to receive signals from more than one station. Further information may be secured from Verti-flex Division, Illinois Seating Corp., 2138 N. Racine Ave., Chicago, Illinois.

RCA TUBES

The RCA Radiotron Division, RCA Manufacturing Co., Inc., Harrison, N. J., have recently announced to equipment manufacturers two receiving tubes, one transmitting tube, two television tubes, and one phototube as follows: RCA-12K8, triode-hexode converter (metal type); RCA-12SR7, duplex-diode triode (single-ended metal type); RCA-928, gas phototube (non-directional type); RCA-1628, ultra-high-frequency transmitting triode; RCA-1840, orthicon; RCA-1848, iconoscope.

The 12K8 is similar to the 6K8 except for heater rating—the heater of the 12K8 requires 12.6 volts and 0.15 ampere. The 12SR7 is similar to the 6R7 but utilizes a single-ended metal construction with the grid lead brought out through the base. The 928 is a gas phototube designed with a caesium-surfaced, cylindrical, mesh cathode which has non-directional light pick-up characteristics.

The 1628 is a three-electrode tube of the



high-perveance type designed for use as an oscillator or r-f power amplifier at ultra-high frequencies. It can be operated at maximum ratings at frequencies as high as 500 megacycles and with reduced ratings as high as 675 megacycles. The maximum plate dissipation of the 1628 is 40 watts in Class C telegraph service. Some of the features of the 1628 contributing to its high-frequency performance are: double-helical filament center-tapped within tube to minimize the effects of filament lead inductance; double grid and plate leads which are brought out of the tube through individual seals to eliminate common impedances between tank and neutralizing circuits; and tantalum plate and grid closely spaced to increase plate efficiency at high frequencies by decreasing electron transit-time between filament and plate.

The 1840 is a special form of cathode-ray tube designated as the Orthicon. It is intended for "picking up" a scene to be telecast and converting it to an electrical signal. This new tube utilizes a low-velocity beam for scanning. Outstanding advantages of the Orthicon are: (1) it has high operating sensitivity, (2) its signal output is free from "dark spot" and other spurious signal, (3) its current-output vs light-input characteristic is linear, (4) it operates with an anode supply of 250 volts, (5) it does not require keystone correction, and (6) its constant black-signal level simplifies d-c restoration.

The 1848 Iconoscope is also a special form of cathode-ray tube intended for "picking up" a scene to be telecast. This type features small size, high resolution capability, and high sensitivity. Because of these features, the 1848 is especially suited for use in portable television cameras.

DUREZ 1900 BLACK

A new, easily preformed, high-impact phenolic molding material has just been announced by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. This molding compound, known as Durez 1900 Black, delivers an unusually smooth finish for a standard high-impact type. It is unique in its particle size and shape through which it is given its excellent preforming properties, it is said. The particle size is so controlled that Durez 1900 Black flows through hoppers and automatic feeding devices easily. For this reason it has been found suitable for many parts requiring a high-impact material.

SPRAGUE KOOLOHMS

Sprague Products Co., North Adams, Mass., announce that their Koolohm wire-wound resistors are now generally available at leading distributors.

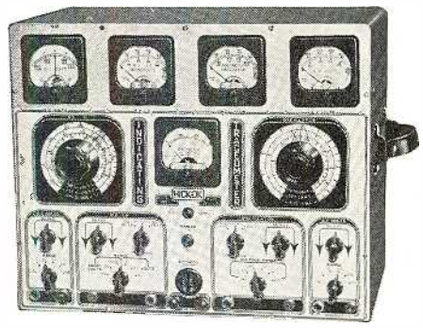
These resistors feature a special type of insulation on the resistance wire which permits interleaved windings and eliminates the necessity of overall coating. Each Koolohm also has the Teledot wattage indicator, a Sprague feature, which consists of a red dot on the end of the unit that changes color when a 25% overload occurs.

ICA AUTO ANTENNA

Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N. Y., have announced buggy-whip antenna with underhood mounting brackets. The aerial is made of chrome plated Admiralty brass and is equipped with both underhood and alligator mounting brackets. Additional information may be obtained directly from Insuline.

