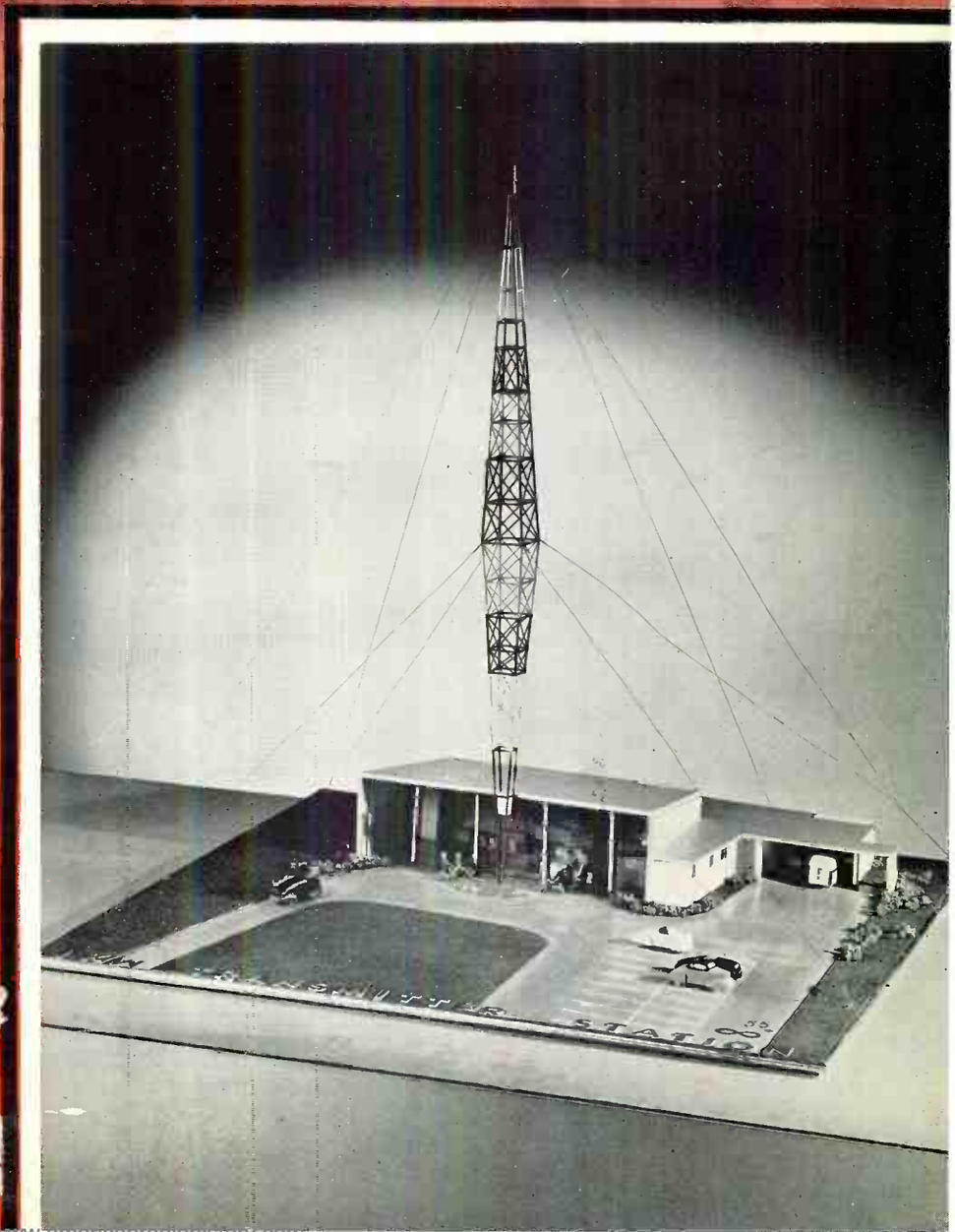
COMMUNICATIONS

NAB, IRE CONVENTIONS

U-H-F ANTENNAS

TELEVISION



JULY

1940

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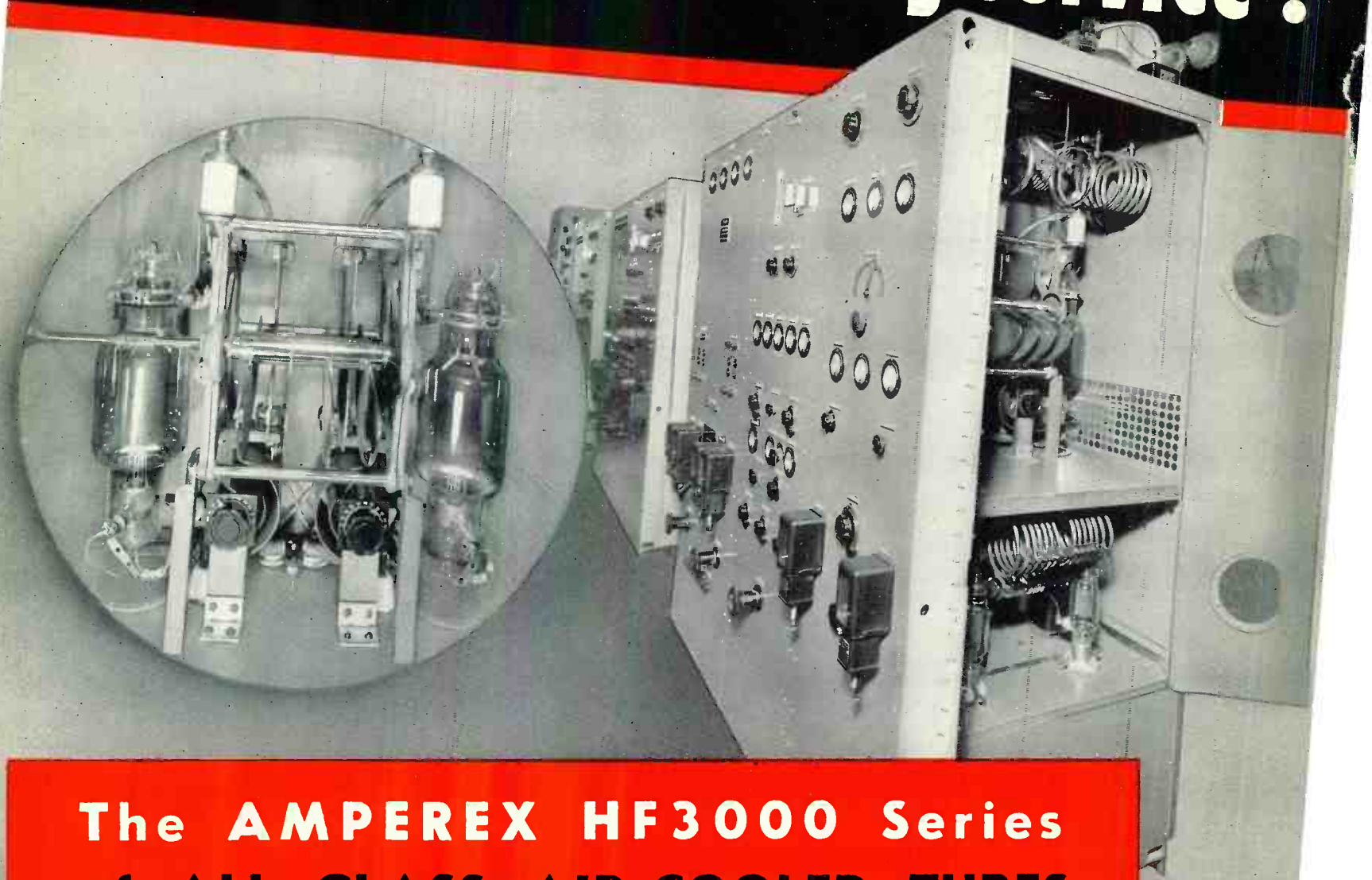

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COMMUNICATIONS

JULY 1940

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VOLUME 20
NUMBER 7

RAY D. RETTENMEYER
Editor

•Contents•

COVER ILLUSTRATION

Shown on the front cover is a model of a prize-winning structure for housing a 1000-watt broadcast station. It was selected out of a field of 91 entries to a national competition held by the Beaux-Arts Institute of Design and sponsored by the Western Electric Co. The winner: Louis Schulman of New York University; the jury: Ralph Walker (of Voorhees, Walker, Foley & Smith), Ely Jacques Kahn, Alfred Fellheimer (Fellheimer & Wagner), J. Andre Fouilhoux (Harrison & Fouilhoux), and J. R. Poppele (chief engineer, WOR).

•Editorial Comment•

IT is interesting to note that the Federal Communications Commission, under the coordinated defense program, plans to maintain a comprehensive 24-hour watch of all communication channels. To make this policing effective, the Commission will augment its field force by the addition of fixed monitoring stations as well as new bases for the operation of their mobile equipment. Present radio monitoring facilities will also be supplemented with ten long-range direction-finder stations.

According to the FCC, the field division, in addition to increased monitoring duties, will be required to watch radiotelegraph and radiotelephone circuits for superfluous signals and to translate foreign language broadcasts. It further intends to check the citizenship of several hundred thousand persons now charged with the responsibility of communications. This figure covers about 100,000 licensed radio operators, a like number of cable and wire operators, as well as communications employees who handle official dispatches and other government messages.

IT is understood that President Roosevelt may soon set up a Communications Defense Board to coordinate the entire communications industry during the present emergency. If such a committee should be established, it could, with the proper personnel, cooperate advantageously with the National Defense Commission. We believe that the communications industry is destined to play a vital role in our preparations for national defense.

THE annual convention of the Institute of Radio Engineers, recently held in Boston, was a distinct success. While we have no official figures regarding the registration, the meetings were well attended and proved to be exceptionally interesting.

While on the subject of conventions, we should like to call attention to two other gatherings soon to take place: the Eighteenth Annual Convention of the National Association of Broadcasters, and the Pacific Coast Convention of the Institute of Radio Engineers. A few of the highlights of the former meeting will be found on page 6 of this issue, the technical program for the latter gathering appears on page 10.

BRYAN S. DAVIS, President
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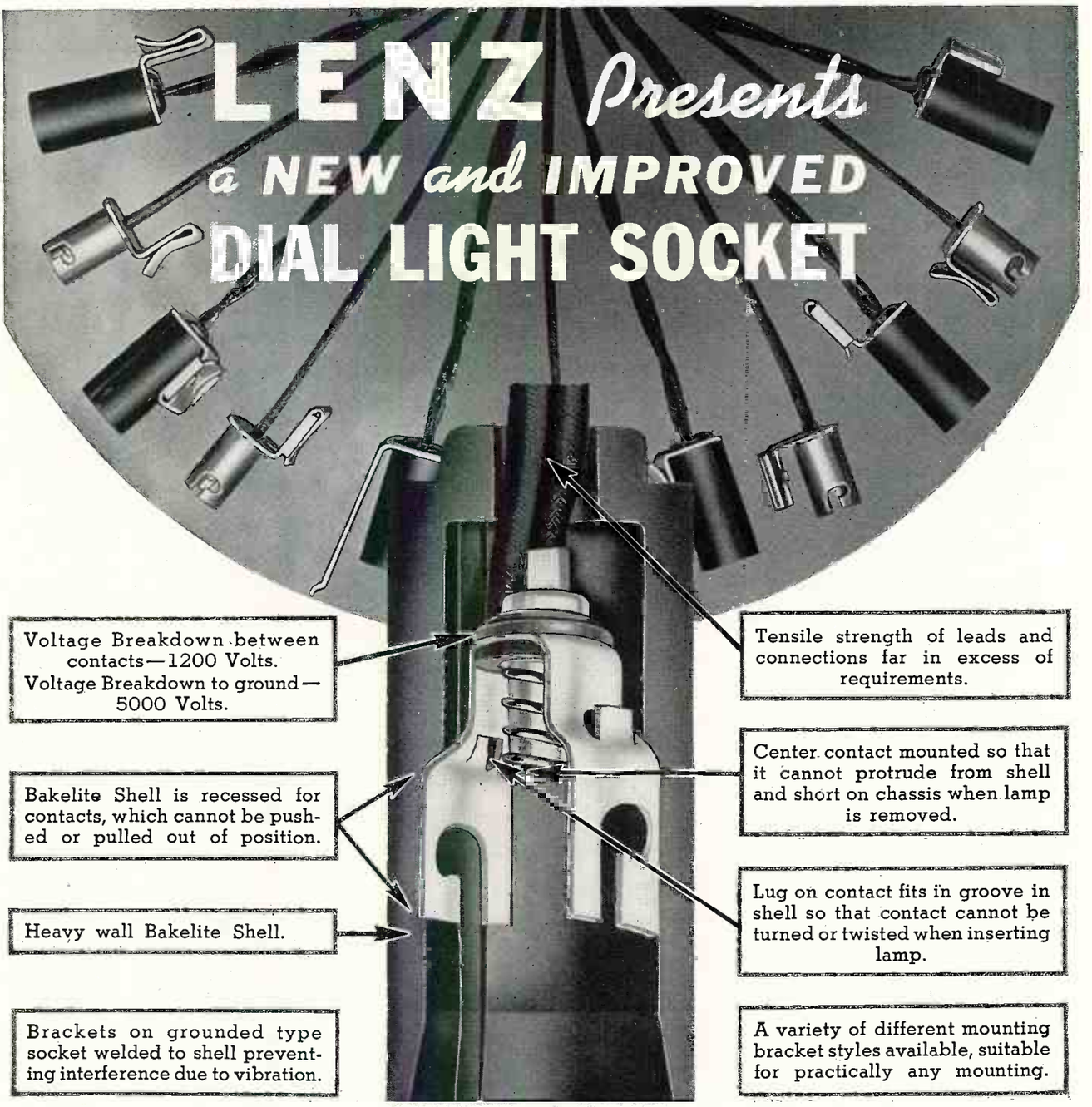

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AN ULTRA-HIGH-FREQUENCY ANTENNA of Simple Construction

By GEORGE H. BROWN & J. EPSTEIN
RCA Manufacturing Co., Inc.
(*Camden, N. J.*)

I. Introduction

DURING the summer of 1936, the writers undertook an investigation of ultra-high-frequency transmitting antennas of simple construction. Several of the conventional antennas, such as the "J" antenna and the "Zeppelin" antenna, were tested. It was soon found that two difficulties were present in most of the simple and popular types. First, the transmission line was seldom properly terminated. While the resulting standing wave on the transmission line was not serious from a power loss standpoint where the transmission line was not of great length, it did make the adjustment of the transmitter rather critical. Second, the concentric feed line was exposed to high radio-frequency fields from the antenna, with the consequent flow of current on the *outside* of the concentric feed line. This current flow caused power to be radiated at various odd angles, wasted much of the power by radiation upward, and greatly distorted the horizontal radiation pattern.

Fig. 1-a shows the current measured along the antenna and on the outside of the concentric feed line of a closed "J" antenna, while Fig. 1-b shows a similar distribution for a sleeve antenna arrangement tested at the same time.

At this time, the writers became familiar with the necessary steps to secure an efficient antenna. In particular, the beneficial results of using horizontal quarter-wave rods below a vertical antenna to establish a ground plane and shield the feed line from high-intensity fields were discovered.

The ideas formulated at this time were incorporated in the design of a new type of antenna, the first model of which was built and tested late in 1938.

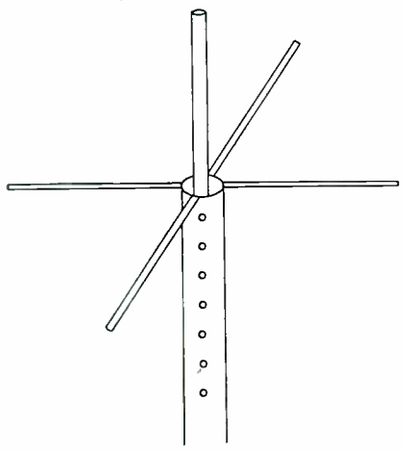
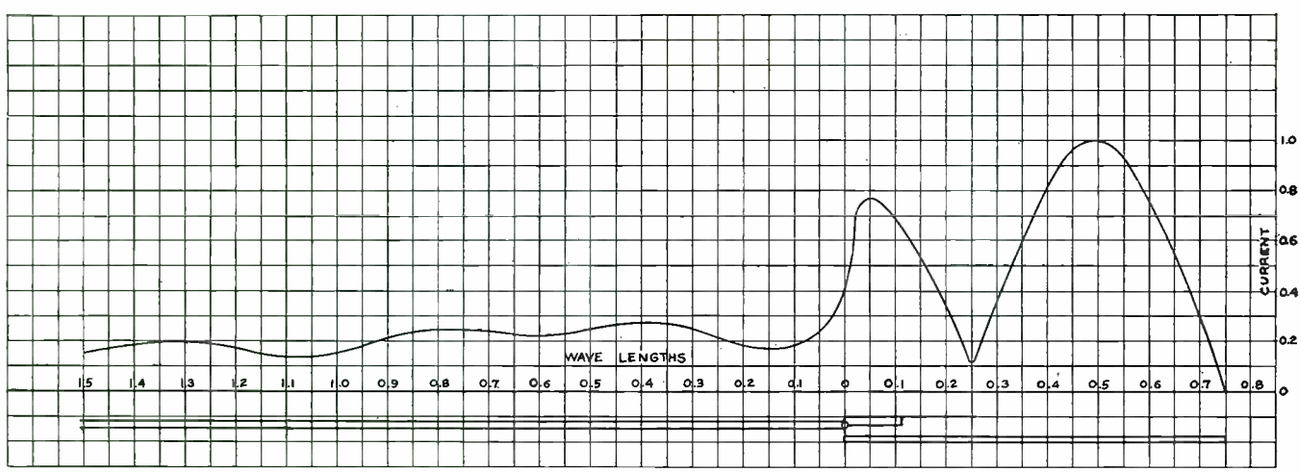


Fig. 2. The elementary antenna arrangement.

Fig. 1-a. Current distribution on the outside of the concentric feed line of a "J" antenna.