HICKOK TRACEOMETER

These are the five measurements that can be made simultaneously without disturbing natural set operation with the



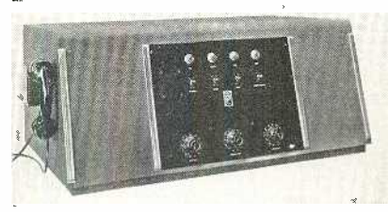
Hickok Model 155 Traceometer: measurement of the signal in microvolts at any point in the r-f, i-f section; measurement of actual oscillator voltage throughout its entire range; measurement of all d-c voltages, a-v-c, a-f-c, power-supply, etc.; measurement of any a-f or a-c voltage in any circuit; measurement of actual wattage consumption of any a-c system to 300 watts. Complete instructions and leads are furnished. For full data, ranges, etc., write the maker, The Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland, Ohio.

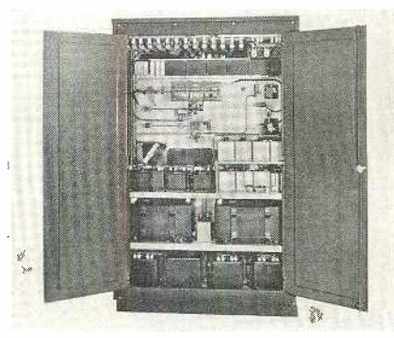
AMPEREX TUBES

The FCC has recently approved three new Amperex transmitting tubes for use in the last stages of commercial broadcast transmitters. The tubes approved are the 342A, 343A and 892R. Technical data sheets have also been made available on the Amperex 846, 232C, 222B and 279A. Write to Amperex Electronic Products, Inc., 79 Washington Street, Brooklyn, N. Y.

BROADCAST TRANSMITTER

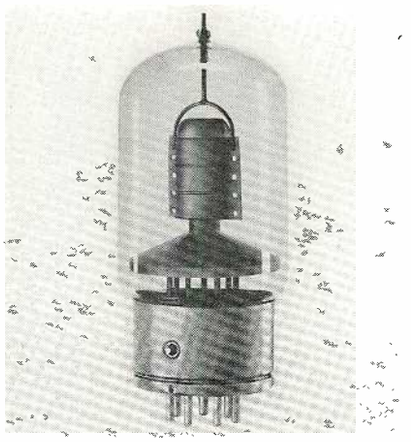
The Radio Receptor Company, 251 W. 19 St., New York City, has recently completed a 1,000-watt high-fidelity broadcast transmitter for the City of New York. It is designed for a frequency range of 25 to 27 megacycles. The frequency response is uniform within 1 db from 30 to 10,000 cycles with a total rms distortion of less than 5% throughout the audio-frequency range with 100% modulation, and no single harmonic component is greater than 3%.





TYPE 257 GAMMATRON

Heintz and Kaufman, Ltd., South San Francisco, Calif., have recently introduced the Type 257 Gammatron, a beam pentode tube. It offers a number of features. The



elements are constructed entirely of tantalum and are mounted directly on a molded base without the use of internal insulators of any kind. Thus, it is said to be possible to pump this tube under extreme temperature and to maintain a vacuum under operating conditions without the use of the usual chemical agent or "getter." The elimination of insulators and the unique construction employed provides that feedback capacity from plate-to-grid is approximately one-third of that found in similar multi-element transmitting tubes, it is said. Thus, the tube will operate on higher frequencies without fear of self-oscillation. Another element of design which makes this type of operation practical is the employment of dual screen grid and suppressor grid leaks, which result in very low inductance drop over their short length, and making it comparatively easy to maintain these elements at ground potential.

PILOT LIGHTS

The Dial Light Company of America, Inc., 136 Liberty St., New York City, manufacturers of pilot light assemblies, announce their new Series 100 pilot light assemblies which accommodate a ¼-watt neon candelabra screw base lamp or a ¼-watt double contact bayonet base neon lamp. The same assembly can also be furnished for 6, 12, and 110-volt double contact bayonet base lamps to be used in applications where vibration might have a tendency to loosen the lamp. A new eight page catalog is available describing this assembly and other Dialco pilot lights.

OHMITE TAPPED CORDOHMS

A new Cordohm, offered by Ohmite Mfg. Co., 4838 Flournoy St., Chicago, has a three conductor cable which furnishes 110 volts for the rectifier plate, plus a reduced voltage for the filament circuits and, in addition, has a fourth conductor to supply the pilot light voltage. Tapped Cordohms are available in a range of values for 4 or 5 tube sets. Bulletin 118 gives illustrative and descriptive information and is obtainable directly from Ohmite.

TUBE & BATTERY CHECKER

The instrument shown in the accompanying illustration is the new Weston Model 777 tube and battery tester. Several other new features have been included in addition

to that of battery testing to provide faster operation, greater flexibility and coverage on a larger number of tube types. Complete information may be secured from the Weston Electrical Instrument Corp., Newark, N. J.