II. Electrical and Mechanical Details

The antenna is simply a vertical quarter-wave radiator supported above four horizontal ground rods. These ground rods are each one-quarter wave long, equally spaced in the horizontal plane, and fastened to the outer conductor of the concentric feed line. Fig. 2 shows this antenna in its simplest form. An arrangement similar to that of Fig. 2 was set up. Impedance measurements were made by inserting a probe voltmeter through the holes in the outer conductor of the transmission line. These impedance measurements showed that the antenna resistance, with four horizontal ground rods, was approxi-



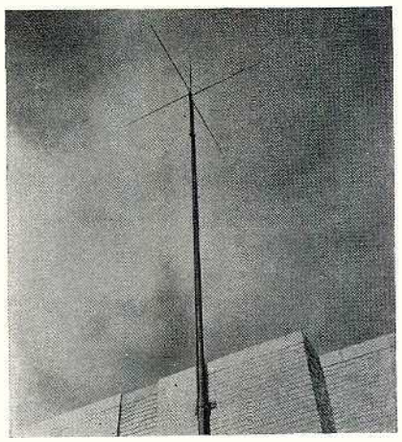


Fig. 4. The MI-7823 antenna installed at WCAU, Philadelphia.

mately 21.0 ohms. It was also found that the reactive component was negligible when the antenna was exactly one-quarter wave long.

It can be shown that the theoretical resistance of this arrangement is given by

$$R = 60 \int_{Z=0}^{Z=\lambda/4} \left\{ \frac{5}{8} \frac{\sin k(a-Z)}{a-Z} \cos kZ + \frac{3}{4} \frac{\cos^2 kZ}{Z} - \frac{3}{4} \frac{a}{Z\sqrt{a^2+Z^2}} \sin k\sqrt{a^2+Z^2} \cos kZ - \frac{1}{8} \frac{\sin k(a+Z)}{a+Z} \cos kZ \right\} dZ \quad \ldots\ldots\ldots\ldots (1)$$

where λ = the wave length
$a = \lambda/4$
$k = 2\pi/\lambda$

When this integral is evaluated, it is found that

$$R = 21.159 \text{ ohms} \quad \ldots\ldots\ldots\ldots (2)$$

The reactance of the system is

$$X = 60 \int_{Z=0}^{Z=\lambda/4} \left\{ \frac{5}{8} \frac{\cos k(a-Z)}{a-Z} \cos kZ - \frac{3}{4} \frac{\sin kZ \cos kZ}{Z} - \frac{3}{4} \frac{a}{Z\sqrt{a^2+Z^2}} \cos k\sqrt{a^2+Z^2} \cos kZ - \frac{1}{8} \frac{\cos k(a+Z)}{a+Z} \cos kZ \right\} dZ \quad \ldots\ldots\ldots\ldots (3)$$

or

$$X = +1.33 \text{ ohms} \quad \ldots\ldots\ldots\ldots (4)$$

Observations were made of the effect of varying the lengths of the horizontal rods. They were found to be fairly non-critical in length, both as to the effect on impedance and as to the efficiency of shielding the outer conductor of the feed line.

Since the antenna resistance is 21.0 ohms, a rather large standing wave would exist on the feed line if this feed line had a characteristic impedance of say 65 ohms. If the characteristic impedance in the quarter-wave of line closest to the antenna is made to be

$$\sqrt{21.0 \times 65} \text{ or } 37.0 \text{ ohms},$$

the remainder of the feed line will then be perfectly terminated. This method was used to match the antenna to the feed line.

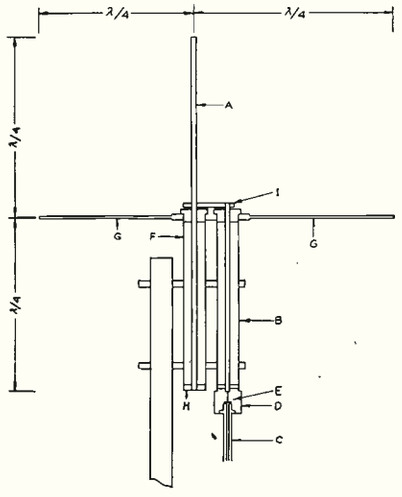


Fig. 3. The mechanical arrangement of the MI-7823 ultra-high-frequency antenna.

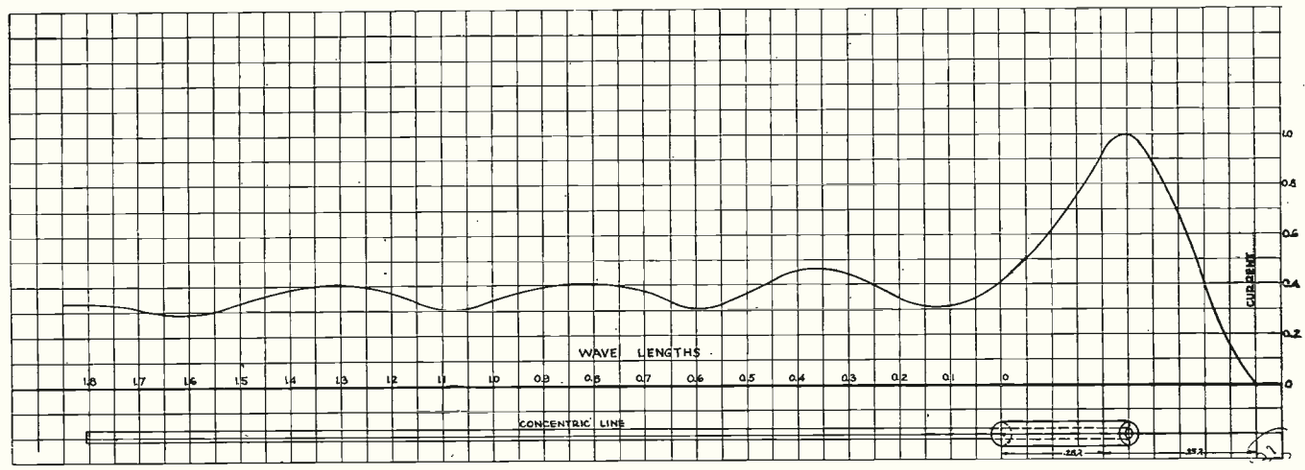
Fig. 1-b. Current distribution on the outside of the concentric feed line of a "Sleeve" antenna.

The actual mechanical construction is shown in Fig. 3. The antenna, A, and the horizontal ground rods, G, are each one-quarter wave long. The 37-ohm section of line to effect the proper impedance transfer is marked B, and is incorporated in the antenna structure. The transmission line, C, enters a junction box, D, and is connected to the transformer by a pigtail, E. The supporting section, F, is made one-quarter wave long, with a metal shorting plug at H. Thus, this section places a very high impedance across the base of the antenna and does not affect the operation of the antenna. The principal reason for including the section, F, is to provide a rugged mechanical support for the antenna. At the same time, this section effectively grounds the antenna to static charges.

One of the first antennas of the construction shown in Fig. 3 was installed at the ultra-high-frequency transmitter of WCAU, Philadelphia. This installation is shown in Fig. 4.

III. Structural Modifications

As our experience with this antenna grew, means of simplifying the construction of the antenna became appar-



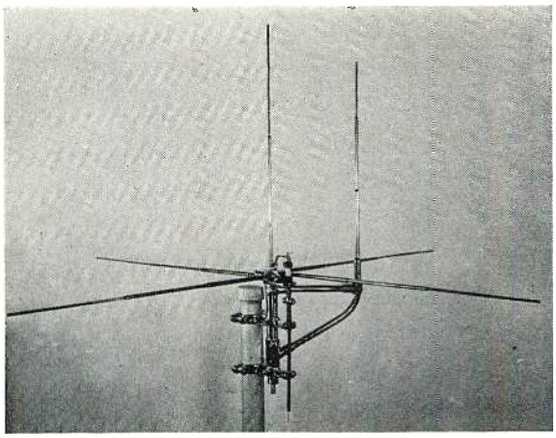
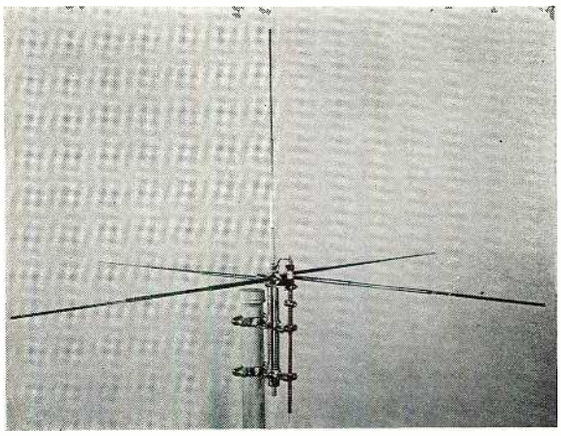


Fig. 6. (Left) The MI-7823A antenna with a reflector.

Fig 5. (Right) The MI-7823A antenna.



ent. The quarter-wave transformer, B, in Fig. 3, was discarded, and the concentric feed line was extended so that the end-seal of the line came at the point marked I in Fig. 3. The antenna length was shortened slightly, and the section, F, was shortened so that it was now about one-sixth wave long. Under this condition, the antenna impedance is 19.0-j29.5 ohms. The impedance of the section F is j42.0 ohms. Then since the parallel combination impedance offered to the transmission line is

$$\frac{j42.0(19.0 - j29.5)}{19.0 - j29.5 + j42.0} = 65.0 \text{ ohms},$$

the transmission line is still perfectly terminated. This new antenna arrangement is shown in Fig. 5.

The flexibility of the new matching arrangement made possible still further improvements. A parasitic closely-spaced reflector was placed on the antenna, as shown in Fig. 6. Since this reflector reacted on the main antenna, the line was no longer fully matched. A slight change in antenna length and in the length of the section F remedied this situation. If the new method of matching had not been used, it would have become necessary to use a very low characteristic impedance quarter-wave transformer.

Fig. 7 shows a horizontal radiation pattern obtained with a single reflector. The unit circle indicates the field intensity obtained from the antenna without the reflector, but fed with the same power.

IV. Frequency Characteristics

For stability of operation, an ultra-high-frequency antenna should offer a transmission line termination which does not change rapidly in the region of the frequency of operation. To determine the frequency characteristics of these antennas, the ratio of minimum voltage to maximum voltage on the feed line were measured for a number of frequencies on either side of the operating frequency. For a ratio of unity, the transmission line is perfectly matched. The results of these measurements are shown in Fig. 8. These curves show that all versions of the antenna have an impedance-frequency characteristic which is suitable for even the wide frequency bands used in frequency-modulation transmission.

Fig. 7. The horizontal radiation pattern of an MI-7823A antenna with a reflector.

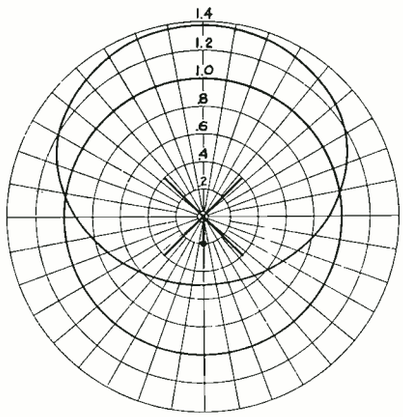
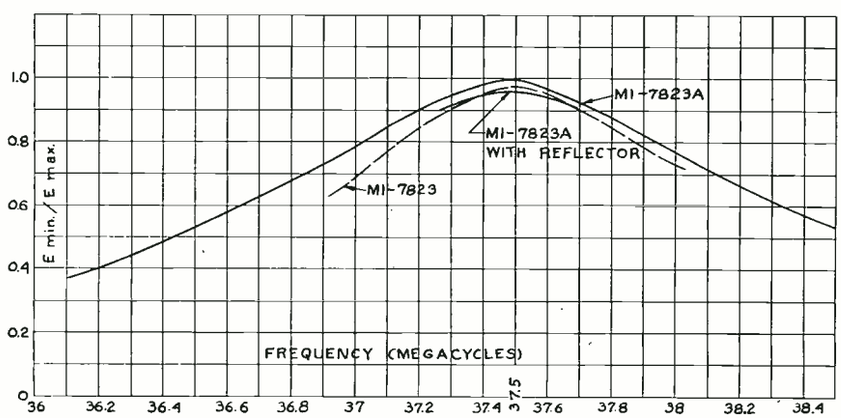


Fig. 8. Standing wave ratios versus frequency of the MI-7823 and the MI-7823A with and without a reflector.



V. Conclusion

Laboratory and field tests, as well as experience with a great number of installations in the field, both in police and broadcast use, show that the antenna is efficient and of practical design. The chief advantages of the antenna are:

(1) The antenna is simple and rugged from a mechanical standpoint.

(2) Field adjustments are not required.

(3) The transmission line is properly terminated.

(4) The concentric feed line is not exposed to high frequency fields. Since currents are not set up on the outside of the concentric line, wasteful radiation from this source does not occur.

(5) The antenna is grounded. Thus partial protection from lightning is provided. This ground also provides an essential static drain when the antenna is used for reception purposes.

CONVENTION

NATIONAL ASSOCIATION OF BROADCASTERS

August 4, 5, 6, 7—St. Francis Hotel

San Francisco, Calif.

THE plans for the Eighteenth Annual Convention of the National Association of Broadcasters are practically complete. This gathering, which is to be held at the St. Francis Hotel, San Francisco, Calif., from August 4 to 7, inclusive, promises to be of considerable importance. In urging stations to be represented, Neville Miller, NAB President, stated:

"The problems which radio faced in the past pale in comparison with those it faces in 1940. We are in an emergency period. New problems, technical, social and commercial confront us. We are setting up a convention program designed to make this a well-informed industry, to give opportunity for all views to be expressed, evaluated and compared before final action is taken. What is done at San Francisco this August will shape the course of broadcasting for possibly years ahead. . . ."

Among those scheduled to address the broadcasters are Louis Johnson, Assistant Secretary of War, Dr. Frank Kingdon, Executive Director of the Citizenship Educational Service, and Federal Communications Commission Chairman James L. Fly. Mr. Johnson will speak on the national emergency and its possible effect on the American system of broadcasting. In light of the national defense program and the increasing social responsibility which station managers must assume, as problems of propaganda and so-called Fifth Column activities become more complex, Dr. Kingdon has been asked to draw upon his own and the experience of those affiliated groups to bring the industry a backlog of usable information.

A comprehensive report on BMI and a complete review of the NAB Code are features of an agenda which includes analyses of the labor situation, the A. F. of M., wages and hours, a full review of f-m, reports covering legislative matters and the relations of the industry with government and advertisers.

Featured in the commercial phase of the convention will be the introduction of the Bureau of Radio Advertising's plan for an industry measurement of the volume of radio advertising by cities and by classification of account. This has been a service long in demand by agency time buyers. A contingent of space buyers from New York and Chicago are already making plans to be present. Advertising executives on the West Coast will also be present. They will be invited to take part in round-table discussions with the Bureau and the Sales Managers' group, to review common problems of commercial broadcasting.

Of wide public and industry interest will be a panel discussion on the problems of special events broadcasting, with particular reference to coverage of the war and the handling of political broadcasting, to be presided over by Mark Ethridge, WHAS. Taking part in the discussion will be Paul White, director of special events of CBS; Abe Schechter, director of special events of NBC; Van C. Newkirk, in charge of special events for KHJ-Mutual on the Coast, and Herb Hollister of KFBI.

In conjunction with the convention there will be meetings of the independent and IRNA groups and f-m broadcasters. The Board of Directors will hold its annual meeting on August 4. On the same day, the Code Compliance Committee will be in session to receive recommendations from members.

While the general tone of the gathering is serious, there will undoubtedly be excellent opportunities for fraternizing with friends and fellow members. In addition one night will be spent at the Exposition on Treasure Island.

On the eve of the NAB Convention, August 3, the San Francisco and New York World's Fairs will join together in a radio program to convey the thanks of listeners to the broadcasters of the country for outstanding public service rendered. At special ceremonies held on both Fair grounds, to be witnessed by distinguished men and women from all walks of life, plaques will be unveiled in dedication to the freedom of American radio.

All in all, this convention may well be one of the most outstanding gatherings in the history of the NAB. It is felt that all the broadcasters who can attend will be well repaid.

Fundamentals of

TELEVISION ENGINEERING

Part X (conclusion): Promising Developments

By F. ALTON EVEREST
Department of Electrical Engineering
OREGON STATE COLLEGE

IT SEEMS particularly appropriate to consider, on the very threshold of commercial television, some of the recent developments which, at the present time, appear to hold much promise for the future. The author claims absolutely no "crystal ball" powers of prophecy, but there are several devices which have recently come into existence which would seem to make their future assured, and which are bound to influence the development of television. There are scores of such promising inventions, but only a few typical ones will be discussed in this, the concluding instalment of this series.

Attaining Larger Images

Many careful studies have been made to determine the optimum size of the image at the receiver. This size is limited on the one hand by the obvious fact that the image must be large enough to be viewed comfortably by the usual family group without eyestrain or crowding. There is a very definite upper limit in image size, however, beyond which it is impractical to go. A ten-foot image in the usual living room would be ridiculous. In between these two extremes is an optimum size which, undoubtedly is larger than the largest images now available on conventional cathode-ray tubes in this country. It is therefore natural that we look for advances in this direction.

Wide-Angle Cathode-Ray Tubes

The first thought in enlarging the received images would be to make the cathode-ray tubes larger. Keeping the usual proportions results in very long, bulky tubes. Some work on this problem has been done abroad with the results such as pictured in Fig. 1. The tubes are made short enough to fit into table-model cabinets horizontally, yet, by the use of larger deflection angles, to obtain an image that is considerably larger than those obtained previously. The problem of retaining suitable spot focus out to the edge of the screen is no small one, and yet the results reported indicate that even this problem can be solved. Magnetic focus and magnetic deflection are invariably used in this type of tube. This type of tube would apparently hold much promise for the less expensive sets which must meet the inevitable demand for larger images.

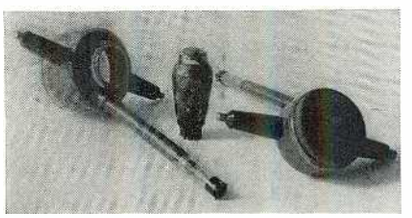
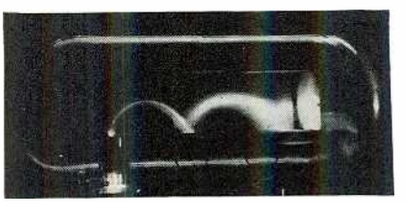


Fig. 2. (Above) Two views of small cathode-ray projection tube . . . compare with vacuum tube at center. (Fernseh)

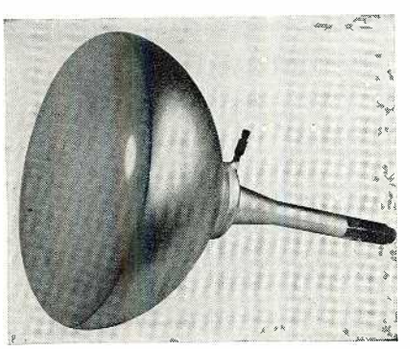
Fig. 6. (Below) An RCA electron multiplier. Electron paths made visible by introduction of gas.



Small Projection Tubes

Demonstrations have been given in this country of large cathode-ray arrangements using second anode potentials of 40 kilovolts or more, which produce a small image having an intensity suitable for theatre projection by means of a conventional optical system.

Fig. 1. Italian (Safar) tube for television reception. Magnetic deflection and focusing are used.



These tubes will probably find a definite service for presentation of television images to large audiences. In Germany, however, they have experimented in the use of this principle in the production of modest sized images for home receivers. A photograph of such a tube developed by Fernseh A. G. is shown in Fig. 2. A polished glass window provides for the external optical system which enlarges the image and casts it onto a rear-projection type of screen. To conserve light, these screens are usually of the directional type which throw the bulk of the light perpendicular to the plane of the screen toward the observers. A folding screen of a size comparable to a home motion picture screen could be built into the receiver.

Light Relay Tubes

The ideal large-screen receiver is one having some device which controls a local light source, thus eliminating fluorescent screen deterioration and other similar effects influencing, in an expensive way, the life of the device. The solution of this problem might be forthcoming in a very interesting form of crystal light relay.

It has been known for many years that certain crystals would rotate the plane of polarization of light passing through them when an electric field was present parallel to the direction of light travel. Later considerable work was done[1] in investigating the magnitude of electrostatic fields that could be produced between the faces of a crystal by the bombardment of one face by an electron beam with the resulting secondary emission from the face. As the crystal, such as zincblend[2], is an insulator, the high electrostatic charge due to the loss of secondary electrons remains on the spot that was bombarded by the beam.

Fig. 3 shows one of several possible arrangements for utilizing the electro-optical effects of these crystals. The zincblend plate having a transparent conducting coating on the rear and a very fine screen some distance from the front face of the crystal is mounted within an evacuated envelope which also houses a conventional electron gun and

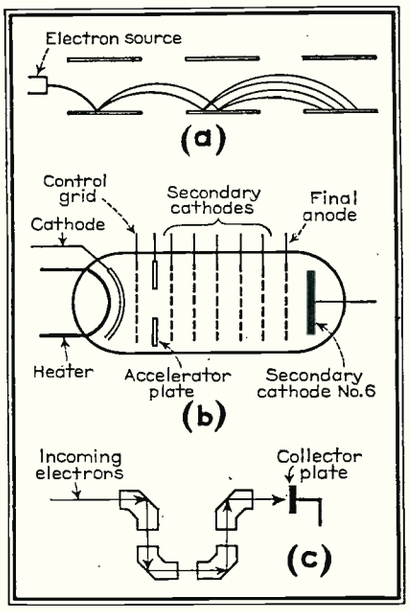


Fig. 5. Sketches of three common types of electron multipliers. (a) plate type, (b) screen type, (c) tubular type.

deflection system trained upon the crystal plate. The high velocity electrons comprising the electron beam pass through the meshes of the screen and strike the crystal with a velocity dependent upon the second anode potential. This electron energy is imparted to the crystal surface resulting in a stream of secondary electrons being knocked off. These are immediately attracted to the screen which, with the transparent conducting coating are bonded to the coating within the tube. This loss of electrons from the spot being bombarded will result in a high charge between the two faces of the crystal. This effect is a local one because the charges cannot leak off due to the high insulating properties of the crystal. The light from the light source passes through two polarizing discs crossed so that no light normally passes through. At this spot under bombardment, however, the potential gradient between the two faces of the crystal causes the plane of polarization of the light to be rotated, resulting in light being allowed to pass through the spot being bombarded, the amount of light depending upon the density of the electrons in the beam. The beam density can be very easily controlled by the control-grid potential of the electron gun which, of course, would be the video signal from the television receiver. In this manner the electron beam intensity would vary from picture element to picture element along each line and from line to line, resulting in an electric potential picture being set up over the face of the crystal. This picture, through the medium of polarization, allows the light from the projection lamp to throw an enlarged image upon the screen.

The potential distributions over the face of the crystal at the end of the frame must be equalized to make ready for the next frame or field. This process may be carried out in a number of ways, one of which would be spraying the crystal plate with a beam of slow electrons which would supply electrons to the face of the crystal, discharging the picture elements and preparing it for another frame.

There are many other arrangements of this particular type of light relay and there are several other types[3] which

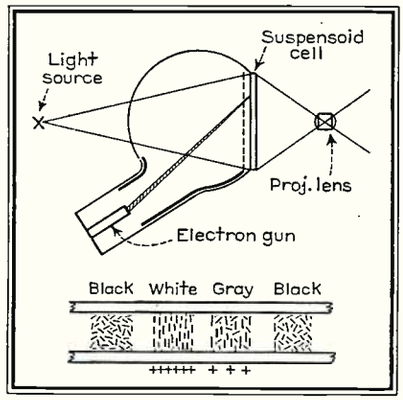


Fig. 4. Sketch of suspensoid cell utilizing electro-mechanical effect of colloidal graphite as a light relay.

hold out some promise. One other type that will be mentioned is the colloidal graphite light relay which has not yet been developed to the point of the zincblend relay. Colloidal graphite is a suspension of highly purified graphite particles, the flakes of which are relatively flat and thin. Normally these flakes are arranged at random rendering the liquid opaque. If an electric field is applied between two faces of a vessel containing colloidal graphite, the flakes tend to line up with the field, making the liquid semi-transparent. The greater the potential applied, the more transparent the liquid becomes. When the potential is removed, the flakes return to their random positions at a speed dependent upon the Brownian motion of the liquid. This can be adjusted to be approximately 1/60 second so that at the expiration of one field, the relay is ready for the next. The potential distribution could possibly be obtained in a manner similar to that of the zincblend relay arranged as in Fig. 4.

This resume by no means exhausts the possibilities of this type of light relay, but, as intended, it merely introduces the subject to readers interested in television, as it seems quite probable that cells similar to these will be common in the future.

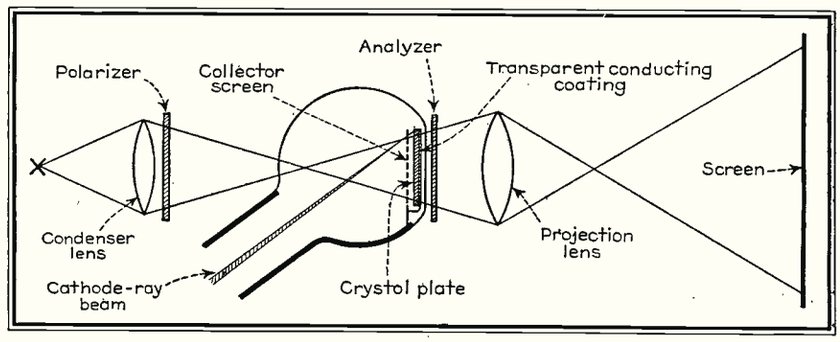
Electron Multipliers

Another device that promises great things in the communication field is the electron multiplier. Research laboratories throughout the world have been interested in developing this infant of the electronic family. The basic principle underlying electron multiplication is that of secondary emission. A moderately fast moving electron colliding with a specially treated surface may knock off one to five other electrons, the exact number being determined by the electron speed, the type of surface, and other factors.

The multiplier of Fig. 5-a utilizes both an electromagnetic and electrostatic field to cause the electrons to stay in the proper path. The successive treated plates are at progressively higher potentials, attracting the electrons liberated from the preceding plate. An electromagnetic field is adjusted until its strength is sufficient to bend the electron beam so that it hits the plate in the proper place. The photograph of Fig. 6 shows a demonstration multiplier of this type in action. The electron paths are made visible by the introduction of a small amount of gas into the tube. The necessity of a magnetic system would appear to be a disadvantage.

(*Continued on page* 18)

Fig. 3. Large-screen television light relay which depends upon the fact that certain crystals rotate the plane of polarization of light passing through them an amount depending upon the electrostatic potential existing between the faces of the crystal. Secondary emission from the front face builds up the necessary charges.



SHORT-WAVE AUTO RADIO

By ROBERT G. HERZOG

Editor, Service

SHORT-WAVE reception has finally invaded the automobile. Although converters have been available for quite some time, it is only recently that complete multi-band receivers were offered for installation in the car.

Aside from the possibility of receiving "Europe Direct" in these perilous times, there is the additional feature that storm static may be eliminated by listening to the favorite network's short-wave outlet (if available) and for reception in locations which represent dead spots for the lower frequencies; while up in the mountains, for instance.

Special antennae are used on short waves for optimum pickup and for maximum signal/noise ratio. Remember that as we go up in frequency, ignition and generator noises become much more pronounced. Most ignition systems have a radiation peak around 50 mc (6 meters).

The Philco Model AR9 is a 6-tube, 3-band auto-radio receiver using loktal type tubes. (See circuit.) In addition to the broadcast range from 540 to 1580 kc there are ranges from 5.4 to 10.1 mc and from 11.5 to 12.1 mc.

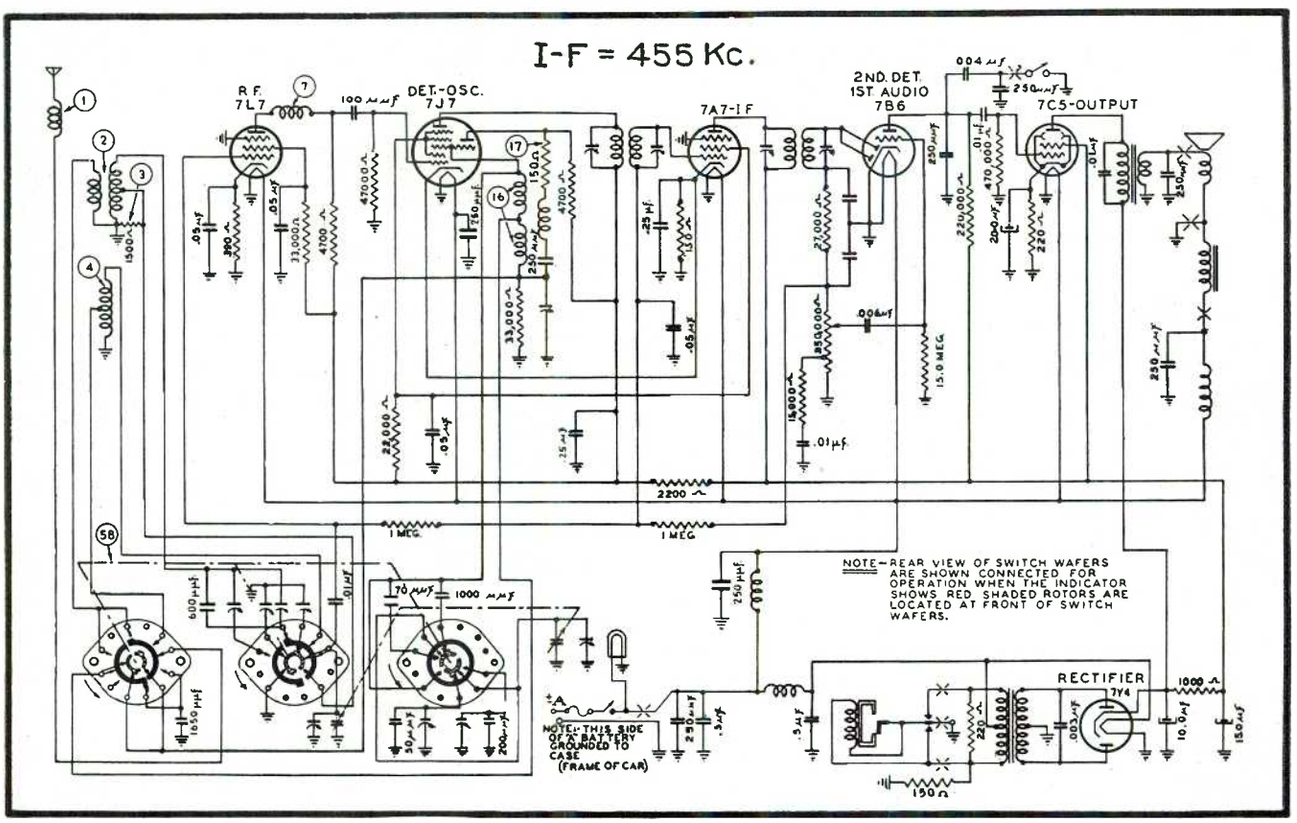
An r-f stage is used for all bands. However, a two-gang condenser suffices since resistance coupling is used for interstage r-f transfer. This method of untuned coupling is more or less permissible in auto sets with the limited voltage picked up on auto antennas. In home sets this stunt would give trouble with cross modulation.

The trimmers are locked against reception of certain police signals. This precaution is necessary since sets capable of receiving these signals are outlawed in some states.

There are two control knobs. One control is the combination on-off switch and volume and tone control. The other control is for tuning and wave change. To change from one band to another it is only necessary to push the proper control in until the proper color dot, for the band desired, appears in a band-indicator window. The tone control is operated by pushing in the other knob. There are two positions: bright and deep.

As mentioned above, it is necessary to add more suppression to the automobile electrical circuits than would be necessary with a standard broadcast-band auto-radio set.

Karadio also offers several all-wave models. Although all are called Model 1079, a choice of any 3-bands is provided among the following six: 150 to 400 kc, 540 to 1600 kc, 1.6 to 4.8 mc, 4.2 to 14.0 mc, 5.6 to 17.0 mc, and 13.5 to 44 mc.



The Philco short-wave auto-radio circuit. This 3-band set uses loktal tubes and operates from 6-volt car battery.

PACIFIC COAST CONVENTION

INSTITUTE OF RADIO ENGINEERS

August 28, 29, 30—Ambassador Hotel

Los Angeles, Calif.

Wednesday, August 28

Morning Session

(1) "Causes of Frequency Variations in Klystron Oscillators," by E. L. Ginzton, W. W. Hansen, R. H. Varian, and J. R. Woodyard, Stanford University, California.

(2) "Ultra-High-Frequency Tubes," by A. V. Haeff, RCA Mfg. Co., Inc., Harrison, N. J.

(3) "Rectilinear Electron Flow in Beams," by J. R. Pierce, Bell Telephone Laboratories, Inc., New York City.

(4) "Propagation of Electromagnetic Waves Inside a Cylindrical Metal Tube and Along Other Types of Guides," by C. P. Hsu and S. S. Mackeown, California Institute of Technology, Pasadena, California.

Afternoon Session

(5) "Measurements of Noise and Vibration," by H. H. Scott, General Radio Co., Cambridge, Massachusetts.

(6) "Distortion Measurements by Fundamental-Suppression Methods," by W. K. Hewlett and David Packard, Hewlett-Packard Company, Palo Alto, California.

(7) "A Resistance-Capacitance Audio-Frequency Oscillator," by G. A. Bretell, California Institute of Technology, Pasadena, California.

(8) "Generation of Square-Wave Voltages at High Frequencies," by W. H. Fenn, University of California, Berkeley, California.

(9) "Design and Test of Sound Equipment by the Intermodulation Method," by J. K. Hilliard, MGM Pictures, Culver City, California.

(10) "Building the World's Farthest-North Commercial Broadcasting Station," by J. W. Wallace, Puget Sound Broadcasting Co., Inc., Seattle. Washington.

Thursday, August 29

Morning Session

(11) "Frequency Modulation," by E. H. Armstrong, Columbia University, New York City. (Address before joint meeting with A. I. E. E.)

(12) "Frequency - Modulated - Wave Broadcast Transmitters," by W. R. David, Radio and Television Department, General Electric Company, Schenectady, N. Y.

(13) "Performance Characteristics of Frequency Modulation in Ultra-High-Frequency Sound Broadcasting," by R. F. Guy, National Broadcasting Co., New York City.

Afternoon Session

(14) "Frequency Modulation Tests and Experience," by M. V. Kiebert, Jr., Jansky and Bailey, Washington, D. C.

(15) "Frequency Modulation Versus Phase Modulation," by C. J. Breitwieser, Lee De Forest Laboratories, Los Angeles, California.

(16) "Loktal - Tube Design and Manufacture," by R. M. Wise, Hygrade Sylvania Corporation, Emporium, Pennsylvania.

(17) "Vacuum Tubes in Chemical Research," by C. J. Penther, and D. J. Pompeo, Shell Development Co., Emeryville, California.

(18) "A Proposal for Reduction of Polarization Errors in Loop Direction Finders," by F. E. Terman, Stanford University, California, and J. M. Pettit, University of California, Berkeley, California.

(19) "Radio Direction Finding for Meteorological Balloons at 1.67 Meters," by L. C. Yuan and S. S. Mackeown, California Institute of Technology, Pasadena, California.

Friday, August 30

Morning Session

(20) "Some Notes on Linear and Grid-Modulated Radio-Frequency Amplifiers," by F. E. Terman, Stanford University, California, and R. R. Buss, Heintz & Kaufman, Ltd., South San Francisco, California.

(21) "A 500 Kilowatt High-Efficiency Broadcast Transmitter," by J. O. Weldon, Weldon Engineering Company, Del Rio, Texas.

(22) "RCA Portable Television Pick-Up Equipment," by G. L. Beers, RCA Manufacturing Co., Inc., Camden, New Jersey.