W. E. MICROPHONE

A new all-purpose cardioid microphone has been announced by the Western Electric Company, 195 Broadway, New York City. The new "multimike" gives engineers the equivalent of six distinct instruments in one unit. With it sound may be picked up with equal sensitivity as a non-directional," "bi-directional," and "cardioid directional." In addition to these three standard patterns, the new multimike can

be switched for any of three degrees of "hyper-cardioid" operation.

HOWARD PRESELECTOR

Howard Model 650 Preselector consists of a completely self-contained two stage high-gain preamplifier. May be used to

feed any type of receiver or other radio apparatus. Input may be obtained from standard antenna or rotable loops. Four loops are furnished for different frequency coverage. Compass scale at base of loop indicate direction of loops. Howard Radio Co., 1731 Belmont Ave., Chicago.

FREQUENCY METER-MONITOR

Edwin I. Guthman & Co., Inc., 400 S. Peoria St., Chicago, Ill., have recently introduced their Type U-10A frequency

meter-monitor. It is particularly designed for use by broadcast stations, radio laboratories, police and amateur stations. Complete information may be secured from the manufacturer.

OVER THE TAPE

(*Continued from page 39*)

NEMA STANDARDS

The National Electrical Manufacturers Association has just published two new standards on Laminated Phenolic Products as follows: NEMA Laminated Phenolic Products Standard, Publication No. 39-57; NEMA Recommended Practice for Machining and Punching Laminated Phenolic Plate, Publication No. 39-58. Copies of these standards may be obtained from NEMA Headquarters, 155 East 44th Street, New York, for $.25 and $.10, respectively.

RCA APPOINTMENT

George S. De Sousa, Treasurer, has been elcted Vice-President and Treasurer of the Radio Corporation of America, David Sarnoff, President, announced following a regular meeting of the Board of Directors. Mr. De Sousa has been Treasurer of RCA since its formation in 1919, and prior thereto was an officer of the Marconi Wireless Telegraph Company of America, the predecessor company to RCA.

G.E. APPOINTMENT

John G. T. Gilmour, since 1931 Director of General Electric's Motion-Picture Department, has been appointed Program Manager of the company's new television broadcasting station W2XB which will go into operation the latter part of this year, it has been announced by C. H. Lang, Manager of the Publicity Department. Charles R. Brown of the company's Market Research Section has been named to succeed Mr. Gilmour in charge of the Motion-Picture Department. W. T. Cook will be in charge of scenarios.

FRANK LUDLAM

Frank Ludlam, Assistant Secretary and Assistant Treasurer of The International Nickel Co., Inc., died on December 8th at his home at 1130 Park Avenue, New York City, after a long illness. Mr. Ludlam was born at Bloomfield, New Jersey, on November 3, 1873.

FINCH FACSIMILE FACTORY

Acquisition of a factory at 4th and Virginia Streets, Passaic, N. J., has been announced by W. G. H. Finch, President of Finch Telecommunications, Inc., New York, manufacturers of various types of facsimile apparatus for use on radio or wire. The Company now maintains offices at 1819 Broadway and 37 West 57th Street. The Company also operates stations W2XBF and W2XWF.

The three story brick building in Passaic contains more than 20,000 square feet of floor space.

TELEVISION DEMONSTRATION

Recently some seventy-five radio authorities and engineers were shown larger screen images with improved pictorial detail which it is said can be obtained within present transmitting frequency limitations. In the Allen B. Du Mont Laboratories at Passaic, N. J., representatives of the Federal Communications Commission, Radio Manufacturers Association, NBC and CBS networks, RCA and other interested organizations and individuals were shown a persistent type cathode-ray screen which it is claimed permits slashing the present R.M.A. image repetitive rate in half without introducing noticeable flicker. Du Mont engineers demonstrated television transmission and reception at just half the usual R.M.A. repetitive rate, or 30 fields or 15 complete interlaced pictures per second. Halving of the repetitive rate means that the transmitting frequency channel or space on the air can likewise be cut in half. Two television channels can be made available where but a single one existed before. However, Allen B. Du Mont favors using this extra elbow room thus gained for an increased number of scanning lines, so as to step up the pictorial detail still more.

BOOK REVIEWS— continued from page 12

few places in which this subject made its appearance were usually amenable to algebraic treatment. Theoretical mechanics as treated by that powerful mathematical tool, vector analysis, was relegated to the physicist and was not usually considered as of great importance to the practicing engineer in his work.

Electron optics, which might have been more aptly named electron ballistics, has, largely due to the advent of television, become a subject of major importance. Since the acquisition of even a superficial knowledge of electron optics requires a rather thorough grasp of the principles of vector analysis and mechanics, the engineer who has hitherto neglected these fields will find that Professor Coe's book *Theoretical Mechanics* is required reading.

The treatment is necessarily mathematical but, although practically every page fairly bristles with equations, it should not be thought that much mathematical training is requisite prior to the reading of this book. The only preliminary mathematical training required of the reader is a very slight knowledge of the most elementary types of differential equations. No familiarity whatever of vector analysis is assumed, this being taken up as needed in the development of the mechanical principles. To quote from the author's preface, "The student learns the vector analysis almost incidentally in the study of the mechanics, and learns it well because he not only studies it directly but continues to use it thereafter."

Only one flaw mars this otherwise admirable book, namely, the unfortunate use of the letter j as the symbol for acceleration. Since Professor Coe did not primarily have the electrical engineer in mind, he can, in no sense, be called to account for having violated the sacredness of j as a rotating operator. An author has the privilege of employing any symbolism he chooses, providing that it is so selected as not to conflict with other symbols. This criterion is neglected by Professor Coe, for he also, and this time quite rightly, employs the symbol j as a unit vector. Since acceleration is also a vector, the reader is constantly subjected to annoyance.

Were it not for the author's irritating use of j as a symbol for acceleration this book would be unqualifiedly recommended.

R. L.

PRODUCTION AND DIRECTION OF RADIO PROGRAMS, by John S. Carlisle, with drawings by Arthur Thompson, published by Prentice-Hall, Inc., 70 Fifth Avenue, New York City, 1939, *397 pages, price* $3.75.

This book takes each of the standard types of radio program, from the time it is merely a wicked gleam in the advertising man's eye until it reaches the microphone, and describes what is done, who does it, and why he does it. The author, who is the production manager of the Columbia Broadcasting System, believes that everyone connected with radio should know a little of the other men's work and problems, and his book is, within the field indicated, well suited to convey such information as might prove valuable.

The author begins by outlining the personnel of a typical radio broadcasting station and system, and the various duties of the different members of the staff; he then proceeds to trace the course of several types of programs through their duly appointed paths, with well-taken comments on whether they are good, bad, or indifferent, and why, and with nice attention to the particular difficulties raised by each program. Several chapters deal with the problems of acoustics and sound effects, and the difficulties experienced in these fields, and these are among the most interesting in the book, being the observations of an intelligent layman vitally interested in results, and in techniques as they affect results.

Little is said of the engineer in this book; he is treated with a sort of affectionate disdain in connection with matters of acoustics, and with a silent respect as to matters electronic. Nevertheless the volume is not without interest for him. The chapters on acoustics and sound effects are well worth a glance, and the special supplement listing laboratories currently engaged in work on acoustics, with notes as to the work being done in each, is of unquestionable value. This writer knows of no other single source for the information contained in this supplement.

E. A. M.

R-F AMPLIFIER— continued from page 9

only one low-voltage power supply would be required for the plate-modulated stage. However, a plate-modulated amplifier requires a high-power audio-system and associated power-supply equipment. The audio amplifier adds to the cost and reduces the overall efficiency of plate-modulated stage.

Grid Bias and Grid Excitation Modulation. Depending upon the type of tubes used, a grid-modulated stage might require approximately from the same number to as many as three times as many tubes as the high-efficiency system to produce the same output. But the output from the grid-modulated stage would be produced with low efficiency, usually less than half of that possible with a high-efficiency stage.

Other High-Efficiency Systems. The over-all efficiency of the amplifier described here is in general higher than that attainable with any of the modulation systems so far developed. Other high-efficiency systems require more circuit elements and more complicated adjustments. The system would in most cases require a higher voltage power supply than other high-efficiency amplifiers. A Doherty amplifier would usually require only half the number of tubes as the amplifier described in this paper to produce the same output.

The salient disadvantages of the system proposed here are the high-voltage power supply required, the multiplicity of voltages required, and the fact that only one tube operates in supplying positive peak power. A negative feedback circuit is required for linearity. Its outstanding advantages are its high efficiency and simplicity.