(23) "Television Receiver Characteristics," by C. F. Wolcott, Gilfillan Brothers, Inc., Los Angeles, California.

(24) "Mutual Acoustic Impedance in Multiple Speaker Systems," by H. S. Knowles, Jensen Radio Manufacturing Company, Chicago, Illinois.

(25) "Portable Television Broadcasting," by Harry R. Lubcke, Don Lee Broadcasting System, Los Angeles, California.

BOOK REVIEWS

ALTERNATING CURRENT BRIDGE METHODS (4th Edition), by B. Hague, published by Pitman Publishing Company, 2 West 45th Street, New York City, 1938, 587 *pages, price* $8.50.

First introduced in 1923, Hague's book on bridges has long been accepted as the most complete and authoritative on this subject. In its fourth edition, the fundamental material has been supplemented to include modern developments in the field so that it is thoroughly up to date in every respect. In this latest edition, 150 pages of new matter has been added, largely devoted to modern practice in bridge measurements, new bridges and the applications of vacuum-tube amplifiers, oscillators and detectors in bridge measurements. Some consideration is given to radio-frequency bridges though, as stated in the first chapter, the book is primarily devoted to measurements which are to be made at audio frequencies.

After a short discussion of the fundamental principles involved in bridge measurements, the theory of alternating currents and their application to bridge measurements are taken up in detail. In the third chapter, the apparatus required for bridge measurements is given extensive consideration. Methods of constructing resistance standards are discussed in detail as well as the points to be observed in building decade boxes.

The requirements of inductance and capacity standards are also given and methods of constructing such standards so that these requirements are most fully met are described.

Following the discussion of standards, the subject of a-c sources is taken up. Interrupter methods, microphone hummers, vacuum-tube oscillators of various types in conjunction with suitable wave-filters and bridge transformers are described.

This chapter closes with a discussion of the various types of detectors, or null indicators, for use with bridges. In this group are included mechanical rectifiers, copper-oxide types, v-t amplifiers and detectors, as well as telephone and vibration galvanometer methods.

Bridge networks of every conceivable type for low-frequency measuements are discussed in the fourth chapter. Each is analyzed and its application is described. Examples of actual measurements with the constants employed are given and sources of error are considered. Valuable advice as to the best practicable arrangement and choice of constants is supplied. Modifications and extensions of familiar bridge circuits, such as Schering's, are described with which measurements at frequencies of up to 1,000,000 cycles may be made. How the Schering bridge may be employed to measure the power factor of oil, and also the recording of small movements, such as the measurement of movement in loaded structures, the displacement of lathe cutting tools are among the unique applications of this bridge method.

The last chapter is devoted to the factors influencing the choice of the bridge method which is to be employed for any given problem and the precautions to be observed in applying the method. In this are included medical and biological applications of bridge methods and in geophysical prospecting. Methods of shielding bridge elements and inter-bridge transformers are discussed in detail.

This handbook is indispensable to any laboratory in which bridge measurements are made. For factory engineers, its value would be enhanced if some consideration were given "limit" bridges so widely used in production processes. J. H. P.

AN INTRODUCTION TO FREQUENCY MODULATION, by John F. Rider, published by John F. Rider Publisher, Inc., 404 *Fourth Ave., New York City,* 136 *pages, price* $1.00.

This book is intended to introduce frequency modulation to the service man. The author confines his attention largely to the receiver, although a graphic picture of what happens at the transmitter and the limitations of ultra-high frequencies are also given.

In addition to covering the most pertinent fundamentals of frequency modulation, the author discusses receiving antennas and the servicing of f-m receivers. Some 32 pages are devoted to the latter subject. Since the art is new and both transmitters and receivers few, the material is necessarily general. It is believed, however, that the data on f-m receiver servicing is covered in sufficient detail to permit the service man to give a good account of himself in this regard until further specific information becomes available.

This book is recommended to all who are interested in the subject of frequency modulation. R. D. R.

THE AMPLIFICATION AND DISTRIBUTION OF SOUND, by A. E. Greenlees, published by Chapman & Hall, Ltd., 11 *Henrietta St., Convent Garden, London, W. C. 2., England,* 1938, 254 *pages, price* 10 *s.* 6*d.*

Intended for the engineer who is interested in the design, application or operation of public address or sound systems generally, this book is written in an elementary and easily understandable style. The use of mathematics, except for occasional reference to elementary laws of electricity is avoided throughout the text. It is copiously illustrated with charts, curves, and diagrams.

The opening chapters are devoted to a review of the fundamentals of electricity. Later such items as chokes, transformers, microphones, loudspeakers, radio receivers, record reproducing equipment and amplifiers are covered in some detail. Performance data is also covered in excellent style. In addition, such items as installation planning, operation and maintenance of equipment, preparation of specifications and general system aspects of sound systems are dealt with fully .

The reviewer was particularly pleased with the chapter on distribution lines and load matching. This subject is treated here in greater detail than in any text known by the reviewer. As an example of the detail in this chapter, some three pages are devoted to the subject of the control of volume by matching transformers. The author also shows how to control the level of various groups of loudspeakers by proper choice of bridging transformers. . . . without the use of relatively cumbersome formulas.

This book is well written and adequately illustrated. It is recommended to all engineers interested in the subject of sound distribution. R. D. R.

AIRCRAFT RADIO AND ELECTRICAL EQUIPMENT, by Howard K. Morgan, published by Pitman Publishing Corporation, 2 W. 45th Street, New York City, 1939, 374 *pages, price* $4.50

This is a timely book on a subject about which little information has been available. It presents in detail data regarding aircraft transmitters, receivers and accessories together with the inspection and maintenance methods used by the TWA. Complete schematics of representative transmitters and receivers are included with the text and each is completely discussed.

An effort has been made to get away from a cut-and-dried engineering presentation, thus widening the usefulness of the book to those who are not technically trained in the subject. The first three chapters are devoted to elementary electrical and radio theory, which are simply and clearly explained.

These chapters are followed by one devoted to accessory equipment for aircraft radio, such as relays, generators, guages, gas analyzers, etc. Next, a chapter in which tubes and amplifiers are discussed is presented and then transmitter fundamentals are taken up. These introductory chapters lead up to a detailed study of commercial aircraft transmitters now in use. Additional chapters are devoted to commercial aircraft receivers, direction-finding and ultra-high-frequency equipment. The troubles which develop in operation and methods of test and repair are discussed in a final chapter.

It is doubtful if many readers who have so little technical background that they require an explanation of electrical theory based on hydraulic analogies can, after studying but fifty pages of text, progress to the point where they are able to work out radio problems involving complex notation, but this sketchy discussion may serve as review material for those who already have some knowledge of the subject. However, for the flyer and mechanic for whom the book is primarily written, the introductory discussion will doubtless be adequate.

The material presented in the chapters on commercial aircraft transmitters and receivers will be of considerable interest to everyone in the radio field, especially so since the international situation is such that a knowledge of such apparatus may become of paramount importance in the near future.

The book is very readable and is written from a practical, rather than an academic viewpoint which makes it far more interesting and informative than the usual text-

(*Continued on page* 19)

TELECOMMUNICATION

PANORAMA OF PROGRESS IN COMMUNICATIONS

RADIO - CONTROLLED SEADROME LIGHTS

RECENT tests of a short-wave control of fluorescent contact lights mounted on doughnut-shaped rubber floats in the Anacostia River (near Washington) seem to indicate that nearly every ocean harbor, lake port, or river in the United States could be turned into a night landing airdrome for seaplanes.

The development of radio-controlled seadrome contact lights was made jointly by engineers of the Westinghouse Electric & Mfg. Co. and the Firestone Tire & Rubber Co., working closely with the Civil Aeronautics Authority. The three groups are reported to have found the right combination to the correct balance between a battery-operated light, a floating unit not hazardous to navigation, and a light control to turn on lights when needed.

The lights may be strung out in lines on water to light a seadrome exactly as boundary and contact lights do on a land airport. The new lights outline the boundary of the landing lanes and the area in which it is safe for seaplanes to land. For larger seadromes it is planned to make several "runways" on the water so that a plane can always land between these lights and into the wind. The lines of light will define several landing lanes, 500 feet wide, at permanent bases where scheduled or extensive operations are necessary.

For temporary or remote bases where portable equipment will be used, one row of lights is considered enough with the plane being instructed to land always to the left of the line. The spacing between making up the line will be about 300 feet. Lanes are planned to be at least 5,000 feet long and twice that if space permits.

Contact lights will be in three colors: red, green and gold. These colors will give the pilot positive indication of his progress down the runway. Two green lights are at the near end, and the remainder of the line will be gold, except two red lights marking the far end.

In addition to the contact lights marking the lanes, seadrome boundary lights which flash red will be floated, about 1,000 feet apart, to warn surface craft that the space inside is restricted for planes. These lights will be kept burning all night for emergency landings.

The light source is a cold-cathode fluorescent lamp about two and a half times as efficient as an ordinary incandescent lamp. It is powered by dry cell batteries which are light in weight and easily replaced. The electrical system has a low battery drain and it is claimed that the steady burning contact light will operate for 60 days, if turned on for a nightly average of five one-hour periods. The flashing red unit, used as a boundary marker, will burn for 2500 hours of continuous operation.

CAA tests of the lights proved that they can be seen from 3 to 4 miles away,

Showing several of the radio-controlled seadrome lights.

depending on the color, on a reasonably clear night. A fresnel lens is used to enclose the bulb and direct the light upwards toward a plane approaching the light. This feature, combined with the stability of the rubber float, makes a light source that does not wink or "shimmy" and appears stationary to the pilot.

The float for the seadrome units is a large rubber doughnut with vertical black and yellow stripes for daytime visibility. Stability of the float in waves up to 6 feet high is practically constant, due to the fact that air pressure is only slightly above atmospheric. The rubber walls are, therefore, extremely flexible, permitting a "jellyfish" action; that is, the physical shape of the float changes to match the shifting stress caused by passing waves. Also the soft rubber walls give when struck by watercraft. Small boats were run at high speed directly into the units to test their durability. In some instances the floats were hit so hard that they disappeared under water but bobbed up undamaged 10 or 15 feet away.

Two types of seadrome lights have been developed. The heavier unit has space for three batteries and is designed to be anchored in place at permanent bases. Its fixture may be removed from the float for servicing on shore. The other unit is portable, has but one battery, and weighs approximately 50 pounds.

Radio control for the lights was perfected after a long period of experimenting. The system developed by Westinghouse radio engineers permits selection of the proper landing lane and the indication of wind direction by the red and green lights. Controls are few and simple so that no technical expert is needed to operate the radio system which is operative up to 6 miles for the seadrome units.

Each light unit has an individual radio receiver mounted inside the metal housing which also includes batteries and control equipment for the fluorescent lamps. Control signals are picked up by a whip antenna also mounted on the unit and similar to that used on many automobiles.

F-M FOR EMERGENCY SERVICE

DOUGLAS County, Nebraska, will soon put into operation one of the first applications in this country of two-way frequency-modulation communication for emergency service. The new system will cover the entire county. Remote control of the 250-watt General Electric frequency-modulation transmitter installed at Clearview, near the center of the county, will be exercised from the sheriff's office at the County Courthouse in Omaha.

The new equipment now makes it possible for the sheriff's office to maintain constant, interference-free communication with mobile units patrolling different sections of the county. Each of these units is equipped with a 25-watt frequency-modulation transmitter.

AIRCRAFT RADIO ASSEMBLY

A NEW radio assembly has been developed by United Air Lines and now is being installed in all the airline's planes. The assembly includes a

switchboard which makes the complete radio facilities of the plane available to the pilots by merely flicking switches and a radio rack which saves 75 to 100 pounds in weight.

Despite the fact radio is an important accessory in air transport operation, no provision is made for it in the construction of transport planes. Thus, the airlines have scattered radio switches at various places in the control cabin and installed radio transmitters, receivers and other apparatus on shelves in the various cargo compartments, or wherever they could find a spot.

The radio switchboard was devised by P. C. Sandretto, superintendent of United's communications laboratory in Chicago. The radio rack was designed by A. F. Trumball, foreman of United's radio electric shop in Cheyenne.

The switchboard, which is as simple to operate as the office telephone switchboard, is a dual output system which simplifies radio operation aloft to the flicking of a switch. It is located on the control column within arm's reach of both pilots. No adjusting is necessary and none of the switches have contingent operation, so that any or all may be operated by one pilot in any combination desired.

The transmitter, the communications receiver, the marker beam receiver, the radio range, the beat oscillator, the directional loop antenna, the auxiliary receiver and even the telephone connecting the pilot's compartment with the stewardess galley, all are operated through a single control panel only eight inches square. Volume controls also are located on the same panel and these are painted in colors to correspond with the colors used for the various radio switches so as to make the desired volume control easily identifiable.

The radio rack centralizes all of the planes' radio equipment in one assembly. It is located in the left cargo compartment, thus leaving the right cargo compartment completely free for baggage, express and other cargo. The electrical junction box is distributed along one side of the rack and this is where the saving in weight—always important in airplane operation—is achieved. About 75 pounds is saved in the wiring alone because heretofore the electrical junction box was located in one side of the plane with wiring extended to jack boxes and shelves hooked overhead or installed wherever spare space could be found any place in the airplane.

Both the switchboard and the radio rack have been built with space prepared for contemplated future equipment like the ultra-high-frequency receivers, instrument landing systems and so on.

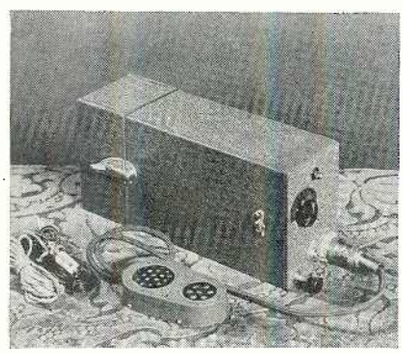
The parachute fire fighter carries a radio. Photo by U. S. Forest Service.

RADIO FOR PARACHUTE FIRE FIGHTERS

A NEW lightweight radio for the parachuting fire fighters is being used on the National Forests for the first time this year. Tests made by the Forest Service on the Chelan National Forest in Washington last fall with a crew of parachute jumpers indicated the practicability of dropping fire fighters from airplanes to put out small fires in some of the inaccessible back-country areas of the National Forests. The new radiophone has been developed so that the "smoke-jumper" can keep in touch with the plane pilot and with his headquarters when he reaches the ground.

Planes which deliver the parachuting fire-fighters scout the fire on their first trip over the spot and drop a small test chute with a ten-pound sand bag to determine wind drift. They then circle back and make a second approach, at which time the parachutist descends, and by using the steering flaps on his parachute, generally manages to reach the ground close to the selected landing spot. On a third approach the pilot drops the fire-fighting kit which is carried down by a burlap parachute with a yellow streamer attached to prevent its being lost—a method used by the Forest Service for some years to deliver tons of equipment to back country fire-fighters. The burlap chute pack contains necessary tools, rations, first-aid kit and the like but the parachutist will carry with him the radio so that he can contact the pilot or his headquarters immediately if necessary or can make reports later.

The radio equipment carried by the parachute fire fighter. Photo by U. S. Forest Service.



The small type radiophone developed by the Forest Service weighs only six pounds with dry batteries and all accessories, and is not quite as large as a loaf of sandwich bread. It measures 2 by 4½ by 12 inches, and operates on ultra-high frequencies between 30,000 and 40,000 kilocycles, having a two-way communication range covering an optical distance which with sufficient elevation may be as much as a hundred miles.

TELEPHONE OF TOMORROW

A PUBLIC demonstration of the "telephone of tomorrow" was made recently when Charles F. Kettering, Vice-President of General Motors in charge of research, formally opened the new Previews of Progress Science Stage Show in the auditorium of the General Motors Highways and Horizons exhibit at the World's Fair of 1940 in New York.

The demonstration was an attempt to indicate how television may in the future be used for utilitarian as well as for entertainment purposes. In it television and telephone equipment were combined into a single operating unit, enabling a lecturer on the auditorium stage to carry on a visual telephone conversation with a person in another part of the General Motors building.

Set up by RCA television and GM Research Laboratories engineers, the apparatus consists of a standard portable television transmitter or "jeep" connected by co-axial cable with a 12-inch-screen experimental television receiver. A push-button telephone is coordinated with the television circuit so that when the telephone instrument is raised at the receiving end, the image of the person answering the call flashes on the screen.

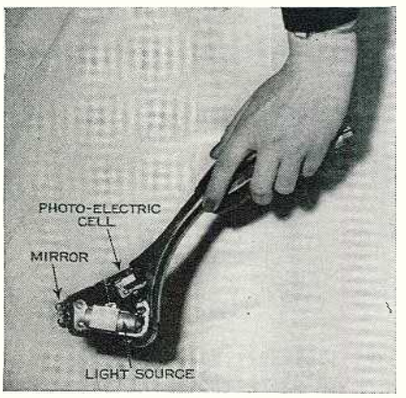
PHOTO-ELECTRIC PICKUP

ENGINEERS of the Philco Corporation have recently designed an interesting phono pickup utilizing a photo-electric cell. A photo of this unit is shown in an accompanying illustration.

The operation of the unit is relatively simple. A tiny mirror is mounted on a rotating axis which swings as the floating jewel (which replaces the needle) follows the curving record groove. A beam of light is directed into this mirror at an angle which reflects it on the photo-electric cell.

As the floating jewel moves along the curve of the record groove, the mirror swings from side to side on its axis,

flashing the beam of light on and off the photo-electric cell. Since the photo-electric cell translates light into electrical energy, the flow of current generated by the photo-electric cell varies in proportion to the amount of light flashed in



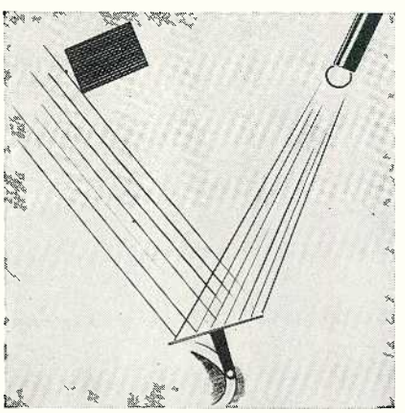
Showing location of light source, mirror, and photocell of pickup.

the cell as the mirror is swung by the jewel.