TELEVISION ECONOMICS

(*Continued from page* 14)

ter in which television is to be viewed. Ultimately the television theatre itself may be designed most effectively to meet the requirements of television presentations but for the present, at least, existing theatres must in the main be used. The screen therefore constitutes the principal flexible element in controlling light distribution to the audience.

So far as the audio portion of the program is concerned, it is self evident that this can be economically handled by connecting the output of the audio portion of the television transmission into the existing sound channel of the film reproducing equipment.

N-5. Theatre Television Projection

As previously indicated, large-screen television pictures have been projected both by cathode-ray tubes operated at high voltages and by mechanico-optical methods (see Section I-10 of this analysis). It need be repeated only that pictures as large as 12 by 15 feet have been shown with a brightness of 10 lux or about 1 foot-candle—which, while at the lower limit, is probably temporarily usable for the purpose. Thousands of people have viewed theater television presentations in Europe and have paid liberally for admission, nor have they been disappointed, judging from the newspaper comments on the performances. There has even been shown in Europe a rather rudimentary large-screen color-television picture. This was shown to some 3,000 people, the picture being 9′ by 12′, produced by mirror-drum scanning, and having 120-line average detail. It was a two-color picture made up of alternate 60-line red pictures and 60-line blue-green pictures, the two sets of 60 lines each being interlaced. While far more detailed pictures of considerably wider color range and fidelity are required for commercial theatre television on a continuing entertainment basis, such results at least indicate initiative and progress in that direction.

In general it must be said that the economics of theatre television are obscure at this time and clouded by the high cost of service, the expense of installing and maintaining the new equipment in a multitude of theatres, the unproven continuing appeal of such a service to the audience (although early indications are favorable), and lack of information as to the relative interest which the audience will show in television as compared to motion pictures. There are many other factors involved

in the possible success of theatre television. The question of maintaining an adequate quality and quantity of program material is paramount. The number, distribution, and interconnection as well as the necessary power of the transmitting stations, together with their cost and the cost of precision receivers, must be considered. General economic conditions in the country are involved. The relationship of both the motion-picture and television industries to each other, the public, the theatre audiences, and the government will require careful consideration. While inherently there is no physical obstacle to the initiation of a modest measure of theatre television presentation, yet much engineering progress will be required before theatre television will approach present motion-picture standards. The development of this field will be vitally affected by the thoughtfulness and wisdom of the leaders in the industries and of the legislative groups which are inherently involved.

In concluding this analysis of "Television Economics", the reader may have gained the impression that the field bristles with unsolved economic problems and with discouraging elements of cost. Nevertheless, it has been deemed desirable to list all major elements of cost, whether involved in equipment or processes, and all serious problems of administration having an economic aspect, so that those planning to enter upon or continue in any branch of television may at least recognize the sign posts along the road and draw their own careful conclusions as to what is required in the way of planning and financing in order to have a reasonable chance of commercial success. Looking back to the earliest days of audio broadcasting, the future then appeared as uncertain and the problems as insoluble as one might endure. Nevertheless by the exercise of pioneering bravery, continued ingenuity, and normal evolutionary methods, audio broadcasting grew to dimensions which would have seemed not merely incredible but in large measure ridiculous to most of those engaged in that art at its beginning. Judging from this, television broadcasting may well have a bright future in this country if the American people and the television industry which serves them have not lost enterprise, the pioneering spirit, acceptance of the new and the better, and that energy which surmounts even apparently insuperable obstacles. In this sense the future of television broadcasting in America will constitute a sort of partial touchstone of the future of the people of this country in many another field or even in their broad destiny. Through the course of television may be learned

much concerning the "state of the nation".

In the preparation of this analysis, the writer has obviously drawn freely upon the work and publications of numerous radio organizations, research laboratories, engineers, and engineering societies. Regarding their contributions as now a part of history and in the nature of educational material, the writer has refrained from assigning specific credit to any of these groups or individuals. Yet in closing, he desires to express his admiration of the intelligent and determined efforts of those others who have brought the art of television to its present state and to express his pleasure at this opportunity of bringing to the attention of his readers such material in this analysis as originated from others than himself.