To minimize the amount of energy required for the jewel to swing the mirror, it was found necessary to utilize a paper-thin mirror specially designed for use in galvanometers. This is silvered with a vaporized aluminum and mounted on a tiny block which swings on an axis which floats on two flexible bearings.

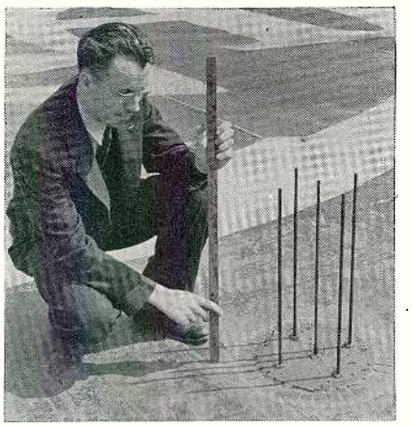
Another problem involved the design of a bulb to supply the light beam. To meet technical requirements as to size and weight a tiny bulb filled with gas to length the life of the filament was designed.

It is also necessary that the beam of light at its source have no waver or flicker. Consequently, the 60-cycle a-c



Illustrating the operating principle of photoelectric pickup.

which operates the radio-phonograph is transformed into a steady flow of light by an oscillator which generates 1800 kc.



D. G. C. Luck showing antennas of radio range beacon.

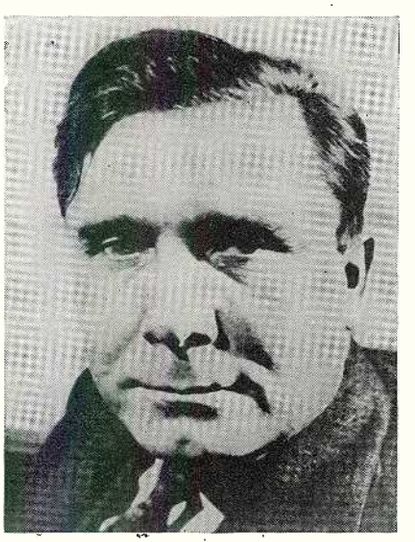
RADIO RANGE BEACON

A NEW radio range beacon which makes possible air navigation by radio without restriction to predetermined fixed courses between cities, has been developed by the RCA research laboratories. Dr. David G. C. Luck told the I. R. E. Convention at Boston that the new device tells a pilot his exact direction at all times with relation to the radio beacon transmitter at his destination. If the plane is forced from its predetermined route, the drift is shown on a dial on the instrument panel. The dial indicates a new route to the original destination as soon as the old course is left behind. Known as the omnidirectional radio range beacon, the new instrument operates in the ultra-high-frequency wave lengths.

PHOTO TRANSMISSION BY F-M

AN interesting demonstration of the transmission of photos by frequency modulation was recently held in

Photo of Wendell L. Willkie as received by G-E f-m receiver.



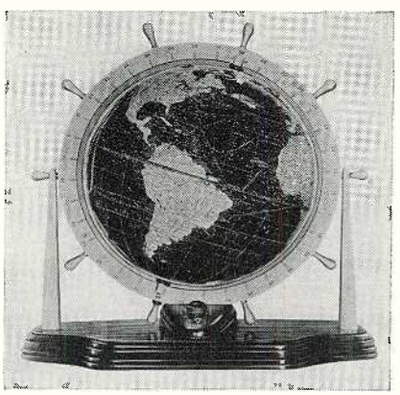
Boston. Photographs made by the Record-American photographers were transmitted by Walter Howey's sound photo system from Winthrop Square, Boston, over four miles of telephone lines to the Yankee Network f-m sta-

Group witnessing f-m reception of photos.

tion WEOD, Boston, where they were broadcast 43 miles to W1XOJ in Paxton, Mass. At Paxton the photos were rebroadcast and picked up on a General Electric receiver at M.I.T., Cambridge, Mass., 44 miles distant. The received pictures were of excellent quality as indicated in the accompanying illustration.

GLOBE-RADIO

A NOVEL idea in receiver cabinet design has been introduced by the Mitchell Mfg. Co., in their "Navigator Globe-Radio." This unit combines the interest value of an atlas with the entertainment value of a radio. A 5-tube



The "Navigator Globe-Radio"

a-c/d-c radio is contained in the 10-inch diameter globe. The globe is mounted inside a brass mariner's wheel which contains easy-to-read figures regarding longitude and latitude.

VETERAN WIRELESS OPERATORS ASSOCIATION NEWS

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

Father of Radio

ON Saturday, September 7, 1940, the combined tribute of the various groups in the radio field on the West Coast will be tendered Dr. Lee de Forest at the Exposition of the Pacific at the San Francisco Fair. The day will officially be known as "Dr. Lee de Forest Day" and Dr. de Forest will be greeted and feted by Mayor Rossi of San Francisco and the officials of the San Francisco Fair. This event is a fitting sequel to the festivities on "Dr. Lee de Forest Day" at the New York World's Fair and is further tribute to the outstanding accomplishments of the "Father of Radio" and one of our nation's outstanding inventors. Gilson Willets, Chairman of the San Francisco Chapter of our Association, and Leroy Bremmer, Secretary of the Los Angeles-Hollywood Chapter, are actively engaged in the preparations for this great day. They will appreciate your interest and cooperation.

Los Angeles

New members admitted at the April meeting of the Los Angeles Chapter were: Don C. Wallace, who started in radio way back in 1915 with the old Marconi Co. Among assignments were the "Cabrillo," "Hermosa," "Yosemite," "Yale," "Harvard" and "George Washington." Shore assignments included KPJ, NPG, KSS, etc. Don is one of the World's best known "hams," through his W6AM. He is at present a leading Pacific Coast manufacturer's representative. . . . Jap Tapp, Chief Engineer of KGER, Long Beach, for the past ten years. . . . Leo Shepard, of the CBS Hollywood Engineering Department. Leo started as a ship operator in 1923, and worked for both RCA and Federal Tel. He has been with KNX-CBS for the last 12 years. . . . Lindley Winser, Station Manager of KOK. He is another old-timer who started in 1915. Ship assignments included the "Prince Albert," "City of Topeka" and "F. A. Kilburn." During the first World's War he was in the Navy, being stationed at San Francisco and Wailupe. He has been with Mackay (KOK) since 1922. . . . Carroll R. Hauser, Chief Engineer of KMTR, Hollywood. Started as a ship operator in 1920, and sailed on the "City of Topeka," "Governor" and "City of Los Angeles." Also at Broadcast Stations KIEV and KIIQ. . . . William Ziegler, Radio Communications Instructor, National Schools. Bill also started as a ship operator in 1925, and for five years sailed the seven seas, then followed seven years as an aeronautical operator and one year with the U. S. Army Air Corps. . . . Harold M. McDonald, KFI-KECA Supervisor, and an Associate Editor for ATE. Mc's past includes ship operating for the old Marconi Co., in 1915 and 1916, and point-to-point operator for the Federal Tel. Co., San Francisco, from 1923 to 1928. While for the past ten years he has been a control supervisor for KFI-KECA. . . . William L. Jepsen, radiotelegraph operator for Mackay Radio. His past experiences date from 1923, as a ship operator for Independent Wireless, RCA, Ship-Owners, Federal Tel., U. S. Coast Guard, and at various coast stations. . . . Myron Kluge, Chief Engineer of KFSG, Los Angeles. Myron was also with KGKY, KGFW and KRKD. . . . J. Ben Fewkes, Jr., U. S. Airways traffic control supervisor, CAA, Burbank. Ben started in 1926, and ship assignments included the "President Garfield," "President Polk" and "Admiral Schley"; shore stations KOK-KNR, KEU-LA, KEU and KBLA. . . . We are

Dr. Lee de Forest with Joseph D' Agostino, RCA exhibit manager, at the New York World's Fair.

glad to welcome each of the above and hope their affiliation with us will be mutually beneficial.

Applications for membership in the Los Angeles-Hollywood Chapter have been received from the following: Mort O. Smith, NBC; Clyde De Vinna, MGM; David Wersen, Frank Wiggins Trade School; E. E. Griffin, Recordall; James H. Brown, NBC; Harold Christensen, KFI-KECA; Art Brearly, KECA; Francis Brown, National Recording Supply; L. B. Kilman, Postal; Ike R. Colbert, MRT; R. D. Ferguson, NBC; Lyman Packard, KFI; M. J. Fickas, RCAC; Ben S. McGlashan, KGFJ; R. L. Lithgow, CBS; C. W. Mason, KFI-KECA; E. A. Freitas, Walt Disney; William Everest, RMCA; and Robert Cook, Walt Disney.

In order that the Chapter's officers will be better known, we give the following brief extracts from their wireless biographies: Dr. Lee de Forest, Ph. D., Sc. D., D. Eng., "Father of Radio and Industrial Electronics." Inventor of the vacuum tube and holder of over 300 patents, and decorations by many foreign governments. One of the 14 greatest American inventors of all times. The Doctor is Chairman of the Chapter's Advisory Council and Honorary President of the National VWOA. . . . Hal Styles, our Chairman, is probably best known for his "Help Thy Neighbor" program. However, Hal is also an old-time wireless operator who started in radio in 1914 and subsequently served aboard the "Finland," "Alamo," "Evelyn," "Algonquin," "Pastores," USGG "Mohawk," "Tasmanic" and "Asuchnet" for the old Marconi Wireless Co. and RCA. Since 1930 Hal has been located in Louisiana doing special events, while for the past three years has devoted most of his time to his own program and publishing business. . . . Richard Stoddart, our popular Vice-Chairman, is chief radio engineer for the Hughes Aircraft Corp. and in 1938 accompanied Howard Hughes on his record breaking "Round-the-World" flight, for which he was awarded a VWOA Scroll of Honor, and also a gold microphone by Lenox Lohr of NBC. Incidentally, Dick is also a pilot in his own right. He started in commercial wireless in 1919, and has worked for Independent Wireless, and NBC. . . . Leroy Bremmer, the Chapter's Secretary Treasurer, has been continuously active in radio since 1917 as ship operator, shore stations, broadcast engineer, ship and shore wireless installations engineering, design, and associate radio editor. Marconi Wireless RCA and Inter-City Radio Tel. were a few of the concerns worked for. He is also the inventor of push-button tuning and is at present a member of the radio techical faculty at National Schools writing the radio course and lessons. . . . James Chappie, Los Angeles FCC radio inspector. Jim was a ship operator from 1913 until 1923, when he quit the sea to enter the Government service. He has been located in Louisiana for the past 12 years. Prior to that, his territory took him out of San Francisco and Honolulu.

For the second time this year, two of our number have been honored by having high lights of their wireless careers dramatized on the "I Was There" program over CBS. The first episode—last February—was built around our Duke Hancock, and related his experience as operator on the ill-fated S/S "City of Honolulu" when she burned at sea while on her maiden voyage in 1923 with over 1,000 passengers aboard and who were all saved through the medium of her SOS calls. Also on the same program was Paul O'Harra, who picked up the distress calls while on a ship off the Alaskan coast, over 2,000 miles away, and through his untiring efforts succeeded in raising rescue ships in

(*Continued on page* 19)

OVER THE TAPE . . .

NEWS OF THE COMMUNICATIONS FIELD

PHILCO BUYS INTEREST IN NATIONAL UNION

A substantial interest in National Union Radio Corporation, manufacturers of radio tubes for equipment of new sets and replacements, has been purchased by Philco Corporation as the first step in a program to expand the scope and activities of National Union Radio Corporation, it was announced recently by S. W. Muldowny, president.

"National Union Radio Corporation will continue as a separate company to manufacture its products and distribute them nationally under its own trade-mark, as in the past," Mr. Muldowny said in discussing the transaction.

SUN RADIO CATALOG

Sun Radio Company, 212 Fulton St., New York City, has just released a 24-page public-address catalog. Among the equipment described and illustrated are amplifiers and sound systems of nearly every type and classification, including portable systems, mobile systems and complete indoor and outdoor installations suitable for the small auditorium or the large arena or stadium.

JOHNSON BUYS BASSETT

The E. F. Johnson Company, Waseca, Minnesota, has just completed arrangements for the purchase of all assets connected with the antenna and concentric cable business of the Bassett Radio Manufacturing Company, Niles, Michigan. This includes all material inventories, tools and equipment, patents and engineering files. Everything has been moved to Waseca, Minnesota, where the E. F. Johnson Company will continue to manufacture and market through its jobbers, the flexible concentric cable, rotary beam antenna, and high-frequency coaxial antennas.

AMPHENOL CATALOG

An interesting 40-page Blue Book Catalog No. 62 for the radio, electrical and aircraft industries has just been released by American Phenolic Corp., 1250 W. Van Buren St., Chicago. In addition to a complete listing of this company's many products such as sockets, plugs and connectors, coaxial cable and connectors, insulators and insulating materials, this new catalog also contains a great deal of information on properties of insulating materials, fabricating methods, etc.

PERMO BOOKLET

Permo Products Corp., 6415 Ravenswood Ave., Chicago, have prepared a comprehensive booklet for the layman on home recording which gives information on cutting needles, records and how to improve all kinds of recordings. This booklet also gives information on how to record different musical instruments, where to place microphones for better pick-up, pertinent information or details on how to make better recordings and general useful information for anyone using the new home recording instruments as manufactured by the various companies that have placed equipment of this type on the market recently.

IRVINGTON VARNISH BULLETIN

"Irv-O-Lite, A New Low-Cost Extruded Tubing," is the title of a bulletin just issued by Irvington Varnish & Insulator Company, 24 Argyle Place, Irvington, N. J. This bulletin covers outstanding features of a new extruded tubing called Type XTE-30 and contains samples, gives sizes, specifies colors, and lists prices.

SIGNAL INDICATOR CATALOG

The Signal Indicator Corp., 16 Hudson Street, New York City, have just released a new illustrated catalog covering their complete line of signal lights, indicating units, pilot assemblies, dial lights and bull's eyes. Copies are available to the trade. Write direct to the manufacturer.

GOULD-MOODY CATALOG

The Gould-Moody Company, 395 Broadway, New York City, have just released a new catalog on their professional line of recording blanks for broadcasting station and transcription studio use. Copies are available to the trade upon application direct to the manufacturer.

ALLOY METAL BULLETIN

The Alloy Metal Wire Co., Prospect Park, Pa., have recently made available an interesting bulletin describing their line of Inconel alloy products. Copies may be secured from the above organization.

SHALLCROSS BULLETIN

A new bulletin is now available from the Shallcross Mfg. Co., Collingdale, Pa. This bulletin is devoted to a discussion of the electrical and mechanical specifications of the various standard and special Shallcross non-inductive wire-wound resistors.

PERMAX PRODUCTS CATALOG

Permax Products, Division Chisholm-Ryder Co., Inc., Niagara Falls, N. Y., have made available their Antenna Catalog No. R-40. It covers vertical radiators, rotary beams, police, marine and commercial antennas, as well as mountings and insulators. Write to the above organization.

MEASUREMENTS CORP. LITERATURE

Measurements Corp., Boonton, N. J., have made available several pieces of literature covering their Model 71 square-wave generator, Models 54 and 65 standard signal generators, and Model 58 television noisemeter. The latter instrument covers the range of 15 to 150 megacycles. Write to the above organization.

GUARDIAN BULLETIN

Antenna, overload, time-dalay, keying, break-in, remote locking control, and high-frequency relays are described in a bulletin released by Guardian Electric Mfg. Co., 1621 W. Walnut St., Chicago. Rather complete information is given. Write for bulletin No. R-4.

AEROVOX EXPORTERS

The appointment of the Rocke International Electric Corp., of 100 Varick St., New York City, as exclusive exporters of Aerovox condensers, is announced. Long specializing in radio products, this export organization is prepared to bridge the gap between the overseas users of condensers and the Aerovox plant in New Bedford, Mass.

BOONTON BULLETIN

A bulletin issued by the Boonton Radio Corp., Boonton, N. J., is concerned with the Type 140-A beat-frequency generator. Rather complete technical data is given. To secure a copy, write to the above organization.

GENERAL INDUSTRIES BULLETIN

A new catalog illustrating and describing phonograph mechanism has been made available by The General Industries Co., Elyria, Ohio. Electric and spring motors as well as record changers and recording assemblies are discussed.

RADIO RECEPTOR BULLETIN

An interesting bulletin, available from the Radio Receptor Co., Inc., 251 W. 19th St., New York City, describes an ultra-high-frequency transmitter for airport traffic control and communications. Electrical and mechanical characteristics are given.

FERRIS BULLETIN

The Ferris Instrument Corp., Boonton, N. J., have made available a bulletin giving rather complete descriptions of their line of signal generators, microvolters, calibrators, etc. Copies may be secured from the above organization.

GARDINER BULLETIN

A new catalog page has been made available by Gardiner Metal Co., 4820 S. Campbell Ave., Chicago. It describes Gardiner rosin-core solder and contains considerable technical data. Write to the above organization.

RCA BULLETINS

Two new bulletins have been made available by the RCA Manufacturing Co., Inc., Camden, N. J. One of these bulletins deals with transmitting and special-purpose tubes, while the second one is concerned with the AR-77 communication receiver.

TELEVISO BULLETIN

Televiso Products, Inc., have issued a bulletin entitled "Instruments for Measurement of Electronic Devices." It discusses a vacuum-tube voltmeter, microvolter, beat-frequency oscillator, signal generator, decibelometer and an audio spectrum divider. Copies of the bulletin are available from the above organization. Write to them at 1135 N. Cicero Ave., Chicago.

MEISSNER LITERATURE

Complete descriptive literature as well as constructional details and circuit diagrams of Meissner's frequency modulation receiver kit may be obtained from Meissner Manufacturing Co., Mt. Carmel, Ill.