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TELEVISION ANTENNA

(*Continued from page* 16)

wires includes water which increases the losses of the line. The 72-ohm line was cotton covered with no attempt at water-proofing. When it was wet, its loss increased from an initial dry value of 5.5 db to a wet loss of 13 db. The 100-ohm line was also cotton covered, but was impregnated with a water-proofing compound. Its loss increased from 1.4 db to 6 db. The surge impedance of both lines was also decreased by the moisture. Lines encased in a good grade of rubber are to be recommended for use in exposed portions of the run from antenna to receiver. There has been some discussion regarding the desirability of using coaxial lines at television frequencies because of lower losses. Where an antenna may be located within 50 to 100 feet from the receiver, a loss of 2 or 3 db would not seem objectionable except in locations near the edge of the service area. Even here increasing the length of the antenna may prove more effective and probably cheaper than installing a coaxial line.

ANTENNA AND TRANSMISSION LINE

What the television set receives across its input terminals depends on the antenna, the transmission line and how they operate when connected together. As has been pointed out above, the selectivity of the antenna may be controlled by the load which the transmission line places upon it. The selectivity of the antenna is selectivity which, in general, refers to a circuit operating at carrier frequencies and hence the response must be made broad but need not be absolutely flat. The transmission line, on the other hand, may have a fundamental resonance con-

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siderably below the carrier frequency and to allow any of its effect to remain would be to produce a bumpy response with several peaks and valleys within the side-band coverage. In addition an improperly terminated line may produce reflections of sufficient amplitude and time delay to produce additional displaced images in the television picture.

Fig. 7 shows two curves of antenna and transmission line response. Curve A was the result of measuring the voltage across a 100-ohm resistor connected directly to the center of the antenna across a 2-inch gap. A 50-foot 100-ohm transmission line terminated by a 100-ohm resistor was connected, the original 100-ohm resistor was removed and the voltage at the center of the antenna was again measured. The departure is shown by the dotted line.

Curve B shows the results of measuring the voltage across the 100-ohm resistor at the end of the transmission line. The difference between the two curves will be seen to be substantially constant and is equal to the loss in the line.

Increasing the gap at the center of the antenna to 12 inches and connecting the transmission line by means of a V 12 inches on a side did not cause any noticeable change in the shape of the output voltage curve, but raised the level approximately 1 db.

GENERAL REMARKS

The frequency range covered in the above experiments was from $f = 30$ megacycles to $2\ f = 60$ megacycles.

Television signals may arrive at the antenna over more than one path. Even a few hundred feet difference in path length is sufficient to cause a delayed image noticeably displayed with respect to the main image. At television carrier frequencies, the ground is a rather poor reflector and the source of delayed signals is likely to be large metal objects such as large buildings. Elimination of undesired reflected signals is largely a matter for experimental determination in a given location. Moving the antenna or changing its direction slightly may be sufficient to eliminate even a strong reflected signal.

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VETERAN WIRELESS OPERATORS ASSOCIATION NEWS

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

At the Dinner-Cruise

THE Fifteenth Anniversary of the Veteran Wireless Operators Association will be celebrated at the Hotel Astor in just a few days—on Wednesday evening, February 21, 1940 (Washington's Birthday Eve), with a Dinner-Cruise in the beautiful Rose Room (on the first floor near the refreshment stand), and you are cordially invited to attend.

The feature of the evening will be the recognition of the splendid part American Broadcasting has played in the life of every American. A Marconi Memorial Plaque of Service will be presented to the National Association of Broadcasters as the representative of the majority of American broadcasting stations. The Engineering heads of the three major networks, each of whom in his early days was a wireless operator, will also be honored. Since the careers of the three so closely parallel one another our Association will award Marconi Memorial Medals of Achievement to E. K. Cohan, Chief Engineer of the Columbia Broadcasting System; O. B. Hanson, Chief Engineer of the National Broadcasting Company, and J. R. (Jack) Poppele, Chief Engineer of Mutual's most outstanding station WOR — as representative of the Mutual Broadcasting System. Each of these men served their time as wireless operators in the early 1900's and are deserving of the awards to be presented.

A Marconi Memorial Medal of Valor will be awarded, posthumously, to Papas Theodorou, heroic operator of a Greek freighter who stuck to his post of duty even though the ship had broken in two and he remained at his key sending distress signals over an improvised antenna on his section of the ship until succor arrived. He was the only member of the crew who did not obtain a life preserver—so engrossed was he in the work of summoning aid to his distressed vessel. Papas Theodorou was the only man lost when the ship finally settled. The last man to leave the vessel—without aid of a life preserver and wearied by his continuous efforts at securing assistance—he was an easy victim for a rough sea. The Marconi Memorial Medal of Valor will be presented at the Dinner to the Consul-General of Greece, Mr. Nicholas Lely, to be forwarded to the family of Papas Theodorou.