GENERAL ELECTRIC IS READY to Fill Your Demands for FM Broadcast Transmitters*

A portion of the F-M assembly line at the G-E Schenectady Works

For Commercial Ope ation You Need These G-E Features

- **1. Simplified Circuit Design** with single crystal control and small tube complement—only 31 tubes in entire 1-kw transmitter!
- **2. Automatic Reclosing** circuit breakers for *both* a-c and d-c overloads prevent costly interruptions.
- **3. 400% Better Frequency Stability** than FCC requirements, according to measurements on typical production transmitters over a room temperature range of 32° to 122°F!
- **4. Unusual Ease of Operation** as a result of the simplicity and complete accessibility of all parts.
- **5. Full Dynamic Range** made possible by low noise level.
- **6. Amazing Fidelity** of *every* transmitter assured by individual cross-modulation and square-wave tests.

* *Designed by General Electric under Armstrong license*

FOR COMPLETE INFORMATION ask the nearest of 80 G-E sales offices, or write General Electric, Radio and Television Department, Schenectady, N. Y.

GENERAL ELECTRIC

160-8

You and your associates can obtain a year's subscription to COMMUNICATIONS (12 issues) for only $1.00 each by using the Group Subscription Plan.

A regular yearly subscription to COMMUNICATIONS costs $2.00 — but when four or more men sign up at one time, each one is entitled to the half-price rate. (Foreign subscribers on the "G-S-P" only pay $2.00 each).

COMMUNICATIONS
19 E. 47th St., N. Y. C.

Please enter annual subscriptions (12 issues) for each of the undersigned for which payment is enclosed at the rate of $1.00 each. (This rate applies only on 4 or more subscriptions when occupations are given.) Foreign Subscriptions are $2.00 each.

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City-State .....
Occupation or title.....
Employed by.....
Nature of business.....
(State if Manufacturer, Broadcast Station, etc.)
Product .....

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Showing the facsimile receivers and transmitter (center) at the RCA Exhibit, New York World's Fair.

RADIO FACSIMILE NEWSPAPER

THE New York Post is cooperating with the Radio Corporation of America in the publication of an experimental radio facsimile newspaper in the RCA Exhibit Building at the New York World's Fair.

Carrying the New York Post's masthead, the facsimile newspaper is published daily in full view of the thousands of visitors to the RCA Exhibit. A miniature front page, the paper measures 8½ x 12 inches per sheet and presents the outstanding news of the day in condensed form.

TELEVISION FUNDAMENTALS

(*Continued from page* 8)

The screen type multiplier, Fig. 5-b requires an electric potential source for the acceleration of the electrons, and sometimes a radial magnetic field is used to keep the electrons in the center of the tube. The screens, some of which are composed of 10,000 meshes per square centimeter, are treated for high secondary emission and it is claimed that about half the projected area of this screen is open space. Gains up to about a million have been attained with this type of multiplier. Tubes of this type[4] with either a thermionic or a photo cathode were recently placed upon the market in England. Mutual conductances of the order of 50,000 micromhos are attainable with these tubes.

The multiplier of Fig. 5-c relies upon the careful design of the "elbows" for the proper electrostatic focusing of the electrons in their travel from one stage to the other. This is necessary for the emitted electrons have more or less random velocities and a proper electrostatic field is necessary to guide them to the next stage. The Farnsworth Image Dissector utilizes a multiplier of this general type to provide sufficient signal with a satisfactory signal-to-noise ratio.

The limitations of most types of electron multipliers lies in the current carrying capacity of the last stage. Difficulties due to photo-emission from the treated surfaces exist, making it necessary to shield them from stray illumination, particularly if the light is modulated such as that from an incandescent lamp operating from alternating current. Voltages from 200 to 300 volts per stage have produced gains of about five per stage. A seven-stage multiplier realizing an amplification of five per stage would result in an overall amplification of five raised to the seventh power or 78,125.

There are many other devices which, although perhaps in very crude forms at the present time, hold great promise

for the future. Such things as frequency modulation, improved forms of ultra-high-frequency generators, television in colors, and many other things might either revolutionize the industry or, on the other hand, leave it unscathed. The impossibility for us to determine in advance which development will amount to something should influence our interest in these ideas not one whit. For the future of television, the art of instantaneous sight at a distance, is definitely assured and its cultural effect on people will be greater than we now realize.

(The End)

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1. Von Ardenne, "Methoden und Anordnungen zur Speicherung beim Fernsehemfang," *TFT,* Bd. 27. November, 1938, pp. 518-524.
2. Schramm, "Uber den electrooptischen Effekt an Zinkblende," *Annalen der Physik* (5) 25. S. 309, 1936.
3. Rosenthal, "The Skiatron," *Electronics and Television and Short Wave World,* February, 1940, pp. 52-55.
4. "The Augetron and Its Application," *Electronics and Television and Short Wave World,* January, 1940, pp. 17-19.

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VWOA NEWS

(*Continued from page* 15)

the immediate vicinity hours later. Incidentally, Paul is now a studio control operator at KNX-CBS in Hollywood.

The second broadcast last week honored our Dr. Lee de Forest, when high lights of his invention of the audion were related. At both broadcasts the principals appeared in person before the mike.

• • •

BOOK REVIEWS

(*Continued from page* 11)

book. The questions at the end of each chapter, which are so arranged that the proper answer may be checked off from a selection, add to the value of the book to those who study alone.

An unfortunate slip occurs on page 46, where the expression for power factor is represented as X/R. J. H. P.

MATHEMATICS APPLIED TO ELECTRICAL ENGINEERING, by A. G. Warren, published by D. Van Nostrand Co., Inc., 250 Fourth Ave., New York City, 1940, 384 *pages, price* $4.50.

This book is written for the technician who is well grounded in calculus and differential equations. It is intended to present the technician with labor saving solutions to analytical problems involving a mathematical approach.

The author begins his subject from the engineer's viewpoint rather than from that of the mathematician. Solutions by a combination of graphical and numerical computations are indicated in numerous instances. The author, while not ignoring the beauty of many classical mathematical methods, centers his effort on the solution of the practical problems involved.

The first few chapters in the book are devoted to such items as real and complex

numbers, differentiation and integration as well as to methods and results of differentiation and integration. The body of the text is given over to the solution of representative electrical problems. Such important theorems as Poissons' equation, Laplace's equation and Gauss' theorem are discussed in some detail. The treatment of Heaviside's operational methods, Bessels' functions, conjugate functions and harmonic analyses are particularly laudable.

Some 15 pages deal with useful formulae of trigonometry, calculus, differential equations, Bessels' functions, Duhamels' theorem and Fourier series.

This book is recommended not only to engineers who will use it as a reference and a ready guide to the solution of electrical problems, but also to those technicians who desire to refresh their memory of mathematics. It is exceedingly well written, and the solution of the many problems outlined are handled in a highly competent and striking fashion. R. D. R.

RADIO'S MASTER ENCYCLOPEDIA, published by United Catalog Publishers, Inc., 230 Fifth Avenue, New York City, 12 pages, price $2.50.

This book is comprised of several separate sections:

(1) Index of Manufacturers' Display Pages, which lists the manufacturers included in the book alphabetically. This is useful in order to locate the different products of a particular manufacturer who makes a number of different products.

(2) Classified Directory, which is customarily called a buyers' guide. This tabulates the various manufacturers who make specific equipment, such as amplifiers, generators, hardware, microphones, wire, etc. Although this section is, in the reviewer's opinion, the most valuable portion of the book, it is, nevertheless, full of errors, both of commission and omission. To cite but a single case, the field of Hearing Aids is completely ignored. Notwithstanding the preceding indictment, it is probably the most complete buyers' guide readily available. It is for this reason, therefore, and for this reason only, that the price asked for this book has any justification.

(3) Index of Trade Names, Trade Marks, etc. This section, as it heading indicates, enables the user of this book to readily determine the name of the manufacturer when only the trade name of the product is known.

(4) Catalog Section. This section, which comprises the major part of the book, is a reprint of the catalogs of a large number of manufacturers. It is arranged according to types of products, for example, vacuum tubes, loudspeakers, phonograph pickups, meters and testing equipment, condensers,. transformers, etc. This section should prove very useful, for it encompasses within the confines of a single volume a large number of manufacturers' catalogs, which would otherwise occupy a considerable amount of space. Although quite comprehensive in the number of manufacturers included, it is, of necessity, far from complete. This latter would not be too great a defect were it not for the fact that some of the most important manufacturers in the field are not included.

(5) General Index. As implied by its title, this section alphabetically tabulates both products and manufacturers.

At the bottom of the page there is given the discount ordinarily available from the list prices. D. B.

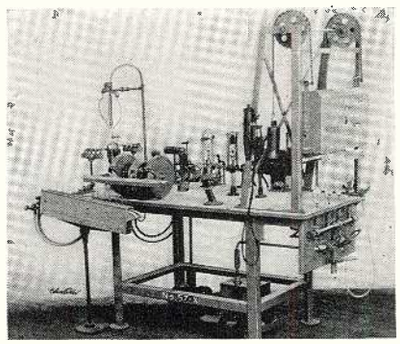
THE MARKET PLACE

PORTABLE RECORDER

A new development by Webster-Chicago is a portable recording system which will cut records up to 10" in size. The cutting head and pickup are of the crystal type. Both 78 and 33 1/3 r-p-m models are available. An amplifier is included as a part of the system. Write to The Webster Co., 5622-5660 Bloomingdale Ave., Chicago, for catalogs.

EISLER LABORATORY UNIT

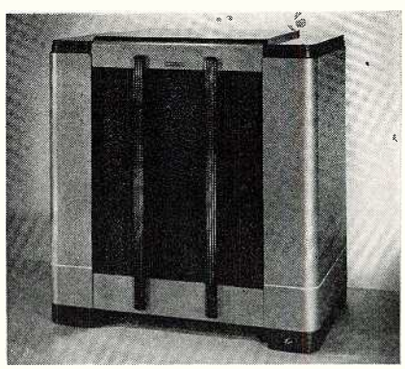
The Eisler Engineering Co., 740-770 South 13th Street, Newark, N. J., has recently developed a laboratory unit which fulfills the need of schools, colleges, experimental and research laboratories for a compact machine. The unit is complete in itself and capable of performing all opera-



tions required in the construction of electric tubes, incandescent lamps, radio tubes, neon tubes, television tubes, fluorescent tubes, mercury switches, ampoules, vials and similar products. A few of the many items included in this unit are: Glass cutter, flare and stem maker, electric spot welder, tube sealer and annealer, vacuum pump, etc.

MONITOR SPEAKER

Stromberg-Carlson announces its No. 35 monitor speaker. This reproducer employs a new dual loud-speaker system which has an exceptionally wide frequency range. Both speaker units are of the direct radia-

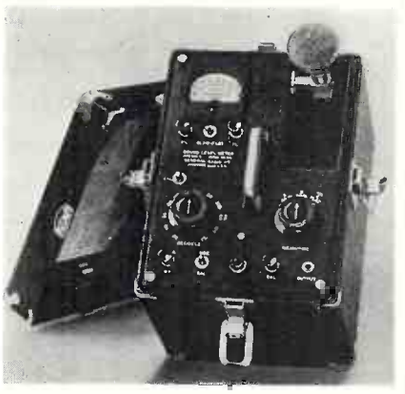


tor cone type, the small high-frequency speaker being mounted coaxially with the low-frequency speaker and within the hollow of its cone, the two thus closely simulating a unit source. Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

SOUND-LEVEL METER

General Radio Co., 30 State St., Cambridge, Mass., announces the Type 759-B

Sound-Level Meter, an improved model of the older Type 759-A. The new instrument meets the standard specifications for sound-level meters as adopted by the American Standards Association and various engineering societies. It is suitable for



use in noise surveys, and for measuring the noise generated by machines and appliances. Features of the new instrument are accuracy, rugged construction, convenience in operation, and portability. A two-speed indicating meter with selector switch is provided. In the Fast position of the switch, the meter speed conforms to ASA specifications. In the Slow position, the meter is heavily damped and can be used for measuring the average value of rapidly fluctuating sounds. New types of vacuum tubes and batteries give reliable operation and long life. The entire assembly is mounted in portable, airplane-luggage type of case. Batteries are self-contained. The range of the sound-level meter is +24 to +140 db. Provision is made for connecting a General Radio Type 760-A Sound Analyzer for analyzing the noise spectrum.

DUREZ 1905 BLACK

Durez Plastics & Chemicals, Inc., of North Tonawanda, N. Y., announce an addition to their new 1900 Black series of phenolic molding compounds, to be known as Durez 1905 Black. This material has an impact strength of .6 (ASTM) and heat resistance of 418° F. Unusually good gloss for high-impact compounds is reported with this material. It is available only in the new particle size, which is especially designed for free flowing through feeders and hoppers to simplify the production of preforms. Due to the high bulk factor of the Durez 1900 series, deeper preform cavities are required. Otherwise, thin preforms will result. Introduction of Durez 1905 Black further increases the scope of phenolic plastic applications for parts requiring a high-impact material.

PENCIL BLUE PRINTS

Ink-like opacity from hard drawing pencils is the important claim for a new transparent medium that is not a tracing cloth and not a vellum. The idea is ink results at pencil speed. Blue prints, made from drawings produced from ordinary hard drawing pencils on this new medium, have a solid background and sharp white lines, it is said. On Blacline prints the detail is solid and sharp, the background is uniformly white. The opacity of the pencil detail due to the drawing surface and the transparency of the drawing base both contribute to the printing results. The Frederick Post Company, P. O. Box 803, Chicago.

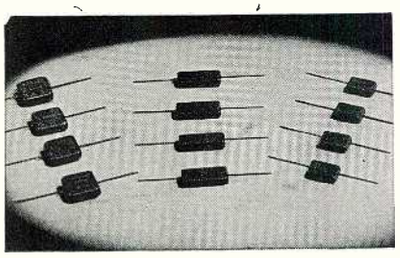
TELESCOPIC TRANSFORMERS

The Kenyon Transformer Co., Inc., 840 Barry St., New York City, has just announced the addition of two new types to their line of telescopic shielded humbucking transformers, as follows:

Type P204, has a primary of 500/333/250/200/125/50 ohms and secondary of 50,000 ohms (single Class A grid). Type P205 has a primary the same as P204 and a secondary of 100,000 ohms to P. P. grids.

SILVER MICA CAPACITORS

Cornell-Dubilier announces an improved line of silvered mica capacitors. They find use in i-f tuned circuits, in fixed-capacitor tuned push-button selector, in high-fre-



quency oscillator circuits, etc. These capacitors are available in values from .000001 to .0025 mfd with d-c voltage rating of 500; and in capacities from .003 to .005 mfd at 300-volt rating. Catalog No. 160T describing these capacitors free upon application. Cornell-Dubilier Electric Corp., South Plainfield, N. J.

ULTRA-HIGH-FREQUENCY TUBES

Two new three-electrode transmitting tubes, Types GL-8002 and GL-8002R, designed for use as radio-frequency power amplifiers at ultra-high frequencies, have been announced by the General Electric Co., Schenectady, N. Y. The GL-8002R is equipped with a milled-copper radiator for forced air cooling while the GL-8002 is water-cooled—otherwise the tubes are identical.

Particularly designed for frequency modulated and television transmitters, these latest additions to the General Electric tube family are capable of an output of 1800 watts and may be used at full rating up to 120 mc (forced air cooled) or up to 150 mc (water cooled). At reduced inputs, frequencies as high as 200 mc (air cooled) and 300 mc (water cooled) can be used.

AIRCRAFT HEADPHONE

Universal Microphone Co., Inglewood, Cal., in July started to distribute its new aircraft headphone list as a supplement to its current list of manufactured microphones for land stations, private and commercial planes, dispatchers, etc. The phones are housed in black bakelite cases, with an adjustable headband that is covered with Black Lastex, and the assembly includes five feet of waterproof cord.

ELECTRIC ETCHER

Everything safely enclosed and out of the way is the outstanding feature of a new and modern portable No. 13 "Universal" Electric Etcher just announced by the Ideal Commutator Dresser Co., 4035 Park Avenue, Sycamore, Ill. The etcher tool and cords, switch and indicator lamp are all "under cover." Small objects are etched right on the work plate which makes up part of the case, while a ground clamp is furnished for larger objects. The cover is removable if desired.

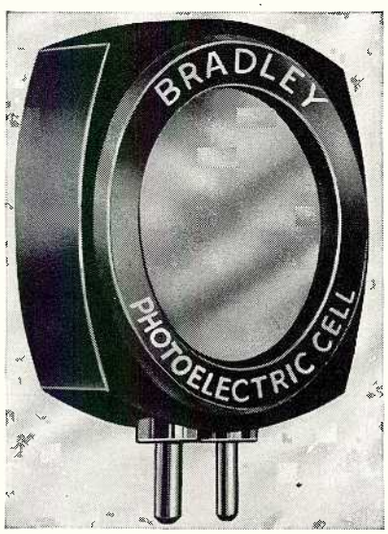
MICROPHONE SWITCH

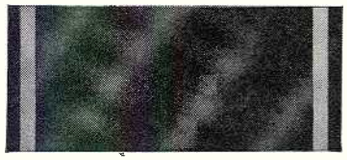
The new Atlas Sound "Break-In" switch offers on-off or press-to-talk operation. Button is pressed for press-to-talk opera-

tion, and turned for on-off switching. For all microphones or circuits having single conductor shielded cable connections. Completely wired and can be instantly attached to microphone; chassis connector; or anywhere in the microphone cable line by using a male and female connector. Atlas Sound Corp., 1449 39th Street, Brooklyn, N. Y.

SELENIUM PHOTOCELL

A new type selenium barrier layer photoelectric cell, developed and manufactured by the Bradley Laboratories, Inc., New Haven, Conn., is offered for light measurement and control. A special sensitizing process gives these cells high current sensi-

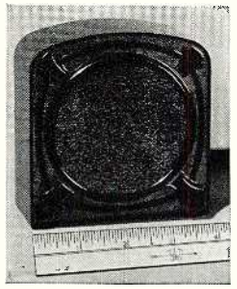




tivity as well as high internal impedance, it is said. The Bradley cell is available in standard sizes or constructed to individual specifications. Engineering bulletins on request.

MIDGET SPEAKER

Oxford Tartak Radio Corp., 915 W. Van Buren St., Chicago, is now ready to market their small Permag cabinet speaker, Model 3ZM-CA. Measuring 4½"x4"x



1⅞", this little unit is expected to find innumerable applications. A second unit, Model 3ZM-CM, designed for use as a microphone, is equipped with a special shielded transformer. Descriptive literature will be sent upon request.

LOW-VOLTAGE TATTELITE

A new low-voltage Tattelite pocket tester has been designed by Littelfuse to cover the range from 3 to 25 volts, momentary up to 50 volts, a-c or d-c. It uses a high temperature coefficient lamp to cover this relatively wide range of voltage. The lamp is housed in a molded, transparent tenite case. It has tinsel wire leads, and alligator clips. Draws only 70 mils. @ 12 volts. While it was designed primarily for use on the 24-volt control system in heating and air conditioning, the largest field

is circuit checking in automobiles, trucks and buses, airplanes, telephones, boats, radio, bells, buzzers, storage battery circuits, etc. Littelfuse, Inc., 4757 Ravenswood Ave., Chicago.

PLUGS AND RECEPTACLES

A new series of specially polarized compact 3-pole plugs and receptacles suitable for use on electrical and electronic devices has just been announced by the American Phenolic Corp, 1250 Van Buren St., Chicago. Unique basic design allows mounting both plugs and receptacles direct to sheet metal panels with a spring steel retainer ring (illustrated), or by means of a riveting plate; or above or below surface with appropriate mounting shells; or as cable connectors having indestructible drawn steel caps equipped either with end or side outlets, or with cable clamps.

RADIART WIND-UP AERIAL

Radiart's Ro-Tenna is a mechanical wind-up aerial which is controlled entirely from the inside of the car. A handy knob raises or lowers the aerial for peak reception or for clearing obstacles overhead. Several models are available for mounting in various positions on the car body.

Additional information may be obtained directly from Radiart Corp., Cleveland, Ohio.

A CRYSTAL CONTROLLED

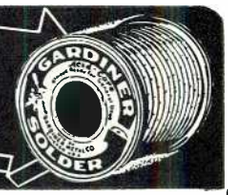
SINGLE FREQUENCY RECEIVER

for broadcast relays, airlines, police, marine, government service specifications; in fact, any service where a single frequency receiver is required.

Frequency Range: 1.5 MC to 20 MC
Selectivity: 40 db down at 6 KC off frequency
Sensitivity: 1 microvolt, 30% modulation at 400 cps for 6 milliwatts across 500 ohm load
Signal to Noise Ratio: 5 to 1 in voltage
Automatic Gain Control: Output variation less than 3 db with input from 5 microvolts to .1 volt (telephone operation)
Image Rejection: 100,000 to 1 in voltage at 5,000 KC
Power Output: Plus 10 db maximum across 500 ohm load
Audio Noise Control: Audio electrically shorted out in absence of received signal (telephone operation)
Panel Size: 3½ inches by 19 inches
Power Requirements: 115 volts, 60 cycles, 40 watts, with self-contained power supply

WILCOX ELECTRIC COMPANY
3947 STATE LINE KANSAS CITY, MO.

OUTSTANDING QUALITY



Gardiner Rosin Core Solder provides a quick acting flux of pure water white rosin—no solvent added. Permits faster, cleaner work by expert or amateur. Unequalled for high tensile strength, uniformity and economy. Costs less than even ordinary solders because produced in volume by the most modern methods. There is a Gardiner quality product for every soldering need . . . in various alloys and core sizes . . . in gauges as small as 1/32" . . . in 1, 5 and 20-lb. spools.

Gardiner METAL CO.
4819 S. Campbell Avenue, Chicago, Ill.

PIEZO Electric Crystals Exclusively

- Quality crystals for all practical frequencies supplied SINCE 1925. Prices quoted upon receipt of your specifications.

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SCIENTIFIC RADIO SERVICE
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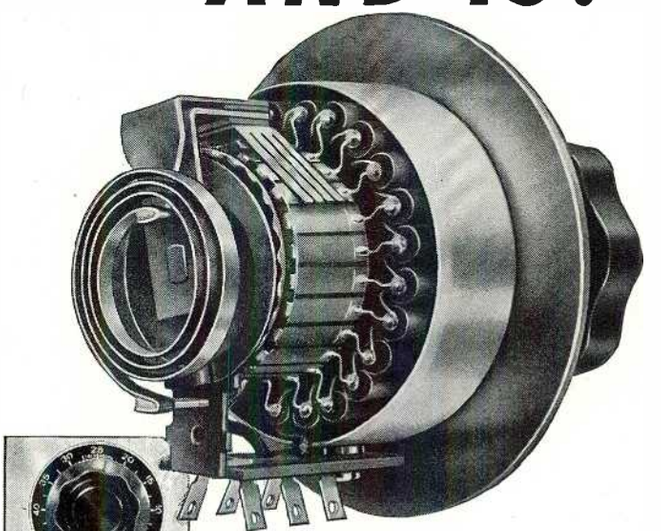
TAYLOR

VULCANIZED FIBRE
PHENOL FIBRE
TAYLOR INSULATION

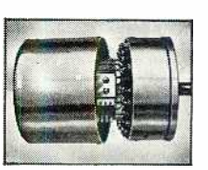
TAYLOR FIBRE CO., Norristown, Pa.

It Looks L ke a Better Attenuator AND IS!



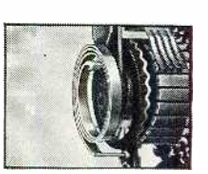
20 STEPS

IRC TYPE A-21

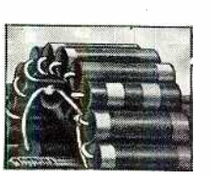


SNUG DUST COVER

BERYLLIUM COPPER CONTACTS



CLOCK SPRING CONNECTOR



IRC INSULATED RESISTORS

Until you actually *try* the A-21 Attenuator, you'll never know what amazing smoothness, quietness and ease of operation have resulted from IRC's exclusive Molded Motor Commutator type of switching mechanism. After more than two years of field experience, in hundreds of broadcast stations and under all conditions of use, *we have yet to hear of a control engineer who has gone back to old-style Attenuators once he has given the A-21 an actual working test!*

The A-21 looks different — and *is* different. Features such as the IRC Clockspring Connector which eliminates one wiping contact; the multi-finger beryllium copper spring which provides large contact area; and the use of IRC Insulated Resistors assure low noise levels maintained in service. The knob rotates with velvety smoothness, with the "feel" of the fine precision device which it is. It is small enough (2" x 2") to fit practically any equipment, constructed throughout for long, noise-free performance. Straight potentiometer or ladder networks available in 21 steps.

Sold by IRC Radio Parts Jobbers. Write for Attenuator Bulletin V.

INTERNATIONAL RESISTANCE COMPANY
415 N. Broad St., Philadelphia, Pa.

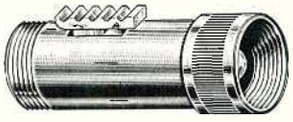
POWER RESISTOR DECADE BOX

A power resistor decade box that can be inserted in actual circuits to simulate working conditions, is announced by Clarostat Mfg. Co., Inc., 285-7 N. 6th St., Brooklyn, N. Y. It is intended primarily for laboratory use, for calibration of meters and for development work generally. It

covers a resistance range of from 1 ohm to 999,999 ohms at a maximum of 1,000 volts, by means of six decade switches on the sloping front panel. Each decade will dissipate up to 225 watts. The maximum current per decade is as follows: No. 1, 5 amp; No. 2, 1.5 amp; No. 3, .5 amp; No. 4, .15 amp; No. 5, .05 amp; No. 6, .005 amp.

MICROPHONE SWITCHES

A new series of Amphenol microphone switches for crystal, dynamic aud velocity microphones is announced by the American Phenolic Corp., 1250 W. Van Buren St., Chicago. The No. MC1S crystal microphone switch is a part of the well known



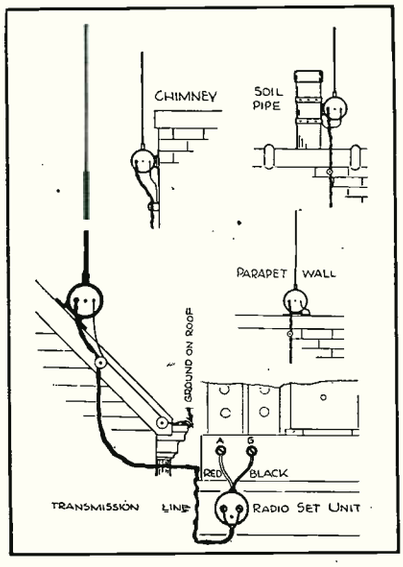
MC1 group of microphone connectors, and couples directly to the microphone. Two and three contact switches fit the MC2 and MC3 series of microphone connectors which are used on dynamic and velocity microphones.

ROD TYPE ANTENNA

The small amount of roof or window space as well as ease of installation are decided advantages for the rod type antenna. As improvements in design bring results closer to the normal performance of large flat top types more and more of these devices will be seen in use on the roof tops of crowded city apartment houses.

The Model 101 Extat rod antenna, shown in the accompanying illustration employs a 9-ft collapsible rod which fits into a base that may be rotated to any position within an arc of 240°. This feature permits mounting outside a window, on the edge of the roof, on a vent pipe or similar protrusion or on the side of the building, with the rod in its normal upright position.

Three separate primaries and three separate secondaries, symmetrically wound on an iron core ½ inch long by ⅜ inch in diameter, are employed in the antenna and set transformers. The primaries and secondaries are spaced by about 40 to 60 turns of plain white cotton the same diameter as the wire. This reduces the internal capacity between them. The entire antenna transformer is housed and sealed in a moisture-proof porcelain shell. The transmis-



sion and ground leads are connected to this transformer on the inside of the shell. A ground lead is provided to ground the antenna transformer at the roof. The transformers are designed for coverage of the bands between 500 kc and 22 mc.

MICROPHONE TRANSFORMER

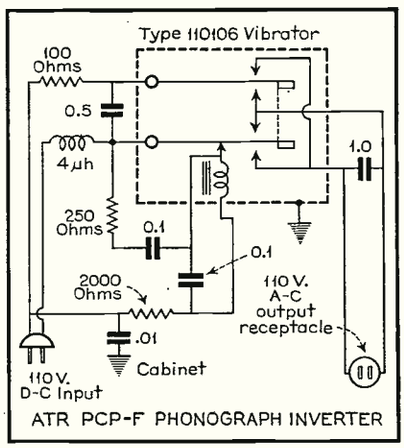
Three new microphone cable transformers, just released by United Transformer Corp., are designed to be inserted in the cable circuit. The units are ruggedly constructed to withstand mechanical abuse. Cable connections are made through the

spring strain relief to terminal boards inside and end caps. Standard fidelity and high fidelity line to grid models are available, as well as a crystal to line matching unit. United Transformer Corp., 150 Varick Street, New York City.

PHONOGRAPH INVERTER

The American Television and Radio midget phonograph motor inverter is designed to invert 110-volt d-c to 110-volt 60-cycle a-c for the operation of small electric motors. Three models are avail-

able. The Model PCP is for the operation of small phonographs, a-c electric razors and similar small a-c devices not associated with radio receivers. The Model PCPF (see accompanying circuit diagram) is identical except for the inclusion of an r-f filter. The Model PCPR has the identical circuit but is provided



with leads for the input and output connections instead of the receptacle and plug provided on the other models. The polarity changer vibrator employed in these units is also available as a separate unit.

The complete inverter provides an output of 15 watts and weighs less than one pound. It is 2⅝ by 2⅝ by 2⅛.

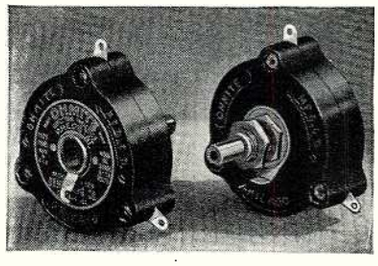
SYLVANIA CHART

A new radio tube base chart, announced by Hygrade Sylvania Corp., Emporium, Pa., is now being distributed to dealers and Service Men. Several revisions have been made and a new style of layout has been adopted. Although reduced in size by showing base views in a smaller size the chart has an increased number of base views and covers all tube types, it is said. For the 376 types extant, there are shown 118 views and a complete index and cross index for all tubes and base views.

Service Men may write directly to the factory at Emporium, Pa., for their copy.

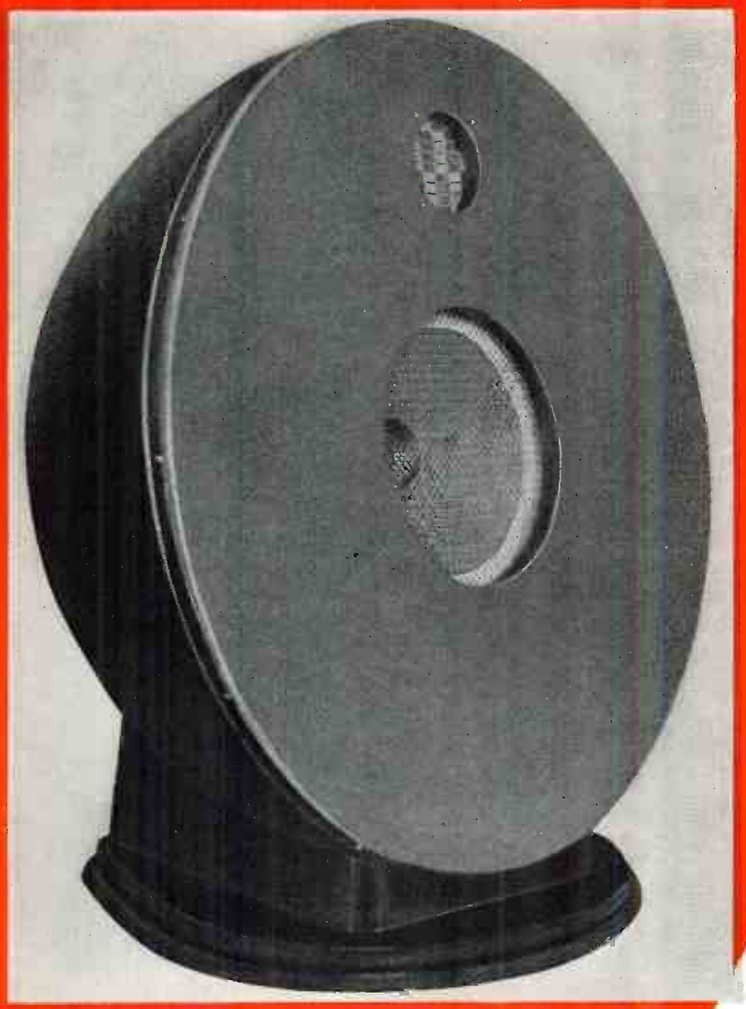
DIRECTION-INDICATOR RHEOSTAT

A new, Model DR-125 direction-indicator rheostat is now offered by Ohmite Manufacturing Co., 4835 Flournoy St., Chicago. This compact, convenient device is connected to the moving part of radio rotary beam antennas, direction finding loop antennas, wind-vanes, etc. The Model DR-125 rheostat has a 360° continuous winding. It is designed for use on d-c up to 24 volts. It consists of a glazed ceramic housing which is 1⅞" diameter and 13/16" deep behind panel. Mounted by a ⅜"-32 bushing and nut on any panel up to ¼" maximum.



CINAUDAGRAPH SPEAKERS

WOOFER-TWEETER UNIT

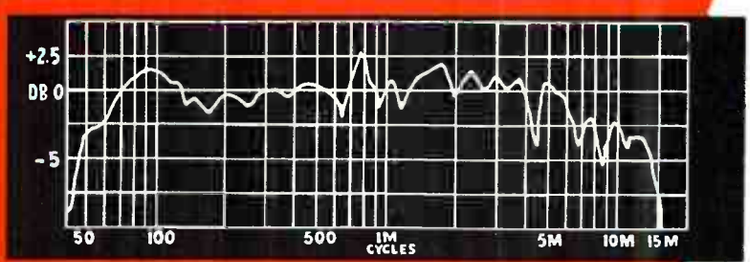


THE IDEAL SPEAKER

for FM, Broadcast Monitor, Auditorium or other High Fidelity Service

The UTC Telesphere baffle is a revolutionary step in speaker baffling. The smooth contours of this baffle prevent internal "cabinet corner" reflections, and uniform spacing from the cone to all parts of the baffle maintains uniform internal phase characteristics. A remarkable improvement in high frequency definition is effected.

No reflexing is used in this infinite baffle to eliminate the "boom" frequently encountered in reflexed units at the peak point.



Type HC-15 watt high fidelity permanent magnet woofer-tweeter combination frequency curve as illustrated uniform from 50 to 15,000 cycles. This combination incorporates the new LM-5-15T tweeter and the new WM-12-15 woofer in a UTC Telesphere baffle. The CN-1500V crossover network is mounted inside the baffle.

List Price $127.50

WOOFER-TWEETER COMPONENTS

United Teletone Woofer speakers are specifically designed for low frequency service in woofer-tweeter combinations. In addition to excellent low frequency response, the design effects negligible cone break-up and minimum "hangover."

- ★ WM-12-15—specially designed low frequency woofer (may be used with LM-5-15T)—15 watts output continuously, List $32.50
- ★ WM-13-23—a heavy duty 13" woofer—will handle 23 watts continuously, List Price $60.00
- ★ WM-15-25—a heavy duty 15" woofer—will handle 25 watts continuously, List Price $75.00
- ★ WM-18-30—a heavy duty 18" woofer—will handle 30 watts continuously, List Price $100.00
- ★ New High Frequency Tweeter, fully enclosed, response ±5 DB, 1,500 to 17,000 cycles, for 15 watt combinations. For 20 to 30 watt woofer-tweeter combinations, two of these tweeters should be used. LM-5-15T, List Price $25.00
- ★ CN-1500V—1,500 cycle crossover network for use with LM-5-15T and a low frequency woofer speaker, matches 6-8 ohm amplifier output, List Price $12.50
- ★ CN-1500L—same as above but for matching 500 ohms $17.50

NO FINER SPEAKER MADE IN ALL THE WORLD

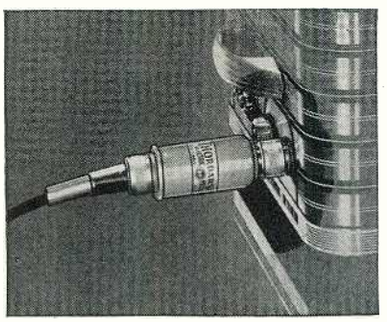
UNITED TELETONE CORP.