A feature of the evening will be a broadcast over the coast-to-coast network of the National Broadcasting Company networks during which the dinner will receive the annual message of greeting from our Honorary President, Dr. Lee de Forest, who will speak from Hollywood, his home.

Tickets for the Dinner are $4.00 payable in advance. A grand dinner including a Martini cocktail and a splendid evening of entertainment and good fellowship makes this event one worth while attending. Many are the old friends who meet at these Cruises after a lapse of many years. That alone is sufficient reason for being with us.

VWOA will have headquarters at the Hotel Astor Monday, Tuesday and Wednesday, February 19, 20 and 21, all through the day. Come up and see us.

DeForest Message

Dr. Lee de Forrest's message to the Fifteenth Anniversary Dinner-Cruise of the Veteran Wireless Operators Association, February 21, 1940:

"Fellow Veterans of the Wireless:

"Perhaps it is merely because the old word is become archaic, faded in obsolescence, that we few survivors of the dark, spark era—love to hear it spoken, delight to pronounce it slowly, affectionately—WIRELESS.

"Somehow WIRELESS sounds to our ears more personal, more like the name of a dear old friend, long dead and gone, but whose name awakens from the faded cells of memory, half-forgotten recollections, of antique ships long ago sunk to Davy Jones, the square-jawed, hard-bitten Old Man who chewed Old Honest and eschewed Old Gold—the echoing crash of an unmuffled spark gap, the pungent smell of nitrous oxide, the abbreviated profanity when a Limey jammed your call—

"Yes — WIRELESS was the name we knew and loved and worshipped like an ancient idol by which we lived and earned our livelihood—while that modern word of Science, RADIO, too generic, too Broadcasty, lacks that personal tang which, some way, will always be associated with our brave youth, when our world was young, and we Veterans sailed the seas of sunrise.

"And so I pledge you all on this present Cruise to drink again to the old love, the old world and the old word, WIRELESS.

"It was in that spirit of resurrection of ancient days and renewing of half-forgotten comradeships that so many of us thrilled last September to the unique joy of such a reunion of Veterans of the brass keys afloat and ships' antenna as never before was known in all the History of Wireless.

"There many a long buried earth-plate was exhumed, many a bending mast or sagging spar found itself straightened, separated shipmates reunited after stormy seas —old handclasps felt again, reviving ties of friendships which had long been frayed or parted.

"My own recollection of that night, never to be forgotten, recalls a thousand earlier memories of distant days, when many of those there present had helped to fashion and make staunch that queer, rakish craft so newly launched to sail the Hertzian waves.

"Judging by today's highly technical standards, that was a motley crew, who knew precious little of the laws of the new Navigation, whose compass was the galena crystal and the Pickard direction loop, their tiller the cat's whisker; whose lantern soon became the Audion bulb, and whose uncanny selectivity of ear made up for almost total lack of selectivity by tuning. But withall, that Veteran crew could fire deadly broadsides from 5-kw sparks; and on occasion fly the Jolly Roger in flagrant defiance of all International Wireless Regulations.

"Ah, those were the days of the Wireless—now 'gone with the wind' from the F. C. C.—as dead as the Civil War. But on that one night (de Forest day banquet —Ed.), at the Sulgrave Club, American Wireless made merry in Merrie England. And conjured up once more from the forgotten past priceless memories—of youthful days long dead, whose reciting made pleasant recollection.

"So you will pardon me if I attempt here to express, as best I can, the heart-felt, heart-deep appreciation which that occasion ('De Forest Day') at the World's Fair aroused within me. As Bill McGonigle's perfect radio voice intoned slowly, impressively, the words upon that Scroll of Honor, I felt, as I had never felt before, can never again feel, the profound significance of what Radio has accomplished for this world of man—and a sense of pride that I had been privileged to play a significant part in its founding and establishment.

"I have hesitated to say all this to you. But I have no hesitation—save that due to my utter inability to express—in telling you now, you Veteran Wireless Operators, how deeply indebted am I to you all for the compelling part which you and your fine organization played in conceiving and arranging the bestowal of those honors. For I prize that Scroll as the highest Honor ever received.

"If my pioneer efforts in Wireless have seemed to deserve all this I can do no more than to express to you now, to each and every one of you, and to your Organization, the deepest, the most sincere, and the friendliest appreciation of which my heart is capable.

"I am proud to have been a pioneer in Wireless, to have aided and watched it grow from a tiny, bitter acorn to the mighty oak whose wide-spread branches now encircle and entwine the world.