150 VARICK STREET ★ NEW YORK, N. Y.

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

MICROPHONE TRANSFORMER

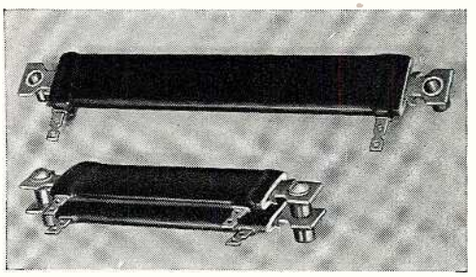
The Thordarson Electric Mfg. Co., 550 W. Huron St., Chicago, announces a new microphone cable transformer which adds to the serviceability of amplifiers now having only high impedance microphone circuits. With the use of this new unit, such amplifiers can be easily adapted for use with low impedance dynamic or velocity microphones. This new cable transformer,



which mounts directly on the amplifier, is available in two types. One is a 30 to 50 ohm unit designed for voice coil connection of dynamic or velocity microphones which have self-contained line output transformers. Fully described in Catalog No. 600-E, available from Thordarson.

RESISTORS

In the accompanying illustration are shown two units of the Blue Ribbon line of resistors now available from Hardwick, Hindle, Inc., Newark, N. J. In these units the resistance wire is space wound upon a steatite core of elliptical cross-section having a maximum thickness of ¼" at its minor axis. The ends of the winding are brazed to terminals which may be of any standard type.



SUPREME INSTRUMENTS

Supreme Instruments Corp., Greenwood, Miss., have announced their Model 549 electronic voltmeter and their Model 543 pocket multimeter.

The 549 electronic voltmeter has standard provisions for a-c and output volts, direct current measurements, etc., in addition to the electronic circuit for d-c voltage and resistance tests. The latter circuits provide for measurements from 0.1 to 6,000-d-c volts and from 0.5 ohms to 1,000 meg.

The Model 543 multimeter, illustrated, provides 13 ranges for d-c voltage, current, resistance and a-c voltage measurements. The d-c voltage ranges are at 1000-ohms-per-volt.

Additional information and prices may be obtained directly from Supreme.

ELECTRONIC MUSIC

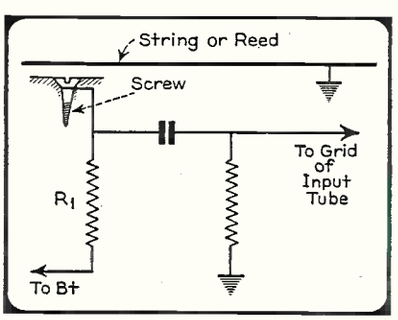
By NATHAN I. DANIEL

REFERRING to the violin as an instrument which is played by scraping the hair of a horse across the intestines of a cat, Benjamin F. Meissner, the holder of numerous patents pertaining to electronic musical instruments, infers[1] that our entire system of making music is extremely primitive. It does seem strange that in an era which boasts tremendous scientific advances in every field there has been no significant change in our musical instruments for hundreds of years.

There is, in general, little controversy among sound engineers as to the merits of producing music by electronic means. The musicians who are to use these instruments require convincing, however. They have the notion that the electrical instruments sound tinny and mechanical. They also believe that one musician with an electrical instrument will replace four or five musicians with acoustical instruments. There is little basis for either of these objections.

Several years ago, when an amplifier and its associated speaker was considered "wide-range" if it could reproduce four octaves, the electronic musical instrument did sound tinny and somewhat mechanical. Today, with the great improvement in speakers, amplifiers and pickups, the electronic instrument can do practically everything that

Fig. 2. Electronic pickup.



[1] "Electronic Music and Instruments", by B. F. Meissner, *Proc. IRE*, Nov., 1936, p. 147.

an expensive original can and, of course, has advantages in providing more volume and greater control.

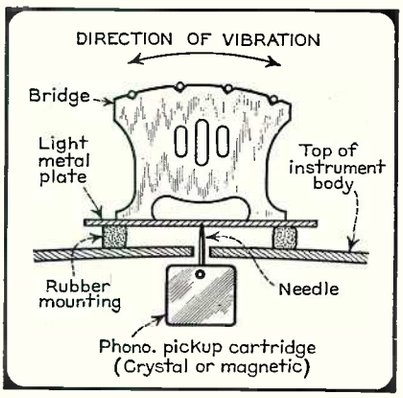
As for unemployment problems, we need only point to the two electronic instruments which have already enjoyed some widespread popularity, to show that this new form of music is creating new positions rather than eliminating old ones. The electric guitar, either Spanish or Hawaiian, is now used in a great many orchestras, whereas guitarists in such places were rarities previously. The electric organ, likewise, has created many new positions for organists. Few churches, theatres, broadcast stations, halls and homes could afford the expense and excessive space required for an organ. The electric counterpart, however, has found wide acceptance.

Technical Aspects

Low hum level, low percentage of distortion, high output and complete absence of buzzes and rattles as well as compact size and light weight are important features that require special consideration in amplifiers built for use with electronic musical instruments.

Hum must be below audibility for all settings of the volume control, a few feet from the speaker, with the instrument connected and ready to play.

Fig. 3. Vibration pickup.



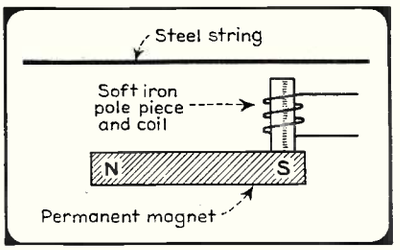


Fig. 1. Magnetic pickup.

If the instrument is to be used chiefly to play cords, the distortion limits are the same as those required for high fidelity radio reproduction. However, if only one note can be played at a time greater distortion is allowable. It is often possible to take advantage of this fact and obtain changes in tone character by purposely introducing harmonic distortion.

An amplifier may sound quite loud when it is used with a tuner or phonograph pickup but will seem only moderately loud when used with an electronic musical instrument. This is more noticeable if the instrument is used in an orchestra where the reproduction will be drowned out if it hasn't sufficient power. It is for this reason that high power output is an important essential for these types of amplifiers.

Buzzes and rattles must be completely absent at all frequencies even at maximum volume. This means that the speaker must be capable of handling the full power of the amplifier. It also means that every part of the amplifier case and chassis must be securely fastened.

Electronic musical instruments, with the exception of the piano and organ, are generally portable devices. Their accompanying reproducing equipment must, therefore, be light in weight and compact in design.

In addition to the contact microphone, which is used essentially to convert a regular musical instrument, there are at least three types of pickups in general use in present day commer-

cial electronic musical instruments. These are shown in the accompanying illustrations (Figs. 1, 2 and 3) and are described below:

Magnetic Pickup

In the magnetic pickup (Fig. 1) a permanent magnet is so placed as to magnetize the steel string of the instrument. A soft iron pole piece, with an associated coil wound over it, is mounted close to the string. As the string vibrates, at any given frequency, it induces a voltage of corresponding frequency across the coil. In electric guitars and mandolins the pole piece is wide enough to fit under all the strings.

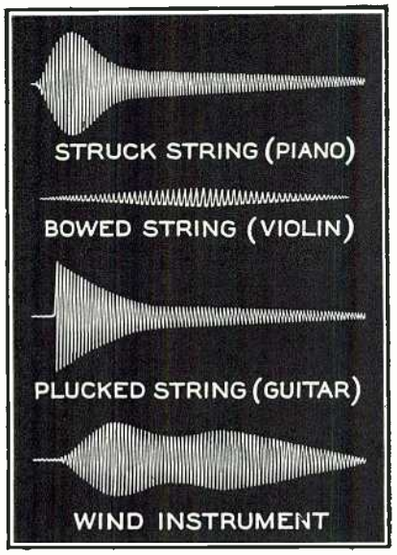


Fig. 4. Tone envelopes for various musical instruments.

There are many variations of this pickup in use. Some manufacturers employ slotted pole pieces. One uses an adjustable screw under each string to obtain correct balance of output. Another eliminates the permanent magnet, using instead, a switch that sends d-c through the pickup coil whenever it is necessary to remagnetize the strings.

An adaptation of the magnetic pickup is being used on a small scale for wind instruments. Instead of the steel string a tiny steel slug is cemented to the reed.

Electrostatic Pickup

In the electrostatic pickup, generally employed in pianos and vibrating reed organs (see Fig. 2), a screw or other small conducting object is mounted near the string and insulated from it. The screw and string form the plates of a small condenser. A polarizing voltage is applied to each screw through a separate filter consisting of a high resistance and a small capacity. As the string vibrates the capacity of the condenser (formed between the screw and the string) varies accordingly. This varying capacity is converted to a varying voltage, as in a condenser microphone, and fed to the grid of an amplifier tube. This is a simple flexible pickup around which clever circuit innovations have been built to make a piano take on new tones.

The sound from a piano starts as soon as a hammer strikes a string. The sound, slightly damped until the hammer leaves the string, starts off strong and decays slowly to inaudibility. (See Fig. 4.) Sound from a plucked string, such as a guitar, starts as soon as the finger or pick releases it. The tone starts very loud, decays rapidly at first and then more slowly to inaudibility. (See Fig. 4.)

Organ and other wind instrument tones (reed or pipe) start when the player begins to blow. However, the vibration of the reed or air column starts off weak and builds up to full strength. Thereafter the sound continues on an even level unless the wind is increased or decreased. (See Fig. 4.)

The envelope of the tone from a piano which uses the electrostatic pickup, can easily be varied. An envelope selector switch can be so wired that in one (organ) position there is no polarizing voltage on the screws until a key is struck. This action connects the voltage to the filter network for the screw associated with that key. As the capacity of this little filter charges up to full voltage, the screw in turn becomes charged and transmits its signal to the amplifier. Thus, instead of starting immediately as in an ordinary piano, the sound builds up slowly like that from an organ.

The piano can, similarly, be made to sound like a harpsichord by connecting another position of the envelope selector switch so that a very high starting voltage is applied to the screws until a key is struck. Thus the sound starts off very loud, decays rapidly at first as the filter condenser discharges to normal voltage, then decays slowly as the vibrating string dies down.

An ingenious method for changing the harmonic content of the output is employed in electronic piano. If the pickup screws are placed near the middle of the strings, rather than close to one end, very little second or other even-order harmonics will be present, since the center of a string is a node for all even-order harmonics. Other positions of the pickup would discriminate against different harmonics.

Instead of using one set of pickup screws, two are used. By proper positioning, each set favors its own series of harmonics. With this arrangement four completely different tones can be obtained at will, by using one set alone, the other set alone, both sets in phase or both sets connected out of phase.

Vibration Pickup

The electrostatic pickup was tried on instruments played with a bow (violin, cello, etc.) without much success. This led to the development of the pickup shown in Fig. 3. A light metal rubber-cushioned plate is mounted under the instrument's bridge, as shown in the illustration. A phonograph pickup, with a needle securely in place, is fastened under the plate with the needle and plate making mechanical contact. When the strings are bowed there is a strong horizontal component of the string vibration which is transmitted through the bridge to the phonograph pickup.

It should be noted that in instruments which employ strings mounted over a bridge, the string vibration is also transmitted through the bridge to the body which acts as a sounding board to reenforce the sound. Electronic instruments which employ the pickup just described, therefore, sound more like the original instruments than they would if the vibrations were taken directly from the strings.

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INTRODUCTION TO CONTEMPORARY PHYSICS, second edition, by K. K. Darrow, published by D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York City, 1939, 641 pages, price $7.00.

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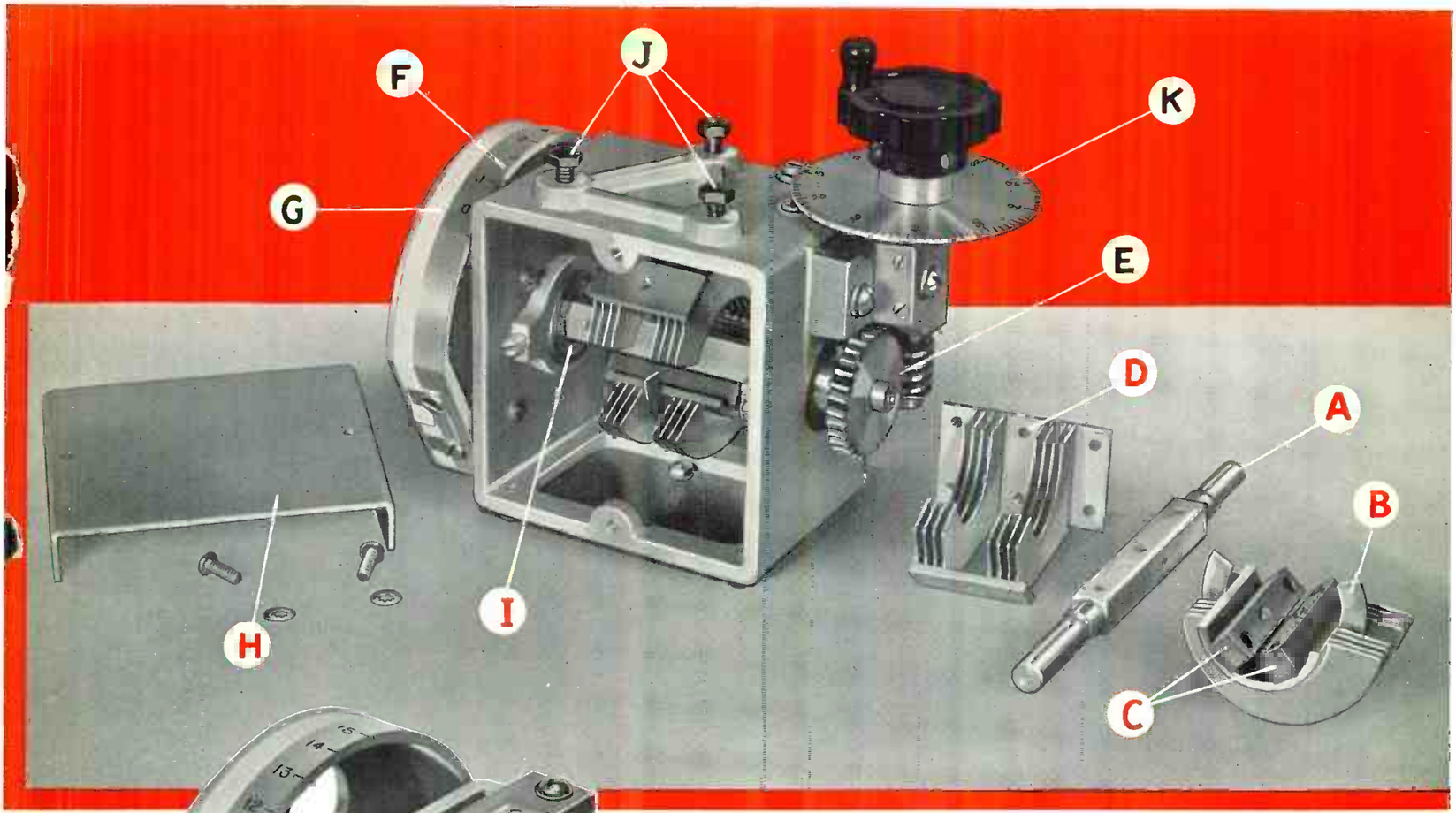

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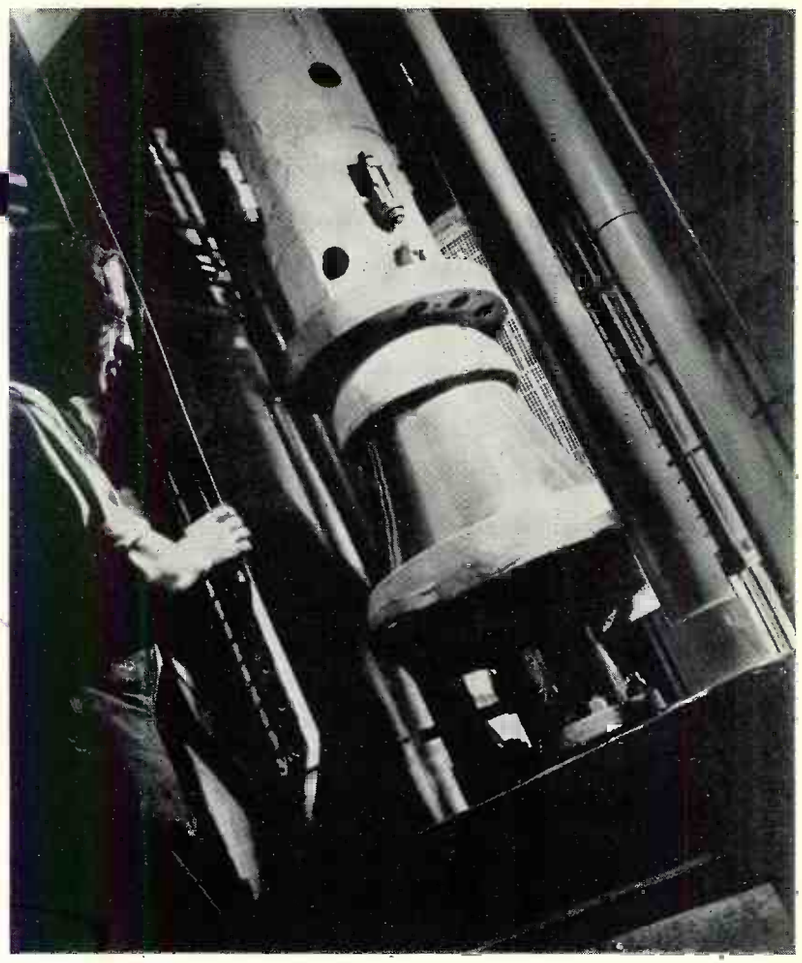

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