"But above all tonight am I proud to be a member and Honorary President of the Veteran Wireless Operators Association, and to realize not only the honors you have given me, but also (as I believe) the friendly affection with which you continue to regard me; and which I so warmly feel for you all.

"And in parting for another year may I point out that 1940 is an anniversary year in which all Wireless men may take legitimate pride. For 25 years ago for the first time, speaking over a chain of audions, which undisputably was a product of earlier Wireless development, the human voice was first transmitted across our continent. Only by that instrumentality am I enabled to speak to you tonight.

'73'

LEE DE FOREST.

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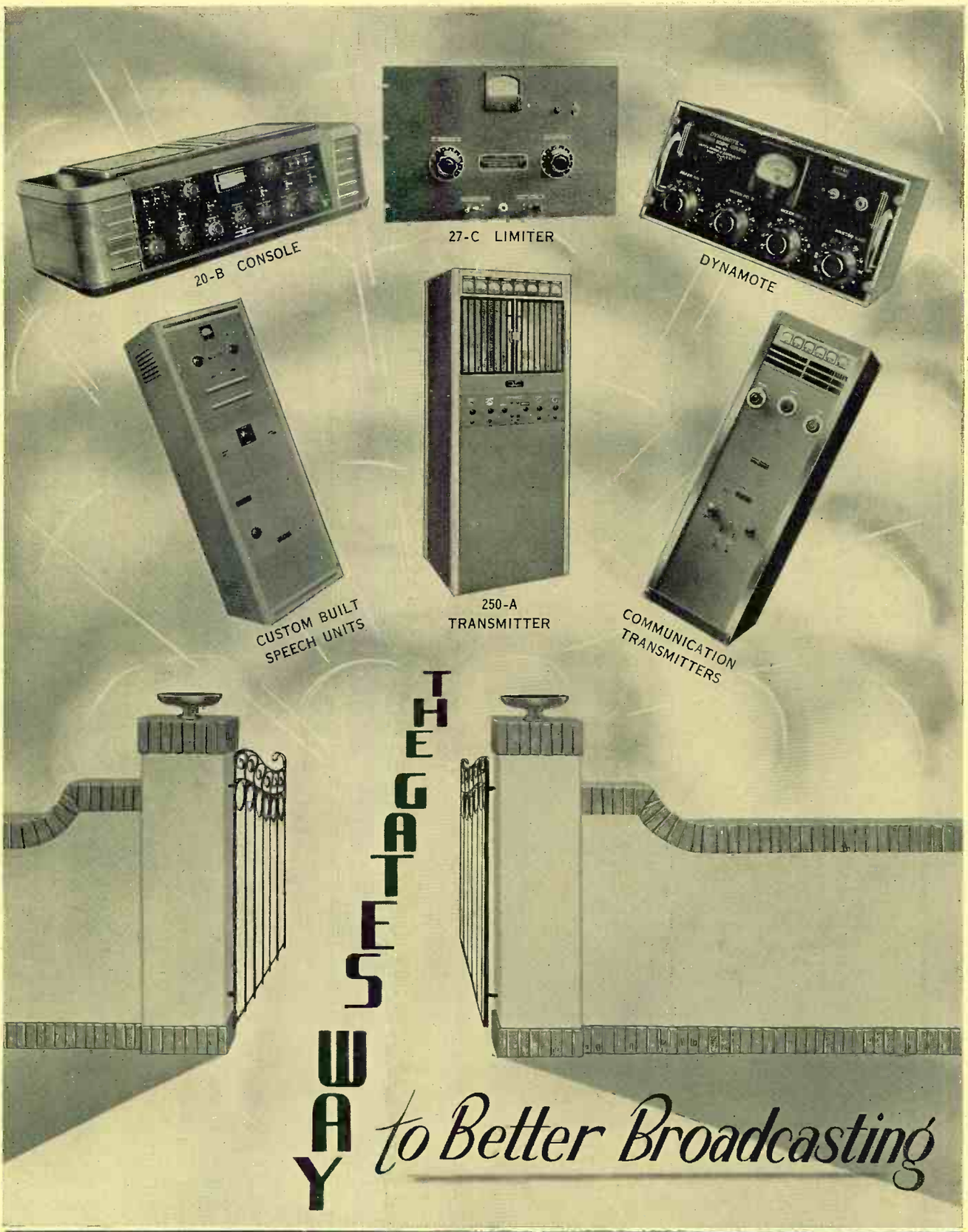

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